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# UNIVERSAL CYCLOPÆDIA AND ATLAS

VOLUME V

# UNIVERSAL CYCLOPÆDIA AND ATLAS

A NEW EDITION UNDER DIRECTION OF

CHARLES KENDALL ADAMS, LL.D.
PRESIDENT OF THE UNIVERSITY OF WISCONSIN
EDITOR-IN-CHIEF

ASSISTED BY A CORPS OF ASSOCIATE EDITORS
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A NEWLY REVISED AND ENLARGED EDITION

ROSSITER JOHNSON, PH.D., LL.D.
EDITOR OF REVISION

**ILLUSTRATED WITH COLORED PLANS, PLATES, AND ENGRAVINGS**

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*VOLUME V*

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# PECULIAR PHONETIC SYMBOLS

## USED IN THE WRITING OR TRANSLITERATION OF THE DIFFERENT LANGUAGES.

---

ā, ē, etc.: long vowels; in the Scandinavian languages the accent (*á*, *é*, etc.) is used to denote length.

ą: a nasalized *a*; so used in the transliteration of the Iranian languages.

å: labialized guttural *a* in Swedish.

æ: open *a* of Eng. *hat*, used chiefly in O. Eng.

aí: used in Gothic to denote *e* (open), in distinction from *ái*, the true diphthong.

aú: used in Gothic to denote *o* (open), in distinction from *áu*, the true diphthong.

bh: in Sanskrit a voiced labial aspirate (cf. *ch*).

ƀ: voiced bilabial (or labio-dental?) spirant, used in discussions of Teutonic dialects.

ç: voiceless palatal sibilant, similar to Eng. *sh*, used especially in transliteration of Sanskrit.

č: frequently used, e. g. in Slavonic languages, to denote the sound of Eng. *ch* in *cheek*.

c: voiceless palatal explosive, commonly used in transliteration of Sanskrit and the Iranian languages.

ch: as used in the transliteration of Sanskrit, a voiceless palatal aspirate, an aspirate being an explosive with excess of breath; as used in German grammar, the symbol for a voiceless palatal or guttural spirant.

dh: voiced dental aspirate (cf. *ch*) in Sanskrit.

ḍ: voiced cerebral explosive, so used in transliteration of Sanskrit.

ḍh: voiced cerebral aspirate (cf. *ch*) in Sanskrit.

đ: voiced dental (interdental) spirant, equivalent to Eng. *th* in *then*; so used in the Teutonic and Iranian languages and in phonetic writing.

ë: a short open *e*, used in Teutonic grammar, particularly in writing O. H. G.

e: the short indefinite or "obscure" vowel of Eng. *gardener*; used in the reconstruction of Indo-Eur. forms, and in transliterating the Iranian languages.

gh: in Sanskrit a voiced guttural aspirate (cf. *ch*).

ǥ: voiced velar (back-guttural) explosive, used most frequently in Indo-Eur. reconstructions.

ȝ: voiced guttural (or palatal) spirant, equivalent to Mod. Greek *γ*, and used in transliteration of Iranian languages and O. Eng.

ḥ: a voiceless breathing, the Sanskrit *visarga*.

hᵛ: a labialized *h*, similar to *wh* in Eng. *what*; used in transliteration of Gothic and the Iranian languages.

ḫ: voiceless guttural (or palatal) spirant, equivalent to German *ch*, and used in transliteration of the Iranian languages.

i̯: the semi-vowel *y*, or consonant form of *i*; used in phonetic writing and reconstructions of Indo-Eur. forms.

j: in the transliteration of Sanskrit and the Iranian languages a voiced palatal explosive; in the Teutonic languages a semi-vowel (= *y*), for which in Indo-Eur. reconstructions *i* is generally used.

jh: in Sanskrit a voiced palatal aspirate (cf. *ch*).

kh: in Sanskrit a voiceless guttural aspirate (cf. *ch*).

ł: the guttural ("thick" or "deep") of the Slavonic and some of the Scandinavian languages.

l̥: vowel *l*; used in transliterating Sanskrit, in reconstructing Indo-Eur. forms, and in other phonetic writing.

n̥: nasal vowel; used in reconstruction of Indo-Eur. forms and in phonetic writing.

ṇ: in Sanskrit the cerebral nasal.

ñ: in Sanskrit the guttural nasal (see following).

ŋ: the guttural nasal, equivalent to Eng. *n* in *longer*; used in transliteration of Iranian languages.

ñ: palatal nasal, similar to *gn* in Fr. *regner*; used in transliterating Sanskrit and in phonetic writing.

ö: palatalized *o*; used in German and in phonetic writing.

ǫ: short open *o* in Scandinavian.

ø: short palatalized *o* (ö) in Scandinavian.

*ph*: in Sanskrit, voiceless labial aspirate (cf. *ch*).

ɋ: voiceless velar (back-guttural) explosive; used in reconstructions of Indo-Eur. forms and in other phonetic writing.

r̥: vowel *r*; used in transliterating Sanskrit, in reconstructions of Indo-Eur. forms, and in other phonetic writing.

š: voiceless cerebral sibilant, equivalent to Eng. *sh*; used in transliterating the Iranian languages and in phonetic writing.

ṣ: voiceless cerebral spirant; used in transliterating Sanskrit.

th: in Sanskrit a voiceless dental aspirate (cf. *ch*).

ṭh: in Sanskrit a voiceless cerebral aspirate (cf. *ch*).

ṭ: in Sanskrit a voiceless cerebral explosive.

ţ: a form of dental spirant used in transliterating the Iranian languages (represented in Justi's transliteration by ṭ).

þ: voiceless dental (interdental) spirant, equivalent to Eng. *th* in *thin*; used in Teutonic dialects and in phonetic writing.

u̯: consonant form of *u*; used in phonetic writing.

ž: voiced cerebral sibilant, equivalent to *s* in Eng. *pleasure*, and to *j* in Fr. *jardin*; used in Iranian, Slavonic, and in phonetic writing.

ʒ: a symbol frequently used in the writing of O. H. G. to indicate a voiced dental sibilant (Eng. *z*), in distinction from *z* as sign of the affricata (*ts*).

# EXPLANATION OF THE SIGNS AND ABBREVIATIONS USED IN THE ETYMOLOGIES.

---

>, yielding by descent, i. e. under the operation of phonetic law.
<, descended from.
=, borrowed without change from.
: , cognate with.
+, a sign joining the constituent elements of a compound.
*, a sign appended to a word the existence of which is *inferred*.

| | |
|---|---|
| ablat. | ablative |
| accus. | accusative |
| adjec. | adjective |
| adv. | adverb |
| cf. | compare |
| conjunc. | conjunction |
| deriv. of | derivative of |
| dimin. | diminutive |
| fem. | feminine |
| genit. | genitive |
| imper. | imperative |
| impf. | imperfect |
| indic. | indicative |
| infin. | infinitive |
| masc. | masculine |
| nomin. | nominative |
| partic. | participle |
| perf. | perfect |
| plur. | plural |
| prep. | preposition |
| pres. | present |
| pron. | pronoun |
| sc. | scilicet, supply |
| sing. | singular |
| subst. | substantive |
| vocat. | vocative |

---

| | |
|---|---|
| Anglo-Fr. | Anglo-French |
| Arab. | Arabic |
| Avest. | Avestan |
| Dan. | Danish |
| Eng. | English |
| Fr. | French |
| Germ. | German |
| Goth. | Gothic |
| Gr. | Greek |
| Heb. | Hebrew |
| Icel. | Icelandic |
| Ital. | Italian |
| Lat. | Latin |
| Lith. | Lithuanian |
| Mediæv. Lat. | Mediæval Latin |
| Mod. Lat. | Modern Latin |
| M. Eng. | Middle English |
| M. H. Germ. | Middle High German |
| O. Bulg. | Old Bulgarian (= Church Slavonic) |
| O. Eng. | Old English (= Anglo-Saxon) |
| O. Fr. | Old French |
| O. Fris. | Old Frisian |
| O. H. Germ. | Old High German |
| O. N. | Old Norse |
| O. Sax. | Old Saxon |
| Pers. | Persian |
| Portug. | Portuguese |
| Prov. | Provençal |
| Sanskr. | Sanskrit |
| Sc. | Scotch |
| Span. | Spanish |
| Swed. | Swedish |
| Teuton. | Teutonic |

# KEY TO THE PRONUNCIATION.

aa..... as *a* in *father*, and in the second syllable of *armada*.

ăa..... same, but less prolonged, as in the initial syllable of *armada*, *Arditi*, etc.

a..... as final *a* in *armada*, *peninsula*, etc.

ă..... as *a* in *fat*, and *i* in French *fin*.

ay or ā.. as *ay* in *nay*, or as *a* in *fate*.

ăy or *ā*.. same, but less prolonged.

ã..... as *a* in *welfare*.

aw..... as *a* in *fall*, *all*.

ee..... as in *meet*, or as *i* in *machine*.

ĕe..... same, but less prolonged, as final *i* in *Arditi*.

e..... as in *men*, *pet*.

*e*..... obscure *e*, as in *Bigelow*, and final *e* in *Heine*.

ė..... as in *her*, and *eu* in French *-eur*.

i..... as in *it*, *sin*.

ī..... as in *five*, *swine*.

*ī*..... same, but less prolonged.

ō..... as in *mole*, *sober*.

*ō*..... same, but less prolonged, as in *sobriety*.

o..... as in *on*, *not*, *pot*.

oo..... as in *fool*, or as *u* in *rule*.

o͝o..... as in *book*, or as *u* in *put*, *pull*.

oi..... as in *noise*, and *oy* in *boy*, or as *eu* in German *Beust*.

ow..... as in *now*, and as *au* in German *haus*.

ö..... as in *Göthe*, and as *eu* in French *neuf*, *Chintreuil*.

ŭ..... as in *but*, *hub*.

*ŭ*..... obscure *o*, as final *o* in *Compton*.

ü..... as in German *süd*, and as *u* in French *Buzançais*, *vu*.

y or *l*.... see *l* or y.

yu..... as *u* in *mule*.

yŭ..... same, but less prolonged, as in *singular*.

*c*h..... as in German *ich*.

g..... as in *get*, *give* (never as in gist, congest).

hw..... as *wh* in *which*.

*k*h..... as *ch* in German *nacht*, *g* in German *tag*, *ch* in Scotch *loch*, and *j* in Spanish *Badajos*, etc.

ṅ..... nasal *n*, as in French *fin*, *Bourbon*, and nasal *m*, as in French *nom*, Portuguese *Sam*.

ñ or n-y.. Spanish *ñ*, as in *cañon*, *piñon*, French and Italian *gn*, etc., as in *Boulogne*.

*l* or y.... French *l*, liquid or mouillé, as (-i)ll- in French *Baudrillart*, and (-*i*)*l* in *Chintreuil*.

th..... as in *thin*.

*th*..... as in *though*, *them*, *mother*.

*v*..... as *w* in German *zwei*, and *b* in Spanish *Cordoba*.

sh..... as in *shine*.

*z*h..... as *s* in pleasure, and *j* in French *jour*.

All other letters are used with their ordinary English values.

## NOTE.

The values of most of the signs used in the above Key are plainly shown by the examples given. But those of ö, ü, *c*h, *k*h, ñ, and *v*, which have no equivalents in English, can not be sufficiently indicated without a brief explanation, which is here given.

ö. The sound represented by this symbol is approximately that of -u- in *hurt* or -e- in *her*, but is materially different from either. It is properly pronounced with the tongue in the position it has when ā is uttered and with the lips in the position assumed in uttering ō.

ü. This vowel is produced with the lips rounded as in uttering oo and with the tongue in the position required in uttering ee, into which sound it is most naturally corrupted.

*c*h and *k*h. These are both rough breathings or spirants made with considerable force, *c*h being made between the flat of the tongue and the hard palate, and *k*h between the tongue and the soft palate. *c*h approaches in sound to English sh, but is less sibilant and is made further back in the mouth; *k*h is a guttural and has a hawking sound.

*l* or y. These are both used to represent the sound of French l mouillé, in (-i)ll- and (-i)l, which resembles English -y- in *lawyer*. Final *l*, that is, (-i)l, may be approximated by starting to pronounce lawyer and stopping abruptly with the -y-.

ñ or n-y. The consonants represented by ñ (Spanish ñ, French and Italian gn, etc.) are practically equivalent to English -ni- or -ny- in bunion, bunyon, onion, etc., and, except when final, are represented by n-y. Final ñ, as French -gn(e), may be produced by omitting the sound of -on in the pronunciation of *onion*.

*v*. This may be pronounced by attempting to utter English v with the use of the lips alone.

See PREFACE (vol. i., p. xli.) and the article PRONUNCIATION OF FOREIGN NAMES.

# THE
# UNIVERSAL CYCLOPÆDIA.

---

: the seventh letter of the English alphabet.

*Form.*—The letter is an early (fifth or sixth century B. C.) invention of the Romans. It was formed by appending a differentiating mark to the lower point of the third letter C. This letter represented the form (< Γ) and had originally the value (*g*) of the Greek gamma. but through the disuse of K it had come to be a sign for the voiceless (*k*) as well as the voiced (*g*) guttural. The original third letter C was therefore differentiated into the two forms C and G, the older form retaining the old place in the alphabet, but restricting itself almost exclusively to the newly acquired value (*k*), while the new form was assigned to the place of the disused sixth letter zeta (I), and assumed the older value (*g*).

*Name.*—The Greek name *gamma* is an adaptation of a Canaanite name represented in Heb. *gimel*, meaning camel (cf. Greek *κάμηλος*). The letter was probably so named on account of resemblance to a camel's hump (∧). The English name (*dzhee*) comes through the Old French from the Latin *gē*, a substitute for *gamma*.

*Sound.*—The letter has two principal values in English: (1) voiced guttural explosive, involving the breaking with voiced breath of a closure between the body of the tongue and the palate, as in *gun*, *ago*, *gift*, *signal*, sometimes assisted orthographically by an *h* or *u*, as in *ghost*, *guilt*; (2) the double consonant *dzh* composed of the voiced dental explosive (*d*) and the voiced broad sibilant (*zh* in azure), as in *courage*, *general*, *logic*, *cringe*; it is often assisted orthographically by an added *d*, as in *bridge*, *judge*. In recent loan-words from the French the letter has sometimes also the value of the voiced broad sibilant alone, as in *mirage*, *rouge*. It is often silent before *n* and *m*, as in *gnat*, *sign*, *paradigm*, and in the combination *gh*, as in *high*, *bough*. In the combination *ng* at the end of syllables (*sing*, *long*) it is merely a sign that *n* is the guttural, and not, as usual, the dental nasal. In the combination *gh* it sometimes has the value of *f*, as in *cough*, *rough*.

*Source.*—The main sources of the voiced explosive *g* are (1) in Teuton. words the Indo-Europ. *gh* (ɣ*h*), as in *goose*: Gr. *χήν* : Lat. (*h*)*anser* : Skr. *haṅsa-* < Indo-Europ. *ghans-*; (2) the *g* of languages from which the English has borrowed; thus in *governor*, *grain*, through French from Lat. *guberna'tor*, *granum*, in *garnish*, *gage*, *guide*, from French representing Germ. *w*, etc. The most important source of the double consonant *g* (= *dzh*) is the French, as in *gentle*, *courage*, *change*, but it also appears in native English words as a Middle English resultant from the Old English palatalized *g* in the O. Eng. combination *ng* and *cg*, as in *singe* (O. Eng. *sengan*), *hinge* (O. Eng. *henge*), *bridge* (O. Eng. *brycg*), etc.

BENJ. IDE WHEELER.

**G**: in music, the fifth degree in the ascending scale of C, major or minor, being the dominant in that scale. *Gamut G* is the note on the lowest line of the bass stave, a seventh below F on the clef line. *Double G* is one octave lower than gamut G. G *dur* is the German for G major, and G *moll* for G minor. *Gis*, in German, is G sharp. G *in alt*, the first note in alt, situated one octave above the treble clef line. G *in altissimo*, a note one octave higher than G in alt.

**Gabbro**: a name generally applied to a rather coarse-grained granular rock of basic composition. In structure and origin it is analogous to granite, of which it forms the basic equivalent. Mineralogically gabbro is composed essentially of pyroxene (variety *diallage*) and triclinic feldspar (generally labradorite or anorthite). It also contains some iron oxide, usually ilmenite, while an orthorhombic pyroxene or olivine may or may not be present. The name gabbro originated in Italy, where it was used by miners to designate a black serpentine. It was introduced in its present meaning by the German geologist von Buch in 1810. The same rocks are still called by the Italians *granitone*, and some of the coarser and more altered varieties are known to the French as *euphotide*. Gabbro is probably in all cases an igneous rock which has solidified at a considerable depth, and therefore so slowly as to produce a rather coarse crystallization. When occurring in sufficient mass it is available for all the economic uses to which granite is applied. The best known gabbros are those of Northern Italy and the Alps of Silesia and the Hartz Mountains in Germany. In the U. S. gabbros are found in the White Mountains, on the north shore of Lake Superior, in Minnesota, and near Baltimore in Maryland. The two essential constituents of gabbro are peculiarly liable to alteration, whereby the diallage becomes fibrous hornblende (smaragdite) and the feldspar a compact white substance known as saussurite. The resulting rock may or may not be schistose, but it is not less crystalline and resistant than the original gabbro from which it has been derived. Such secondary rocks resulting from the metamorphism of gabbros are known as euphotide, gabbro-diorite, or saussurite-diorite.

GEO. H. WILLIAMS.

**Gabelentz**, HANS CONON, von der: philologist; b. at Altenburg, Germany, Oct. 13, 1807; studied finance, law, and Oriental languages at Leipzig and at Göttingen. Among his works are a critical edition of Ulfilas's translation of the Bible (1843–46); *Die melanesischen Sprachen* (1860–73); *Grammatik der Kassiasprache* (1858); *Ueber das Passivum* (1861). D. Sept. 3, 1874.—His son HANS GEORG CONON VON DER GABELENTZ: philologist; b. at Poschwitz, Mar. 16, 1840; studied at Jena and at Leipzig, and was Professor of Oriental Languages at Leipzig and in the University of Berlin. He is author of *Chinesische grammatik* (1882); *Die Sprachwissenschaft* (1891); *Handbuch zur Aufnahme fremder Sprachen* (1892). D. Dec. 12, 1893.

**Ga'bii**: an ancient Latin city which stood 12 miles E. of Rome, on the banks of a small lake in a volcanic crater. In early Roman days it was an important town, but it decayed, as allusions in Cicero, Horace, and Juvenal show. It afterward revived and became a bishop's see, but is now deserted.

**Gabin'ius**, AULUS: Roman politician; became tribune at Rome in 66 B. C.; served under Pompey 64–63, and gained immense wealth; was prætor in 61; consul in 58; proconsul in Syria and Judæa 57; restored Ptolemy Auletes in 55, and was convicted of corruption and exiled. He was recalled toward the end of 49 by Cæsar, and stationed with troops in Illyricum, where he died about 47 B. C.

**Gable** [O. Fr. *gable* (Low Lat. *ga'balum*) from O. H. Germ. *gibil*, front side, probably under the influence of *gabala* (> Mod. Germ. *Gabel*), fork]: the triangular upper part of a wall

which receives the end of a pitched roof. When inclosed, as in classic architecture, between a horizontal cornice below and "raking" cornices above, it is called a *pediment*.

The steep roofs of the Middle Ages led to special developments in the design of gables, which became important features of external architecture. They were usually pierced with rose-windows, and crowned with molded copings which were often adorned with crockets and terminated in a rich finial at the summit. In the fourteenth and fifteenth centuries false gables, wholly independent of the roofs behind them, were used as decorations over porches, doorways, and window-heads, and were designed with rich open-work tracery in trefoils, cusps, and other fanciful patterns. Gables continued to be prominent and picturesque features in the Renaissance architecture of England, Germany, and the Low Countries. In France the architects of the early Renaissance decorated their dormers with rich gables; but this fashion passed away, and in the later Renaissance of France, as throughout that of Italy, gables are replaced by classic pediments.

The term "gable wall" is used by builders in New York city and in some other cities of the U. S. to designate the side walls or party walls of houses built in continuous blocks, irrespective of the actual form of these walls. This usage arose from the practice which formerly prevailed, of pitching the roof to the front and rear from a ridge parallel with the street, the party walls and other side walls forming low gables. A. D. F. Hamlin.

**Gablenz**, gaa'blents, Ludwig Karl Wilhelm, Baron von: Austrian general; a son of the Saxon lieutenant-general Gablenz; b. at Jena, July 19, 1814, and educated at the Military Academy of Dresden. He served first in the Saxon horse-guard, but in 1833 entered the Austrian service, and became, after six years, a captain of horse. He was often employed in honorary service. In 1848 he fought in Italy under Radetzky with great distinction, and was made a major of the staff. He next became chief of staff to Count Sehlick; distinguished himself especially at Kaschan; obtained the Maria Theresa cross, and was promoted to be colonel. Soon after he was employed in diplomatic negotiations. In 1853 he was appointed director of the bureau of statistics in Vienna; in 1859 distinguished himself in the disastrous battle of Solferino, and by his defense of Caoriana covered the retreat of the center. In 1863 he was made a lieutenant-marshal, and in 1864 received the command of the Sixth Army-corps, which was sent against the Danes in Schleswig-Holstein. As governor of Holstein he made a very favorable impression by his liberality. In 1866 he commanded the Tenth Army-corps, and at Trautenau on June 28 he gained the only advantage which the Austrians could boast of in that disastrous war. He also took part in the battle of Sadowa, and was sent to the Prussian headquarters to negotiate after the battle. When the war was over he retired, and was chosen member for life of the Austrian upper house, in which he belonged to the liberal party. In 1867 he became commandant of Croatia and Sclavonia; in 1868 he was made a general of horse and in 1869 general in command of Hungary. Nov. 28, 1871, he retired. D. in Zurich, Jan. 28, 1874.

**Gablonz**, gaa'blōnts: town of Bohemia, on the Neisse: 8 miles S. E. of Reichenberg (see map of Austria-Hungary, ref. 2–E); the center of a manufacturing district where more than 10,000 men are employed in the fabrication of ornamental glassware. Pop. (1890) 14,653.

**Gaboon'**, or **Gabun**: a so-called river, but properly an estuary on the west coast of Africa near the equator, extending 50 miles or more inland, with a width of 7 miles or more. It receives two small rivers near its upper end. It has given its name to the adjacent coast. M. W. H.

**Gaboon-Congo**, or **Gabun-Congo**; also called **French Congo**: organized in 1886 as the French colony of Gaboon and the Congo, and officially designated on Apr. 30, 1891, as "Congo français," or the French Congo. In 1895 the colony was divided into the two districts of the French Congo and Upper Ubangi. The French Congo district embraces the Atlantic coast from the German Cameroons on the N. to the possessions of Portugal and the Congo Free State on the S., the region of the Gaboon river, the whole basin of the Ogowe river, and the valleys of the Kuilu, Alima, Likuala, and Sanga rivers. The Upper Ubangi embraces the territory to the N. of the Ubangi (Mobangi) and Mbomu rivers as far as Lake Chad, and as far E. as the Bahr-el-Ghazal province of Egypt. The entire possession has an area of about 300,000 sq. miles, nearly equally divided between the two districts. The population is estimated at about 7,000,000. A large part of the country has not yet been effectively occupied. The chief highways of trade are the Gaboon, Ogowe, Congo, and Ubangi rivers, while the Sanga is of the highest importance as an excellent waterway N. and S. through Upper Ubangi. The chief exports are rubber, ivory, palm oil, and copal. The foreign trade has grown very little for years, and is about $1,000,000 a year, nearly equally divided between exports and imports. C. C. Adams.

**Gaboriau**, gaa-bō'ri-ō, Émile: novelist; b. in Saujon, France, in 1835. He began contributing to the Paris newspapers early in life; published his first story, *L'Affaire Lerouge* (1866), and followed it with *Le Dossier 113* (1867); *Le Crime d'Orcival* (1868); *Monsier Lecoq* (1869); *Les Esclaves de Paris* (1869); *La Vie Infernale* (1870); *La Clique Dorée* (1871); and *La Corde au Cou* (1873). He left MSS. of *L'Argent des Autres* (1874) and *La Dégringolade* (1876). D. in Paris, Sept. 28, 1873.

**Ga'briel** [Heb., man of God, mighty one of God; *gebher*, man + *el*, God]: the name of the heavenly being who communicated prophetic tidings to Daniel (Dan. viii. 16, ix. 21), and foretold in later times the birth of St. John the Baptist and of Jesus Christ (Luke i. 19, 26). Gabriel in Jewish, Christian, and Mohammedan traditions is reckoned as one of the great archangels. In the Koran he is said to be the special medium of communication between God and Mohammed, for he caused the Koran to descend on Mohammed's heart (*Koran*, Sura 2).

**Gabriel, Order of St.** (Roman Catholic): (1) a congregation of lay conventual brethren (*conviventes*) and of non-conventual gentlemen (*confluentes*) at Bologna, founded in 1638. They are engaged in the work of instruction. (2) The order of the Brothers of St. Gabriel in France, founded in 1835 by the Abbé Deshayes. They are also engaged in instructing the young, especially in rural places; but they chiefly, if not exclusively, devote themselves to instruction in matters of doctrine.

**Gad** [Heb., fortune]: seventh son of Jacob by Zilpah, and founder of the Israelitish tribe of Gad, which, after the conquest of Canaan under Joshua, settled E. of the Jordan, N. of Reuben, and S. of the half-tribe of Manasseh; but subsequently the Gadites were found far to the N., E., and S. of their prescribed limits. They were a warlike people with many flocks. Little is known of them after Tiglath-Pileser carried them into captivity about 740 B. C. (1 Chron. v. 6, 26).—Gad, the "king's seer," a prophet who was a personal follower of David, wrote the acts of David (1 Chron. xxix. 29). His writings are not extant, unless in the form of portions of the books of Judges and Samuel.

Revised by Willis J. Beecher.

**Gad'ara**: a stronghold of Trans-Jordanic Palestine, on a hill just S. of the Hieromax, about 8 miles S. E. of Lake Tiberias. It is not mentioned in Scripture, although plainly indicated by the expression "country of the Gadarenes" (Mark v. 1; Luke viii. 26, 37). It is first mentioned by Polybius (*Hist.*, v. 71), who relates its capture by Antiochus the Great (218 B. C.), and speaks of it as "the strongest of all the cities in that part of the country." It was one of the cities of Decapolis, and had a mixed population, predominantly Greek. In later times several bishops of Gadara are enrolled in the general councils of the Church. Its ruins, called by the Arabs *Umm Keis*, occupy a space about 2 miles in circumference. The ancient pavement of the principal street is described by Porter as almost perfect. There are hot baths on the bank of the river near by. The swinging stone doors of the old tombs in the limestone rock are a remarkable sight.

Revised by S. M. Jackson.

**Gaddi**, gaad'dee, Gaddo: painter; b. in Florence, Italy, about the middle of the thirteenth century. He began by imitating Byzantine art, but he became known to Cimabue, and followed his artistic advice. Gaddi was distinguished as a mosaic worker, and executed several works in Florence together with Andrea Tafi. He was called to Rome in 1308, and there adorned the ancient basilica of St. Peter and also that of Sta. Maria Maggiore with mosaics, which still remain. He also painted in Florence several works in the manner of Cimabue. He was living in 1333. W. J. S.

**Gaddi**, Taddeo: painter; b. in Florence, Italy, in 1300; a son of Gaddo Gaddi, with whom he studied art till he was twelve years old, when Gaddo died leaving him under the care of Giotto, his godfather. He remained twenty-four

years with this master painting frescoes in Santa Croce, works which are regarded as masterpieces. He also had repute as an architect. He rebuilt the Ponte Vecchio, and continued the campanile of Sta. Maria del Fiore after Giotto's death. D. about 1366. He left two sons, Giovanni, who died very early after giving promise of artistic ability, and Angelo or Agnolo (b. 1326; d. about 1395), also renowned as a painter. He left many works in Florentine churches. He also was a mosaic worker, and restored the work of Andrea Tafi. At fifty years of age he went to Venice, more in the quality of merchant than of painter. Cennino Cennini and Stefano di Verona were his most remarkable pupils. W. J. Stillman.

**Gade**, gaa'de, Niels Wilhelm: musical composer and conductor; b. at Copenhagen, Denmark, Feb. 22, 1817; studied there under local teachers, and entered the royal orchestra as violinist. His first important work, his *Ossian* overture, composed in 1841, was crowned by the Copenhagen Musical Union, and the king granted him a royal stipend for foreign travel. He became an intimate friend of Mendelssohn and Schumann, and belonged to the romantic school of composers. His works include eight symphonies, five overtures, much chamber music, many songs, both solo and choral, and several cantatas, viz., *The Erl King's Daughter*, *Comalo*, *The Crusaders*, *Zion*, *Psyche* (the last three were produced at the English Birmingham festivals), and *Spring's Message*, two concertos for violin and orchestra, and much music in smaller forms. D. Dec. 22, 1890. D. E. Hervey.

**Ga'des** (in Gr. τὰ Γάδειρα): a city of Spain (now called Cadiz) founded by the Phœnicians, outside the Pillars of Hercules (Straits of Gibraltar). It was regarded as the extreme limit of the world, so that "beyond Gades" came to be a synonym for "impossible." It was an important commercial center, according to Strabo second in population only to Rome. Gades exported to Rome and the Orient salt fish (sardines), Negro slaves, and the native ballet-girls, called *Gaditanæ*. J. R. S. S.

**Gad-fly** [*gad* represents the shortened form (used in comp.) of O. Eng. *gād* > Mod. Eng. *goad*]: a name applied to the breese or horse-fly (*Tabanus bovinus*) and other dipterous insects of the family *Tabanidæ*, the females of which goad or sting horses and cattle. Their bite is deep and painful, but not poisonous. The name is also erroneously applied to Bot-fly (*q. v.*), and other insects of the family *Œstridæ*.

**Gad'idæ** [Mod. Lat. deriv. of Late Lat. *gadus*, codfish, from Gr. γάδος, a kind of fish]: a group of fishes of great value. The body is elongated and more or less compressed, and tapers into the caudal fin; the scales are cycloid and very small; the lateral line continuous and parallel with the back; the head is generally conic; the eyes lateral and large; the nostrils double; the opercula normally developed and unarmed; the mouth has a more or less extensive lateral oblique cleft; the upper jaw is little protractile; the dorsal and anal fins are variously formed, but always long and without spines; the caudal fin is distinct; the pectoral fins are narrow, and the ventral fins jugular. The species are chiefly confined to cold waters, and mostly to those of the northern hemisphere, but a few types are found in the cold deep waters of the lower latitudes, and reascend toward the surface in oceans of the southern hemisphere. Among the well-marked sub-families are (1) the *Gadinæ*: this subfamily includes the true codfishes (*Gadus*), the pollocks (*Pollachius*), the haddock (*Melanogrammus*), the tomcods (*Microgadus*), whitings (*Merlangus*), etc. (2) The *Phycinæ*: to this group belongs the so-called "hake" (not the true hake, which is a *Merlucius*) of the New England and neighboring provincial coasts. (3) The *Lotinæ*: this group has two types, *Molva*, the true ling, which is marine, and *Lota*, restricted to the fresh waters, and embracing the cusks or burbots of the interior lakes and rivers of the North. (4) The *Gaidropsarinæ*: this includes the smallest and least useful species of the family; those of the coasts of North America are rare and of no economical importance, and unknown to the fishermen; on the European coasts, however, they are more common, and in England are known under the name of rockling. (5) The *Brosminæ*: the sub-family includes the *Brosmius*, known under the names of cusk and torsk. About sixty or seventy species of the family have been described, among which are several genera peculiar to the depths of the tropical or sub-tropical seas, where the water has a low temperature compared with the surface and the land. As many as seventeen species have been discovered along the eastern coast of North America, but only three or four in the western or Pacific region. Theodore Gill.

**Gadow**, Hans Friedrich, M. A., Ph. D., F. R. S.: anatomist and ornithologist; b. at Cracow, Pomerania, Mar. 8, 1855; educated at the Universities of Berlin, Jena, and Heidelberg, and afterward became Strickland curator and lecturer on the Advanced Morphology of Vertebrata at the University of Cambridge, England. Dr. Gadow is one of the leading authorities on the anatomy of birds, having devoted himself especially to the study of the structure of that group. His published papers are numerous, and have appeared most often in the *Transactions* and *Proceedings* of the Zoölogical Society of London, the *Transactions* of the Philosophical Society of London, *Morphologisches Jahrbuch*, and *Journal of Anatomy and Physiology* of London. He is author of vols. viii. and ix. of the British Museum *Catalogue of Birds*, the one containing the *Paridæ*, *Laniidæ*, and related forms, the other the *Nectariinidæ* and *Meliphagidæ*; also author of the volume *Aves* in Bronn's *Classen und Ordnungen des Thierreichs* (Leipzig, 1884–93). F. A. Lucas.

**Gadro'sia** (in Gr. ἡ Γαδρωσία): a province of Ariana (now *Iran*) in Eastern Persia, conquered by Alexander the Great; now regarded as identical with Baluchistan. J. R. S. S.

**Gadsby**, Henry Robert: composer; b. at Hackney, London, Dec. 15, 1842, and principally self-instructed in music. His compositions are numerous and important, and include many cantatas, psalms, overtures, and other orchestral pieces, and much church music. They are all brilliant and pleasing. D. E. H.

**Gadsden**: town; capital of Etowah co., Ala. (for location of county, see map of Alabama, ref. 2–D); on the E. Tenn., Va. and Ga., the Chattanooga S., the Louisville and Nash., and the Nash., Chat. and St. L. Railways, and on the north bank of the Coosa river, at the southern terminus of Lookout Mountain, in the midst of the Coosa coal-fields and deposits of iron. It has many steam-mills engaged in cutting yellow-pine lumber. Pop. (1890) 2,901; (1900) 4,282.

**Gadsden**, Christopher: statesman and patriot; b. in Charleston, S. C., in 1724; educated in England, returning to Charleston in 1741; engaged in a mercantile business, in which he was largely successful. In 1765 he was appointed a delegate to the Congress which met at New York in October to petition against the Stamp Act; was also chosen member of Congress in 1774; was among the earliest advocates of republican principles and American independence; colonel and brigadier-general of South Carolina volunteers in 1775; engaged in the siege of Charleston in 1776; during the siege of 1780, while Lieutenant-Governor, he remained, with five of the council, within the lines of the city; several months after the capitulation he was arrested by order of Lord Cornwallis and transported to St. Augustine, where a parole was offered him, which he refused, remaining in close confinement for forty-two weeks. In 1782 he was chosen Governor of South Carolina, but declined the office, continuing, however, to serve both in the Assembly and council. D. at Charleston, Aug. 28, 1805.

**Gadsden**, James: statesman and soldier; b. at Charleston, S. C., May 15, 1788; graduated at Yale College 1806, and engaged in commercial business in Charleston until 1812, when he was appointed second lieutenant of engineers U. S. army; served during the war with Great Britain (1812–15); as aide-de-camp to Gen. Jackson 1816, with whom he served in Florida; promoted to be captain 1818, and appointed colonel and inspector-general U. S. army 1820, but was not confirmed by the Senate; member of the legislative council of Florida Territory (1824), and commissioner to treat for the removal of Seminole Indians to Southern Florida; U. S. minister to Mexico in 1853, and negotiated the purchase of Arizona. (See Gadsden Purchase.) D. at Charleston, S. C., Dec. 26, 1858.

**Gadsden Purchase**: a name given to that part of Arizona and New Mexico which lies S. of the river Gila. This region was purchased from Mexico for the U. S. by Gen. James Gadsden (*q. v.*) by convention dated Dec. 30, 1853, the U. S. paying $10,000,000, and Mexico giving up a large amount (stated at from $15,000,000 to $30,000,000) in claims for Indian depredations. The sale was very unpopular in Mexico, where it was a principal cause of Santa Anna's banishment as a traitor (1855). Area of purchase, 45,535 sq. miles.

**Gadwall**, or **Gray Duck**: a wild duck (*Chaulelasmus streperus*) of Asia, Europe, America, and North Africa. It is very quick, and hard to shoot, but is highly prized for the table. It inhabits both fresh and saline marshes, and is a bird of passage.

**Gaelic Language and Literature** [Mod. Irish *Gaoidhilge*, Gael. *Gaidhlig*]: in its wider application, the language and the literature of the *Goidil*—i. e. of the Celtic population of Ireland, which from about the end of the fifth century A. D. had acquired a footing in Scotland also. (Cf. CELTIC LANGUAGES and IRISH LANGUAGE.) The term *goidetic* has also come to be used in this sense; the form *gadhelic* is, however, wrong. In the more restricted sense *Gaelic* or *Erse* (i. e. Irish) denotes the language of the inhabitants of the Scottish Highlands and the western islands so far as they have preserved their old Celtic idiom. Though originally not differing from Irish, as the scanty records from the Middle Ages show, the Gaelic has in the course of the centuries differentiated itself in the different districts where it is spoken. It is constantly losing ground before the English. Gaelic literature had its rise early in the sixteenth century. It begins with a collection of poems by the Dean of Lismore (1512), which contains, however, several poems of Irish origin. The dependence of the Gaelic literature upon the Irish shows itself even on the surface in the later Gaelic orthography, which closely resembles the Irish. The most familiar literary name is that of James Macpherson with his *Poems of Ossian* (1762). It is, to be sure, becoming ever more apparent that the later published Gaelic text was subsequently translated from the so-called English translation. These poems indeed represent an extremely free and even arbitrary use and elaboration of certain *motives* drawn from the Gaelic legends. The forgery offered, however, the impulse to a collection of the tales and songs actually in circulation among the people. See especially J. F. Campbell's *Popular Tates of the West Highlands and Heroic Gaelic Ballads* (1872). They prove to be a mixture of a late form of the mythological legends introduced from Ireland and the common legendary lore of Europe. The remaining Gaelic literature is chiefly religious in character, Bible translations, sermons, etc. Yet in no century are the secular poets entirely lacking; they may in a certain sense be regarded as the successors of the old Irish-Gaelic bards. (See IRISH LITERATURE.) An agreeable introduction to this literature is afforded by John Stuart Blackie's *Language and Literature of the Scottish Highlands* (1876). R. THURNEYSEN.

**Gaeta**, gä̆-ā'tä̆ [Ital. < Lat. *Caje'ta*]: a strongly fortified seacoast town of Southern Italy; in the province of Caserta; about 40 miles N. W. of Naples; lat. 41° 30′ N., lon. 13° 40′ E. (see map of Italy, ref. 6–E). It was an ancient Greek colony, most picturesquely situated on a steep promontory overlooking the Bay of Gaeta, and was a favorite resort of the Roman aristocracy—Cicero, Augustus, Tiberius, Faustina, and many others had luxurious villas here. Monuments of this period still exist, as the tomb of Lucius Munatius Plancus, the reputed founder of Lyons, and that of Sempronius Atratinus. The famous duodecagonal column or tower, inscribed with the Greek and Latin names of the winds, is now a ruin. Gaeta has the honor of being the first among the Italian towns to form, after the downfall of the Roman power, an independent communal government, such as gave birth to the great republics of Genoa, Venice, and Florence. This little commonwealth was a republic in the time of Charlemagne; coined money and was ruled by its own dukes or doges until 1230. It sustained many noteworthy sieges during the Middle Ages; was the retreat of Pius IX. in 1848–49; and was the only stronghold that made a spirited resistance to Victor Emmanuel's forces in 1860 in defense of Francis II., ex-King of Naples. It was during this siege that rifled cannon were first used as battering-guns on a large scale. The citadel surrendered to Gen. Cialdini on Feb. 13, 1861, after three months' defense. The population of the town in 1892 was 16,848, chiefly occupied in the coasting-trade and in fisheries.

**Gætu'lia**: ancient name for the western part of the desert of Sahara. It was situated S. of Mauritania and Numidia, and inhabited by the Gætulians, who are supposed to have been the aboriginal Berbers. The Gætulians first came in contact with the Romans during the war with Jugurtha, in whose army they served as light cavalry. They were subdued by Lentulus, who from his victory over them received the surname of *Gætuticus*. G. L. HENDRICKSON.

**Gage**, LYMAN J.: banker and Secretary of the U. S. Treasury: b. at De Ruyter, N. Y., June 28, 1836; educated at Rome Academy; was a clerk in the post-office there; became a clerk in a bank in 1854; removed to Chicago in 1855; was bookkeeper for a lumbering firm, and later in the Merchants' Savings, Loan, and Trust Company, of which he became cashier; accepted a similar position in the First National Bank, and was elected its president Jan. 24, 1891; appointed Secretary of the Treasury March, 1897.

**Gage**, MATILDA JOSLYN: woman suffrage advocate; b. in Cicero, N. Y., Mar. 24, 1826; educated at home, at Hamilton Seminary, De Ruyter Academy, and Clinton Liberal Institute; early became interested in the woman suffrage movement, and was corresponding secretary of the New York State Woman Suffrage Society 1869–70; president of the same for nine years; president of the National Woman Suffrage Association 1875–76; for many years chairman of the executive committee and general secretary of the same; president of the Woman's National Liberal Union 1893; editor and publisher of *The National Citizen* 1878–81; one of the editors of the *History of Woman Suffrage* (1881–86); and author of *Woman's Rights Catechism* (1870); *Woman as an Inventor* (1871); *Woman, Church, and State* (1893). D. March 18, 1898.

**Gage**, SIMON HENRY, B. S.: physiologist; b. in Maryland, N. Y., May 20, 1851; educated at Cornell University; instructor there in 1878; and Associate Professor of Physiology since 1889; author of *Anatomical Technology* (with Prof. B. G. Wilder, 1882); *The Microscope and Histology* (1881; 4th ed. 1892); and articles in the *Reference Handbook of the Medical Science*; was collaborator on *Foster's Encyclopædic Medical Dictionary*; and has published many scientific papers.

**Gage**, THOMAS: English missionary and author; b. probably in Surrey about 1596; was sent to a Jesuit college in Spain, but disliked the order and joined the Dominicans. In 1625 he started for the Philippine islands with a party of missionaries; going by way of Mexico he deserted the party there, and for twelve years was a missionary and parish priest in Chiapas and Guatemala. In 1637 he returned to Europe, and in 1641 renounced the Roman Catholic religion for the Protestant; joining the parliamentary party he became rector of Acrise, Kent (1642), and in 1651 at Deal. In 1648 he published his *English-American or New Survey of the West Indies*, in which he described his travels in Mexico, and pointed out the defenseless condition of that country. It attracted wide attention and soon led to privateering expeditions against the Spanish colonies. Gage also published a controversial work, and was active against the Roman Catholics. He was appointed chaplain of the expedition of Venables and Penn to the West Indies, and died at Jamaica, 1656. HERBERT H. SMITH.

**Gage**, THOMAS: last Colonial Governor of Massachusetts and commander-in-chief of the British force in North America during the Revolutionary war; b. in England in 1721; a son of the first Viscount Gage; served as lieutenant-colonel in Braddock's expedition against Fort Duquesne in 1755; was appointed Governor of Montreal in 1760, and on the departure of Gen. Amherst succeeded him as commander-in-chief of the British forces in America. Being considered the most suitable person to execute the tyrannical laws of Parliament intended to subdue the rebellious spirit manifested in Massachusetts, he was appointed Governor of that province, and arrived in Boston May 17, 1774. Several regiments soon followed him, the repair of fortifications on Boston Neck was begun, the powder in Charlestown arsenal was seized, and on the night of April 18, 1775, detachments were sent out to Lexington and Concord to take possession of stores, a proceeding which led to the battle of Lexington on Apr. 19. In May, 1775, the provincial congress of Massachusetts declared Gen. Gage unworthy of obedience, and the exercise of his functions was henceforth confined to Boston. In June he issued a proclamation offering pardon to all rebels excepting Samuel Adams and John Hancock, and established martial law. The battle of Bunker Hill occurred a few days later, after which Gage was relieved by Sir William Howe, and returned to England the following October, where he died Apr. 2, 1787.

**Gagern**, gaa'gern, HEINRICH WILHELM AUGUST, Freiherr von: statesman; b. at Bairenth, Germany, Aug. 20, 1799; studied at the military school in Munich 1812–14, and in 1815 fought as an officer in the battle of Waterloo. After the war he studied law at Heidelberg, where he aided in founding the Burschenschaft, and at Jena, Göttingen, and Geneva. He then entered politics, and after holding several government offices was elected to the second chamber of grand ducal Hesse, where he steadily opposed the policy of the Federal Diet and of the state governments; but the reactionary party triumphed, and von Gagern retired for a time from public life. In 1846, however, he was re-elected to the chamber, where his influence consolidated and strengthened

the liberal party, and from this time he was one of the leading spirits in the movement for German unity which resulted in the Frankfort Parliament of 1848. His liberalism was moderate, practical, and in marked contrast to the prevailing spirit of that assembly, but he was chosen its president, and stood by his party till the ignominious failure of the Parliament to effect its purposes proved the hope of German unity vain for the present. In 1850 he offered his services to Schleswig-Holstein, and held the rank of major in the luckless campaign that followed. In his later years he was a member of the Grossdeutsche party. He represented grand ducal Hesse at Vienna from 1864 to 1872, and in the latter year received a pension and took up his residence at Darmstadt, where he died May 22, 1880.

F. M. Colby.

**Gai'a** (in Gr. Γαῖα, Γῆ, the earth: in Lat. *Tellus*): in Greek mythology the daughter of Chaos; of herself she begat Ouranos, the vault of heaven, and took him to husband. To him she bore the Titans, Cyclops, etc., all powerful beings, whom their father banished to Tartaros (the abyss beneath the earth) because he feared them. In anger Gaia induced and assisted Kronos, a Titan, to slay Ouranos. From his blood sprang the giants, and thus after Kronos had been deposed by his son Zeus, as prophesied by Ouranos, Gaia became the instigator of the war between the gods and the giants. In art Gaia appears chiefly as the mother of Erichthonios, the earth-born King of Athens, and the giants. She is seen rising from out of the earth, only the upper half of her body being visible. As the element Earth she either reclines upon her elbow on her native element or she sits upon a rock holding infants in her lap and surrounded by animals, all being symbols of her fruitfulness. See Roscher, *Lexicon* under *Gaia*; Baumeister, *Denkmäler* under *Gaia* and *Pergamon*.

J. R. S. Sterrett.

**Gail**, gāl or (Fr. pron.) gaal, Jean Baptiste: classical scholar; b. in Paris, July 4, 1755; appointed assistant to Vauvilliers in the chair of Greek in the College of France 1791; became titular professor 1792; curator of the Greek and Latin MSS. in the Imperial Library, and member of the Institute of France in 1809. He aided greatly in restoring the study of Greek in France, and published a large number of works illustrating the classic Greek authors, but his writings are no longer held in high estimation. His principal works are *Theocritus*, with translation (1792); *Anacreon* (1793); *Homer* (1801, 7 vols.); *Xenophon* (1797–1815, 10 vols. 4to); *Thucydides* (1807, 10 vols. 8vo); and a collection of philological essays and memoirs entitled *Le Philologue* (24 vols. 8vo). D. Feb. 5, 1829.

Revised by Alfred Gudeman.

**Gail**, Jean François: philologist; son of Jean Baptiste Gail; b. in Paris, Oct. 28, 1795; was for a time assistant to his father in the College of France; professor in the Military Academy of St. Cyr. Published *On the Nature of the Bacchus-worship in Greece* (1821); an edition of the *Periplus* of Scylax (1825); an edition of the *Geographi Græci Minores*, of which 3 vols. appeared (1826–31); and, in conjunction with Longueville, a translation of Matthiæ's Greek grammar. D. Apr. 22, 1845.

Revised by Alfred Gudeman.

**Gail Hamilton**: See Dodge, Mary Abigail.

**Gaillard**, gäă'yaar', Claude Ferdinand: engraver and portrait-painter; b. in Paris, Jan. 7, 1834. Pupil of Léon Cogniet; second-class medal, Salon, 1872; Prix de Rome (engraving) 1856; first-class medals, Salon, 1872, and Paris Exposition, 1878 (engraving); Legion of Honor 1876. His portraits are notable for minute rendering of detail. D. in Paris, Jan. 19, 1887.

W. A. C.

**Gaillard**, Edwin Samuel, A. M., M. D., LL. D.: physician; b. in Charleston district, S. C., Jan. 16, 1827. Took his literary degree 1845 at Columbia, S. C.; received first honors in South Carolina Medical College 1854; went to Europe 1857; returning thence, settled in New York city. In the month of June, 1861, he was awarded the Fisk fund prize for his essay on ozone. During the war of 1861–65 he filled every position in the Confederate army from assistant surgeon of a regiment to that of medical director of army and inspector of hospitals. He established *The Richmond and Louisville Medical Journal* 1866; was elected professor in the Medical College of Virginia 1867; and received a prize for an essay on diphtheria 1867. Removed to Louisville, Ky., and published his journal there, at the unanimous request of the Medical Society of that State, 1868, and was for nine years Professor of Principles and Practice of Medicine in the Louisville Medical College. In 1874 he established *The American Medical Weekly*. D. in Louisville, Ky., Feb. 2, 1885.

**Gaillardet**, gäă'yaar'dā', Théodore Frédéric: author and dramatic writer; b. at Auxerre, France, Apr. 7, 1808; became known through the celebrated drama *La Tour du Nesle*, performed in Paris for the first time in 1832, and the authorship of which he claimed against Alexandre Dumas *père*. After this he went to New York, and founded the Franco-American paper *Le Courrier des États-Unis*, of which he was the Paris correspondent after his return to France in 1852. Besides the drama already mentioned, he published *Struensée, ou le Médecin de la Reine*, a drama in five acts, and *Georges, ou le Criminel par amour*, a drama in three acts. He was also the author of the *Mémoires du Chevalier d'Eon* and of the *Professions de foi et considérations sur le système républicain des États-Unis*. D. in Paris, Aug. 13, 1882.

**Gaines**, Edmund Pendleton: soldier; b. in Culpeper co., Va., Mar. 20, 1777; appointed second lieutenant Sixth U. S. Infantry Jan., 1799, and first lieutenant Feb., 1802; U. S. collector of the port of Mobile, Ala., 1805; captain 1807; major and lieutenant-colonel 1812; colonel 1813; adjutant-general (rank of colonel) 1813, and brigadier-general U. S. army 1814; for gallant conduct in the defense of Fort Erie, Aug., 1814, where he was severely wounded, he was breveted major-general, and received the thanks of Congress and a gold medal; similar testimonials were made to him by the States of Virginia, Tennessee, and New York. In 1816 he was appointed one of the commissioners to treat with the Creek Indians; engaged against Creek and Seminole Indians as commander of the Southern military district; wounded by Seminole Indians in Florida 1836. D. in New Orleans, June 6, 1849.

**Gaines's Mill, Battle of**: a conflict which occurred during the civil war in the U. S. (1861–65); also known as the battle of Cold Harbor and of the Chickahominy. After the battle of Fair Oaks (May 31–June 1, 1862) the Army of the Potomac, strengthened by additional troops and supplies, with its base at White House, on the Pamunkey river, lay in front of Richmond threatening the city from the N. and E. Its left wing was on the south side of the Chickahominy river, and its right, under Gen. Fitz John Porter, was on the north. Gen. McDowell's corps was in the vicinity of Fredericksburg, under orders to join McClellan and participate in the proposed attack upon Richmond. On May 27 Gen. Porter sent out Morell's division and Warren's brigade, with a small force of cavalry and artillery, toward the N. W. to drive the Confederates from the right and rear of the army, and either to open the road for McDowell, should he move down to join McClellan, or, if it was decided that McDowell should remain near Washington, to destroy the roads and bridges so that they could not be used by Jackson if he should march from Northern Virginia to join Lee. This movement brought on the action at Hanover Court-house in which the Confederates were defeated and driven from the field with severe losses in killed, wounded, and prisoners. It having been decided in Washington that McDowell was not to join McClellan, Porter destroyed the railway bridges and returned to his camp on May 29.

The position of McClellan's army immediately before the battle of Gaines's Mill, passing from left to right, was as follows: The left wing on the S. of the Chickahominy, consisting of the Third Corps, Heintzelman, the Second Corps, Sumner, and the Sixth Corps, Franklin, with the Fourth Corps, Keys, in reserve, was covered in front by strong works and impassable ground, and on its flanks by swamps and the river. It extended from White Oak swamp near Anderson's Mill to the Chickahominy at New bridge. The right wing, consisting of the Fifth Corps, Porter, on the north (left) bank of the Chickahominy, covered the ground between that stream and the Pamunkey. Joining the left wing at New bridge, it extended up to Beaver Dam creek, which was strongly fortified, the crossings of the creek near Mechanicsville and Ellison's Mill being covered by field works, and the rest of the line by rifle trenches. Infantry outposts occupied positions up to Meadow bridge, and beyond them the cavalry extended the picket line northward to the Pamunkey. The reserves of cavalry and infantry were posted near Cold Harbor and in the vicinity of the bridge crossings of the Chickahominy, ready to move in any desired direction.

On June 26 Lee, leaving about one-third of his force under Magruder, moved A. P. Hill's, Longstreet's, and D. H. Hill's corps to his left, crossed the Chickahominy at Mechanicsville and above, drove in the outposts covering the crossings, and turning to the right attacked, at 3 P. M., Porter's works at Beaver Dam creek. These were defended by McCall's division of Pennsylvania reserves, re-enforced later in the day by a detachment from Morell's division. The Confederates made two gallant attacks, but were repulsed with great slaughter. Their losses were nearly 2,000 out of the 10,000 making the attack, while the Union losses were only about 250 out of the 5,000 engaged. This fight is known as the battle of Mechanicsville or Beaver Dam creek. While this action was in preparation and in progress, Jackson's corps, consisting of his own and Ewell's divisions, which had eluded the Union forces in the Shenandoah valley, was approaching the scene of battle from the N. W. During the night of the 26th it became evident that Jackson would arrive in time to come into action the next day, and would extend the Confederate line so far to the N. and E. as to render the position at Beaver Dam creek untenable; consequently in the early morning (about 3 o'clock) of the 27th this position was abandoned. The troops fell back and took up a new line about 6 miles to the eastward on the bank of a small stream lying to the E. of Powhite creek. This line was approximately semicircular in form, its left resting in the low ground near the Chickahominy, and its right nearly S. of Old Cold Harbor in Elder swamp. Through the center, which faced nearly N. W., ran the road to New Cold Harbor and Gaines's Mill. This position was strong, but owing to deficiency of axes and lack of time was but partly and imperfectly fortified with breastworks of logs, rails, knapsacks, etc. The east bank of the creek was high, sloping, and covered with brush and timber which afforded cover to the infantry. Good positions existed from which the artillery swept the ground in front, and the high ground behind the line was gently rolling, affording more or less cover to the reserves; while the bridges in the rear allowed re-enforcements to cross from the south bank if ordered to do so. The number of troops in the right wing, however, was not great enough to man the whole line as strongly as was desirable. The line was occupied by Sykes's division on the right and Morell's on the left, with McCall's in reserve. Slocum's division of Franklin's corps crossed the river and arrived upon the field late in the day, and rendered most valuable services, as did French's and Meagher's brigades of Sumner's corps still later.

A. P. Hill, advancing from Mechanicsville, came up to Powhite creek near Gaines's Mill, where his crossing was resisted by the Ninth Massachusetts Volunteers, and his advance delayed until he was compelled to deploy a large force to drive this regiment back. This brought on an engagement which lasted from about 12.30 to 2 P. M., and gave the name to the battle. Meanwhile the other corps moved forward and took up their positions. The Confederate line when finally formed was nearly parallel to the Union line, with Longstreet on the right, then in order A. P. Hill, Jackson, Ewell, and D. H. Hill, the corps of the latter forming the left of the line. Shortly after 2 P. M. the main action commenced with an advance by A. P. Hill, who moved out from the direction of New Cold Harbor toward the Union left center. The battle extended in both directions along the whole front, and continued without intermission for nearly two hours, when the Confederates were repulsed along the whole line. After a short interval the attack was renewed. The Union reserves were placed in line where needed, and finally, when all had been thrown into the first line, Slocum's division arrived at about 4 P. M., and his brigades were separated and sent where their services were most required. This general attack was repulsed at about 5 P. M., but minor combats continued at parts of the line.

At about 6.30 P. M. another determined attack was made which was also repulsed: but a final assault made just as dusk was approaching, although unsuccessful along most of the line, broke through the left center and compelled the rest of the line to fall back. The right retired in good order, the left hurriedly but without confusion, resisting as it fell back, and all finally rallied near the Adams House on the high ground near Woodbury's bridge, under the cover afforded by Sykes's division and the brigades of French and Meagher, which had been sent over to re-enforce the right wing. During the night of the 27th the troops were safely transferred to the south bank of the Chickahominy, and the bridges were destroyed soon after sunrise of the 28th. Magruder, by vigorous demonstrations during the day, had led the corps commanders of the left wing to believe that the main attack might be made upon them, and had caused them to doubt the propriety of weakening themselves in order to re-enforce the right wing. Ewell, moving down the north bank of the river, destroyed part of the railway near Dispatch Station on the 28th, and on the 29th was at Bottom's bridge, but was recalled by Lee to join in the subsequent movements.

McClellan no longer controlling the north bank, and therefore compelled to abandon his base at White House, transferred to his new base on the James river all the supplies, etc., which he could load upon his transports and wagons, and destroyed the rest. The other battles of the "Seven Days" followed in quick succession. The total Union force engaged in this battle was about 30,000 men, and the losses in killed, wounded, and missing 6,837, besides 22 guns. The Confederate force and losses are not accurately known. Their force was probably about 60,000, in round numbers, and their losses greater than Porter's, particularly in killed and wounded. For full description and discussion, see *Official Records*, *Battles and Leaders of the Civil War*, and *The Peninsula*, of Scribner's War Series.

JAS. MERCUR.

**Gainesville**: city; capital of Alachua co., Fla. (for location, see map of Florida, ref. 3–I); on the Fla. Cen. and Peninsular, the Gainesville and Gulf R. Rs., and the Plant System of Ry. and S. S. lines; 57 miles N. E. of Cedar Keys, 60 miles S. W. of Jacksonville. It is in an agricultural and orange-growing region, has become a noted winter resort for invalids from the Northern States, and contains several churches, East Florida Seminary, hotels and boarding-houses, 2 banks, and 2 daily and 3 weekly newspapers. Pop. (1890) 2,790; (1900) 3,633.

**Gainesville**: city; capital of Hall co., Ga. (for location of county, see map of Georgia, ref. 2–H); on the Ga. and the Richmond and Danv. Railroads; 53 miles N. E. of Atlanta. It is the seat of Georgia Seminary and Gainesville College; has six churches for whites, and contains car-shops, machine-shops, and mills. It is situated on the summit of the Chattahoochee ridge, which forms the watershed between the Atlantic Ocean and the Gulf of Mexico; has a number of fine springs—chalybeate, limestone, and freestone; and is therefore a very popular health resort. Pop. (1880) 1,919; (1890) 3,202; (1900) 4,382.

EDITOR OF "EAGLE."

**Gainesville**: city (founded in 1849); capital of Cooke co., Tex. (for location of county, see map of Texas, ref. 2–H); on the Gulf, Col. and S. F. and the Mo., Kan. and Tex. Railways; 6 miles S. of Red river and 310 miles N. of Galveston. It has 2 colleges and 5 brick school-houses. The chief industries are manufacturing, agriculture, and stock-raising. Pop. (1880) 2,667; (1890) 6,594; (1900) 7,874.

EDITOR OF "HESPERIAN."

**Gains'borough**: town of Lincolnshire, England; on the right bank of the Trent; 21 miles above its junction with the estuary of the Humber (see map of England, ref. 7–I). It has large manufactures of linseed oil, and carries on an important transit trade between the interior and the North Sea, vessels of 200 tons burden being able to reach it. Its old hall, now used for exchange, assembly-rooms, etc., is a curious structure, forming the three sides of a quadrangle, with a tower 75 feet high, and is supposed to have been built by John of Gaunt. Pop. (1891) 14,372.

**Gainsborough**, THOMAS: painter of landscapes and portraits; b. at Sudbury, Suffolk, England, in 1727. He was an artist from childhood, and at eighteen began to support himself as a portrait-painter. Marriage at nineteen with a young lady of moderate fortune made him comparatively independent, and for several years he lived at Ipswich and Bath, painting portraits with rapidly increasing success. Returning to London in 1774, he gained reputation by portraits of the royal family and eminent people. The portraits of Mrs. Sheridan, Mrs. Siddons, and Mrs. Graham are among his best; and one of his most famous is that of a young man named Buttall, the picture being known as *The Blue Boy*, and now belonging to the Duke of Westminster and kept at Grosvenor House, in London. Gainsborough's fame, however, rests largely on his landscapes, which have a character of their own for simplicity of theme and treatment, subdued tone of color, and idyllic charm of feeling. He has been called by good authorities the father

of modern landscape. He was a friend and rival of Sir Joshua Reynolds, was one of the original members of the Royal Academy, and was, except for a short interval, a regular contributor to its exhibitions from 1768 till 1784. D. in London, Aug. 2, 1788.

**Gairdner**, gārd'ner, WILLIAM TENNANT, M. D., LL. D.: pathologist; b. in Edinburgh, Nov. 8, 1824; graduated from the University of Edinburgh 1845; after holding various professional positions was elected in 1862 Professor of Medicine in the University of Glasgow, which position he still (1893) holds. He early distinguished himself in pathological investigations, and among other important works has published *Contributions to the Pathology of the Kidney* (1848); *On the Pathology of Bronchitis, and the Diseases connected with Bronchial Obstruction* (1850); *On Medicine and Medical Education* (1858); *Clinical and Pathological Notes on Pericarditis* (1860); *Public Health in Relation to Air and Water* (1862); *Clinical Medicine*; *Observations Recorded at the Bedside, with Commentaries* (1862); *Facts and Conclusions as to the use of Alcoholic Stimulants in Typhus Fever* (1864); *A Plea for the Extension and Alteration of the Curriculum of Arts in the University of Glasgow* (1865); *On the Function of Articulate Speech and its connection with the Hand and the Bodily Organs*; and *Case of Aphasia or Speechlessness of Cerebral Origin* (1866). He has also contributed largely to American journals. C. H. THURBER.

**Gaisford**, gāz'fŏrd, THOMAS: Greek philologist; b. at Ifort, Wiltshire, England, Dec. 22, 1779; educated at Christ Church, Oxford; took orders in the Church, but devoted himself to classical learning; appointed Professor of the Greek Language in the University of Oxford in 1811; dean of Christ Church in 1831; and rector of Westwell and curator of the Bodleian Library (1847). The letters of Wyttenbach show that Gaisford was regarded, after the death of Porson, as the best representative of English scholarship, and he was often consulted in regard to the MS. treasures in England. His literary activity was very great, and began early. His principal works are *Hephæstionis Enchiridion de Metris* (1810; reprinted in Leipzig, 1832); *Poetæ Græci Minores* (1814–20, 4 vols.; reprinted in Leipzig, 1823, in 5 vols.); *Stobæi Florilegium* (1822, 4 vols.; reprinted in Leipzig, 1823, 4 vols.); *Sophoclis Tragœdiæ* (2 vols., 1826; reprinted in Leipzig, 1827, 8 vols.); *Euripidis, Hec. Orest. Plœn.* (1809; suppl., 1822); *Herodoti Historiæ* (1824, 4 vols.; 3d ed. 1849; reprinted in Leipzig, 1824); *Suidæ Lexicon* (folio, 3 vols., 1834); *Paræmiographi Græci* (1836); *Scriptores Latini rei Metricæ* (1837); *Etymologicum Magnum* (folio, 1848); *Eusebii Demonstratio Evangelica* (3 vols., 1852). He was elected a corresponding member of the Institute of France, and member of other learned societies. D. June 2, 1855. Revised by ALFRED GUDEMAN.

**Gaits**: peculiar combinations of movements of the legs and bodies of certain animals, such as walking, running, ambling, racking, cantering, galloping, etc. All varieties are due to differences in the associations of the legs, or to the special characters and relations of their movements, or to both. In bipeds, such as man, there are observed only three gaits or slight modifications of them—the walk, the run, and the jump—but in quadrupeds there are many varieties. In the former the movements are relatively simple. In walking the body is slightly inclined forward so as to advance the center of gravity. Owing to the progression of the body the supporting leg gradually reaches the vertical, and then is directed backward more and more as the advance continues; in the meantime the passive leg has been lifted from the ground and swung forward with a pendulum-like movement, and finally straightened out and brought to the ground, thus adding to and ultimately replacing the labor of the previously active leg. Thus there is an alternation of activity and passivity in the two legs. In this gait one foot does not leave the ground until some time after the other has been implanted; consequently during a great portion of the time the body is supported and propelled by both legs. In running the body is more inclined forward than in walking, and in proportion to the speed. The actions of the two legs are essentially the same as in the walk, but of course more rapid and greatly increased in vigor. The propulsive efforts are so strong that the active foot leaves the ground before the other touches, so that there is a period during which both feet are raised, and another during which the body rests on but one. In jumping the two legs act almost simultaneously, so as suddenly to project the body from the ground.

In quadrupeds the number of gaits is much increased, owing to the greater number of legs and the possible variations in their associated movements. The different kinds are well illustrated in the locomotion of the horse. Some of these are natural; others are acquired by education. What one learns from them is applicable to those of other animals. The labor of propulsion in quadrupeds is accomplished almost solely by the hind legs, the fore legs doing but little more than affording support. The mechanism concerned in advancing the body is the same in all—the foot becomes for the time a fixed point and the axis of rotation for the leg. The muscles now acting between the leg and body pull the latter forward, causing the pelvis or shoulder to describe the arc of a circle. In drawing the passive leg forward the leg is flexed to keep the foot free from the ground, and the shoulder or pelvis joint now becomes the axis of rotation. In order to maintain steady progress the legs are brought into play alternately. In nearly all gaits the body is supported and propelled during the major part of the time upon two feet, while the others are passive and being brought forward preparatory to their supplementing the work now carried on. Occasionally, and for short periods, the support may be upon three legs, and at other times it may be upon but one. In all gaits, with the exception of the walk, the feet are entirely off the ground for variable intervals. When the body has thus been projected it alights always upon one hind foot, and not upon a fore foot, as is generally supposed. In trotting, ambling, and cantering the next foot to touch the ground is the diagonally opposite fore foot in trotting, and the fore foot of the same side in ambling and cantering; but in the gallop and run the second foot to touch is the opposite hind foot.

In all gaits the legs are paired in their actions, the combinations sometimes being lateral, at others diagonal, and at others opposite. In some instances there is a constant shifting from the lateral to the diagonal, and *vice versa*. In ambling the pairing is lateral; thus the fore and hind legs on each side act together, moving forward and backward very much as though the hoofs were connected by a rigid bar. In trotting the association is diagonal—the right hind leg with the left fore leg and the left hind leg with the right fore leg, the pairs moving together as in ambling, the difference being that in trotting they are diagonal, while in ambling they are lateral. In cantering, galloping, and running the relationship is chiefly between the two hind legs and the two fore legs respectively, the former being operated so as to cause jumping movements, and the latter in alternate progressive and recessive motions such as are observed in trotting, while the relation between the anterior and posterior legs is diagonal. In walking the pairing shifts from the diagonal to the lateral and *vice versa* during each complete act. Thus assuming that the first pair in action consisted of the right hind leg and left fore leg, in the next phase the right fore and hind legs would be active; during the next the left hind leg and right fore leg; during the next, the two left legs, and so on, there being four shifts during each complete act.

While there is thus found a dual association in the movements of the legs, no two feet are raised from or touch the ground at precisely the same time, although the intervals in some instances are exceedingly small. In walking, while there is an obvious pairing of the hind and fore legs, the paired legs do not move backward or forward together except during the period when the association is lateral, and even then they do not move in unison, because the hind leg completes its act at a time when the fore leg has but little more than half completed its work. The result is that the feet are raised from and touch the ground in succession, so that four hoof-sounds are heard, the intervals between them, however, being irregular. In ambling the pairing is lateral and the two feet moving forward and backward together leave the ground and touch it almost simultaneously, so that but two sounds are heard, one due to each pair. Each, however, is a double sound, because the hind foot touches a little before its associate, but the interval is so short that the sense of hearing is not sufficiently acute to detect it. In trotting the diagonal legs are moved in the same relation as the lateral pairs in ambling, and leave and strike the ground similarly; consequently but two sounds are heard, both, however, being double, as in ambling and for the same reason. In the canter four foot-sounds are heard. The support of the body is chiefly lateral, as in the amble, but the legs on the two sides do not move together, one hind foot striking first, then the fore foot on the

same side, then the opposite hind foot, and finally the other fore foot. The time interval between the striking of the hind and fore feet is longer than that between fore foot and hind foot; hence while there are four sounds they are grouped in twos, the right fore foot and left hind foot forming one couple and the other pair the other. In the gallop three sounds are noted. In this gait the support is diagonal, but on one pair the support is for a longer period than on the other, hence an irregular interval; besides this the hind legs are co-operating so as to cause jumping movements, while the fore feet are brought forward almost together, one of them striking much sooner than the other and simultaneously with the diagonal hind foot; the other hind foot then strikes, followed by the fore foot. In the run two strokes are heard, the first being due to the striking of the two hind feet and the second to that of the two fore feet. In none of these instances do two feet strike absolutely simultaneously.

In the walk the body is supported and propelled by at least two legs, and during a part of the time, especially during a slow movement, as in pulling a heavy load, by three. There is also a continual shifting of the pairing from the diagonal to the lateral and from the lateral to the diagonal. Thus if the now active legs are the right hind leg and left fore leg, the next active pair will be the two right legs, and then the right fore leg and left hind leg, and then the two left legs, and so on; but in the intervals of these shifts a third leg has come into activity, and is now an additional factor in the work; soon, however, one of the two previously active legs has finished its movement, and the foot is raised, thus relegating the labor to two.

The movements of the legs in the different gaits have been accurately studied by means of instantaneous photography. Such observations show that when the animal in walking has reached a period when the support and propelling power are diagonal and dependent upon the right hind leg and left fore leg, the right hind leg is well under the body, the left hind leg is fully extended and directed backward, the fore foot has just left the ground, and the right fore leg is flexed and has completed about three-fifths of its movement forward. The body now moving forward, the supporting hind leg approaches the vertical, while the paired leg is directed backward; the passive hind leg is flexed and being pulled forward, and is hanging flexed almost vertically, while the foot of the fore leg has just reached the ground, and now adds additional power to the pair. In the next phase the fore foot of the pair is lifted, thus throwing the work upon the right lateral pair; during this time the left hind foot has been brought forward under the body, and strikes the ground, thus adding another active leg to the lateral pair, so that now the two right and left hind legs are efficient. The body continuing its forward movement causes the right hind leg to become fully extended, then the foot is raised, shifting the work to the right hind leg and left fore leg. During each complete act there are seven distinct periods which are determined by the legs that are active—1, right hind leg and left fore leg; 2, right hind leg, left fore leg, and right fore leg; 3, right hind leg and right fore leg; 4, right hind leg, right fore leg, and left hind leg; 5, left hind leg and right fore leg; 6, left hind leg, right fore leg, and right hind leg; 7, left hind leg and left fore leg. The next period again begins the series.

In the walk, as in most gaits, the body is supported and propelled during most of the time by two legs, but in this gait there are never less than two; so that in this respect it differs from all others, in which during certain periods one leg alone is active or all the feet entirely off the ground.

In walking the feet touch the ground in succession, as is obvious from the fact that there is a continual shifting from two to three feet and *vice versa*. Thus they strike in what the musician would term four tempo, and in this order—right hind foot, right fore foot, left hind foot, left fore foot. The intervals are, however, not regular, owing to the fact that the movements of the hind legs are slower than those of the others, so that the sounds are in couples, there being a longer interval between the touching of the fore foot and hind foot than between that of the hind foot and fore foot. In this gait the associated diagonal fore foot is always behind in its movement about half of the extent of the movement of the hind foot, and when the support is lateral the difference is little less.

The amble is a gait in which the lateral legs are paired, the support and propulsion being transferred from one lateral pair to the other. In this mechanism the hind and fore legs are moved together, so that the positions of both of the pairs are identical. Assuming that the movement is in the phase where the body is supported by the left legs, their positions being vertical, both the right legs are flexed and just about opposite the active legs. The inactive legs are drawn forward, the hind legs are strongly inclined backward, the left hind foot is then raised from the ground, the support being now alone on the left fore leg; in another moment this foot is raised and the body is poised in the air. The feet of the right side strike, the hind foot a little in advance of the fore foot, the passive legs are flexed under the body and being swung forward; then the hind foot leaves the ground, the body now being supported by the right fore foot, then the left hind foot strikes, thus affording for a short period a diagonal support; the right fore foot is then raised, and immediately thereafter the left fore foot strikes. The reason for the occurrence of this diagonal support during one of the periods is owing to the fact that the degree of movement of one of the hind legs is not as extensive as that of the other (sometimes the right and sometimes the left; in this case the left), the consequence being that one executing a shorter movement strikes sooner than it should in proper relation to the rhythm of the others, and thus breaks the regular sequence of the sounds. In this gait but two distinct hoof-sounds are heard, which are due to the striking of the lateral pairs, but each is a double sound, the hind foot striking a little sooner than the corresponding fore foot.

The pace differs from the amble essentially only in its greater speed.

The word rack is applied to several gaits which are more or less closely related to the amble and pace. According to some the main differences are that the propelling hind foot leaves the ground sooner than the associated fore foot, consequently affecting the time when they strike the ground, thus causing four sounds instead of two. Others speak of the rack as being a combination of trotting motions in the anterior legs and galloping movements of the hind legs, but such a gait clearly belongs to the type of the gallop. As generally regarded, the rack is a slight modification of the amble. In the trot the pairing of the legs is diagonal, the left hind leg being associated with the right fore leg and the right hind leg with the left fore leg. The movements are different from those observed in the walk, but like those observed in the amble, the pairs moving together backward and forward. Assuming that the active pair consists of the left hind foot and the right fore foot, and that they have just been firmly implanted on the ground, being extended forward to the extreme, the opposite pair will be found almost midway between extension and flexion—i. e. almost vertical. As the body moves forward and the active legs are almost straight up and down, the passive legs, which have since finished their work and left the ground, have been brought forward so that now they are flexed and suspended almost opposite the active legs. With the continued progress of the body the supporting legs are directed backward while the passive legs are swung forward, but before the active legs cease their efforts the body has been projected with such force that when their feet are raised from the ground neither of the feet of the before passive legs has yet touched, so that for a period the body is suspended in the air. It alights on the passive (right) hind foot and then the paired (left) fore foot strikes, so that there is a continual shifting from one diagonal pair to the other, and a period during each operation when all the feet are off the ground. In a moderate speed all the feet are not off the ground until the active legs are directed well backward and the passive legs well forward, but in a fast trot the feet of the active legs are off the ground when the inactive legs have been drawn forward in the vertical position, the force with which the body is projected being sufficient to allow time for the full extension forward of the passive legs. In the trot but two distinct strokes are heard; the sounds, however, are double, since the hind feet strike sooner than the associated fore feet.

The canter, gallop, and run belong to the same type of gait, the canter being a slower movement and the run a faster one. The type is characterized by a succession of springing or jumping movements executed chiefly by the hind extremities, while the fore legs are mainly engaged in affording support. There is a double pairing of the legs—the two hind legs and the two fore legs being paired, and then a diagonal pairing between the hind and fore legs; consequently the gait is of a rather more complicated character

than those previously considered. As in the amble, both hind legs are not subjected to the same degree of movement, the one executing the full swing antero-posteriorly, while the other is only extended backward but little beyond the perpendicular. Thus it is customary to speak of a gallop as right hand or left hand, according as one leg or the other executes the full swing.

In the canter the following movements may be observed: Assuming that the body has just alighted on the right hind foot, which is implanted well under the body, the three passive legs are off the ground, the passive legs are drawn forward, the right fore foot reaches the ground, followed almost immediately by the left hind foot; the body is now supported by three feet, the right hind foot is now raised and immediately following this the left fore foot touches, then the right fore foot is raised, so that the support is now on the two left feet; the left hind foot is now raised and the support is on the left fore foot; this foot is raised and the body is off the ground; then the right hind foot reaches the ground, and the above sequence is repeated. It will be observed that the support shifts in the following sequence: one foot, two feet, three feet, two feet, one foot, body suspended, then one foot as in the beginning. No two of the feet strike the ground at precisely the same time, so that four sounds are heard, but at irregular intervals.

In the gallop the movements of all the legs are more rapid and the striking of the hind feet almost simultaneous, so that three sounds are observed instead of four as in the canter. This is owing to the fact that the association of the hind legs is more intimate than in the former variety.

In the run, assuming—as in the description of the canter—that the body has just alighted on the left hind foot, the other three legs are passive, the right hind leg and left fore leg are straightened and directed forward preparatory to striking, while the right fore leg is semiflexed; then the right hind leg strikes, the left fore leg is still directed forward and the foot near the ground, and the right fore leg is half straightened out; then the left fore foot reaches the ground, while the corresponding hind foot is about to be lifted, and the right fore foot has been brought farther forward; then the left hind foot is raised and the support passes to two legs, both of which are almost vertical; the left passive hind leg is directed backward to the extreme, while the left fore leg is now almost straightened forward; then the right hind foot is raised and both hind legs are directed well backward and are some distance above the ground, the right fore foot has been straightened and is rigid preparatory to receiving the impetus of the body; the right fore foot then strikes; in the next phase both hind feet are well above the ground and directly opposite each other; the fore feet support the body, the left being directed backward and the right forward, forming an inverted V; in the next phase the left fore foot has left the ground; the hind legs have been drawn a little forward, one a little more than the other, and the right fore foot is at an angle of about 80° and alone supports the body; in the next phase the right fore foot is raised, the body in the meantime having moved so far forward that the leg has completed its work and is now entirely off the ground, all four legs being bunched under the body; the next operation is a straightening out of all four legs, the left pair being straightened sooner than the right, and the hind leg sooner than its associate, so that it strikes first, as in the first phase. It will be observed that the support and propulsion are first by the left hind leg, then by the two hind legs, then by the two hind legs and left fore leg, then by the right hind leg and left fore leg, then by the left fore leg, then by the two fore legs, then by the right fore leg, and finally the body is entirely without support. In running the body is for about one-fifth of the time entirely off the ground, for about two-fifths of the time on one foot, and for two-fifths of the time on two or three feet. There is an alternation of support and propulsive power from the hind legs to the fore legs, but the latter act practically as supports, the propulsive force being obtained from the hind legs. But two hoof-sounds are heard; the two hind feet and one fore foot striking almost simultaneously form one compound sound, the second sound being caused by the other fore foot.

The chief distinguishing features of the various gaits are as follows: In the walk the legs are paired diagonally and laterally alternately during each act; the body is supported by two or three feet, never by one, nor is it ever without support, as in the amble, trot, canter, gallop, and run; four hoof-sounds are heard, but at irregular intervals; the pairs do not move forward and backward together excepting when the pairs are lateral, and even then not exactly together, since the fore foot completes its act much before its associated hind leg, and when the pairing is diagonal the fore leg has completed its movement when the paired hind leg has but half finished. In the amble the pairing is constantly lateral, the two left and the two hind legs respectively forming the couples; the pairs move forward and backward together; the feet of each pair strike the ground almost simultaneously, so that but two sounds are heard, but each of them is a double sound, since the hind foot strikes a little in advance of the fore foot. In the trot the pairing is constantly diagonal, and they move forward and backward in the same relationship as in the amble; two hoof-sounds are noticed, as in the amble, which are similarly produced by the couples and are double sounds. In the gallop there is a double pairing, first between the two hind and two fore legs respectively, and second between the diagonal hind and fore legs; the hind legs are engaged in springing or jumping movements, while the fore legs are moved as in trotting; the support is first on the hind pair, then diagonal, then on the fore pair, and in the intervals on one or three feet, depending upon the particular phase of the movement, as already stated; three sounds are noted, the first being due to the striking of the hind pair, the second to that of the diagonal fore foot, and the third to that of the other fore foot. In cantering the striking of the hind feet is separated by a distinct interval, so that four sounds are produced. In the run the two hind feet and one fore foot strike simultaneously, so as to cause one sound, and the other fore foot to produce another, so that but two are heard.

In the walk, amble, and trot the long axis of the body is in a line with the direction of travel, but in cantering, galloping, and running it is oblique—in the right-handed gait the left side of the body is directed forward, and in the left-handed gait the other.

The speed of these gaits is in the following order: the walk, the amble, the pace, the trot, the canter, the gallop, and the run; but these standards are by no means fixed; the trot, for instance, can be so modified as to be even slower than the fastest walk or faster than a moderate gallop. The stride in the walk is about 6 feet, in the amble and canter about 10 feet, in the pace about 12 feet, in the trot from 10 to 15 feet, in the gallop from 12 to 15 feet, and in the run from 18 to 20 feet.

Certain gaits are natural to some animals, but are acquired in others. Thus the amble is the natural gait for the camel, dromedary, elephant, and certain others, but the horse must be taught it. Some are easier to execute at certain speeds than others; thus the horse in fast trotting if pushed too hard will break into a gallop. Most animals prefer certain gaits to others; some when compelled to take a gait faster than a walk will trot, others amble, others rack, others canter, etc. Interesting departures from these typical gaits are noticed in different animals and birds. Thus in the rabbit, besides the jumping movements, which closely resemble the run in the horse, there are often seen short walking steps in the anterior extremities which are a number of times repeated and followed by a single jumping movement of the hind legs. Aquatic and carnivorous birds usually exhibit a very awkward wabbling gait in walking.

The crow and blackbird walk quite gracefully, while the sparrow and thrush advance by a series of leaps. In insects and other low organisms the associated movements of the legs vary greatly in the different species.

There are certain advantages in having four or more legs instead of two, chiefly in the fact that with the former the position of the body is horizontal and thus more readily maintained in the condition of equilibrium, and because of the variety of gaits by which one set of nerve-cells and muscles can in a measure be relieved by a partial shifting of the work to others. In man peculiarities are observed in the walk of different individuals by which many men are readily distinguished from others. In certain diseased conditions the walk is so modified that the altered gait is in a measure characteristic of the disease. This is well illustrated in the peculiar gaits in cerebellar disease, locomotor ataxia, etc.

EDWARD T. REICHERT.

**Ga'ius**, or **Ca'ius**: a Roman jurist of whose personal history little is known and whose family name is unknown, Gaius being a prænomen. He wrote during the reigns of Hadrian and the Antonines, and it is conceived from his style that he was only a teacher and writer upon the law, and not

a practical jurisconsult. He was the author of numerous works upon the Roman law, of which the most important was the *Institutes*. This work was freely used in compiling Justinian's *Institutes*, and was the basis of the *Lex Romana Visigothorum* (506 A. D.), but was supposed to be lost. In 1816 Niebuhr discovered a palimpsest at Verona, which was afterward found to contain, almost entire, the long-lost *Institutes* of Gaius. The palimpsest was afterward deciphered in spite of great difficulties, and the text was published first in 1820, and thereafter in other editions with additions and emendations, until the parchment became practically destroyed by the chemicals used upon it, first by Bekker and Göschen, then by Bluhme, and lastly by Studeman, who with Krüger published an edition in 1884 (Berlin). There is now lacking only about one-tenth of the whole text, made up of the undecipherable parts and the parts lost in the manuscript. An English edition by E. Poste (Oxford, 1890) is very complete, containing an English translation and full commentary. See also *Gaius, the Institutes and Rules of Ulpian*, with notes by J. Muirhead (Edinburgh, 1880), and *Institutes of Gaius and Justinian*, Y. L. Mears (London, 1882). Revised by M. WARREN.

**Galabat**, or **Metemone**: a district and town on the frontier between Egypt and Abyssinia; was down to 1873 the center of the Egyptian slave-trade, and is still a place of considerable commercial importance as the great entrepôt between Egypt and Abyssinia. The town and the district were originally peopled by a colony of Tokruris from Darfur. It is now under Italian control.

**Galactom'eter**, or **Lactom'eter** [*galactometer* is from Gr. γάλα, γάλακτος, milk + μέτρον, measure; *lactometer* is from Lat. *lac, lactis*, milk + Gr. μέτρον]: an instrument for determining whether milk has been watered or not. In some cases it is a mere hydrometer or specific-gravity glass —in other cases a graduated test-tube, the richness of the milk being judged by the percentage of cream which appears after standing.

**Galam Gum**: See GUM.

**Galangal**, gă-lăng'gal [from O. Fr. *galingal*, deriv. of *galangue* < Mediæv. Lat. *galan'ga*, viâ Arab. from Chinese *Kao-liang-kiang*, literally, mild ginger from the district of Kao; *Kao*, a district of China + *liang*, mild + *kiang*, ginger]: a stimulant, aromatic drug; derived chiefly from the *Alpinia officinarum*, of the order *Zingiberaceæ*, a native of Southern China. It resembles ginger, and is used for the same purposes, but is seldom seen in the U. S. *Greater galangal*, a substitute for the true, is the root-stock of *Alpinia galanga* of Java.

**Galanthus**: See SNOWDROP.

**Galap'agos Islands** [from Span. *galápago*, turtle]: an archipelago in the Pacific Ocean; between lat. 0° 44′ S. and 1° 3′ N.; 800 miles W. of Ecuador, and claimed as a possession of that republic. The group consists of about a dozen mountainous islands, besides numerous islets and rocks, with a total area of about 2,400 sq. miles; the largest is Albemarle, a long, narrow island with over half the entire area; others are Indefatigable, Narborough, James, Charles, and Chatham, or Grande. All are of volcanic origin and full of extinct craters; the highest peak is in Albemarle, directly under the equator (5,020 feet). The soil is barren, and the flora and fauna are both poor in species, but very interesting owing to their relations with those of the continent. Many of the forms are peculiar to the archipelago and some of them to particular islands; the relations are rather with temperate than with tropical forms. Large marine turtles are very numerous. The climate is comparatively cool and healthful, but showers are infrequent. The Galapagos archipelago was certainly discovered before 1570, but it was first clearly described by Dampier in 1684. In the eighteenth century the islands were the resort of buccaneers and freebooters. Fitzroy and Darwin explored them in 1836, and they have been visited by various other geographers and naturalists. The Ecuadorian Government has made several attempts to people the archipelago, and for a time it had a penal settlement on Charles island; in 1893 there were only a few fishermen, turtle-hunters, and wreckers, mainly on Chatham island. HERBERT H. SMITH.

**Galashiels**, găl-a-sheelz': town of Scotland; on both sides of the Gala; partly in Selkirkshire and partly in Roxburghshire (see map of Scotland, ref. 13–I). It has large woolen manufactures, twenty-three in number, which produce Scotch tweed almost exclusively. It is the chief seat in Scotland for the manufacture of this kind of goods. Value of product in 1890, £1,250,000. Pop. (1891) 17,249.

**Galate'a** (in Gr. Γαλατεία): in Greek mythology the daughter of Nereus ("the old man of the deep") and Gaia, sister of Thetis, and aunt of Achilles. She was loved by the Cyclops Polyphemus, who slew her lover Acis in a fit of jealousy. The love of Polyphemus was a favorite subject with the Greek and Latin poets; cf. Theocritus, *Idyl* xi. (transl. by A. Lang). See Holland, *De Polyphemo et Galatea*, in *Leipziger Studien*, vi., p. 141 ff., and Roscher's *Lexicon*, *s. v.* Poems in English on the subject are: *Song of Polypheme*, by John Gay; *A Tale of Polypheme*, by Austin Dobson; *Polypheme's Passion*, by Robert Buchanan; *The Cyclops of Euripides*, by Shelley; *Galatea*, by J. S. Blackie: *The Death of Acis*, by B. W. Procter. See also Gayley's *Classic Myths in English Literature*, p. 464, where a list of modern paintings that refer to the myths relating to Galatea is given. J. R. S. STERRETT.

**Gala'tia** [*Galatia* = Lat. *Galatia* = Gr. Γαλατία, deriv. of Γαλάται, Gauls]: a province of Asia Minor, lying between Bithynia, Phrygia, Lycaonia, Cappadocia, Pontus, and Paphlagonia. The Gauls, with Thrace and the lower Danube as their base of operations, overran and devastated a great part of Asia Minor for a period of forty years, until they were finally conquered in 235 B. C. by Attalos, King of Pergamon, who forced them to settle permanently in a portion of Phrygia and Northern Cappadocia. Thenceforward the country thus occupied was called Galatia, after the Gauls. They were divided into three tribes: the Trocmi (Τρόκμοι), occupying the country east of the river Halys, with Tavium as their center (Tavium located in 1884 by Sterrett); the Tektosages (Τεκτόσαγες), with Ancyra (now Angora); and the Tolistobogii (Τολιστοβώγιοι), with Pessinus as their center, occupying territory west of the Halys. They gradually lost their identity by intermarriage with the natives, though ultra-Gallophiles claim that traces of Gallic blood are visible in the present inhabitants of Galatia, some of whom have light hair and blue eyes. The country is distinguished chiefly as the home of the Angora goat, which produces the much-prized mohair.

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**Galatians, Epistle of St. Paul to the**: a book of the New Testament written—some say from Ephesus in 55 or 56, but more likely from Corinth in 57 or 58—to the disciples in Galatia, where Paul himself had founded churches. It is the peculiarity of the epistle that it is addressed not to a particular church or individual, but to the churches of a district. The occasion of the epistle was the interference of certain persons who sought to impose Jewish laws on Paul's converts. He is led into a disenssion of the relations of Christianity to Judaism, and his treatment of this question shows more of the influence of his rabbinical education than any other of his writings. This is, next to the Romans, doctrinally the most important of his epistles. There is scarcely any dispute as to its authorship. The best commentaries are by Ellicott, Lightfoot, and Schaff (in Lange). See PAULINE EPISTLES. Revised by S. M. JACKSON.

**Galatz**, gaa'lăats, or **Galacz**: commercial city of Roumania; on the Danube, which here is navigable for vessels of 300 tons, 85 miles above the Sulina mouth (see map of Turkey, ref. 2–D). It is the great center of trade between Vienna and Constantinople, exporting grain, wine, wool, and timber, and importing cloth, cotton, and silk goods, ironware, leather, and tobacco. It is the seat of the European Danube commission and of a bishopric. Pop. (1890) 59,143.

**Galaxy**, or **Milky Way** [*galaxy* is from O. Fr. *galaxie*: Ital. *galassia* < Lat. *gala'xias*, from Gr. γαλαξίας, milky way, deriv. of γάλα, γάλακτος, milk]: a circle of nebulous or cloud-like light spanning the entire heavens, with the appearance of which every one is familiar. One of the ancient philosophers is said to have conjectured that it was really

formed of stars too small to be singly visible to the naked eye. This conjecture was strengthened by Galileo, who, scanning that part of the heavens with his telescope, found minute stars in great numbers, and it was entirely confirmed by his successors, especially by Herschel, in whose telescopes the cloudiness seemed to be entirely resolved into stars. The number of the smallest telescopic stars in the Galaxy is now known to be greater than in all the rest of the heavens, so that this cloudy girdle really forms the most important part of the visible universe. The problem of the structure of the Galaxy is therefore almost the same with that of the structure of the universe, and is still far from being satisfactorily solved. The most celebrated theory on the subject is that of Herschel, who considered that the aggregation of the stars in this belt was caused by the stellar system stretching out immensely farther in this direction than in others. In this theory the figure of the universe is that of a flat round disk, near the center of which the sun is placed, and the reason so many more stars are seen in the Galaxy than elsewhere is simply the much greater space which the telescope looks through when pointed so as to look edgeways through the disk. This theory was shown by Proctor to be extremely improbable. If the universe were so constituted, the density of the Milky Way would be nearly uniform, and it would shade off at the edges very gradually and uniformly. But a careful examination with the naked eye is sufficient to show that the object in question is composed principally of separate clusters or clouds of irregular form, between many of which comparatively dark spaces are seen, while in many other places there are spots of comparatively great brilliancy. Now, on Herschel's theory, or any other theory of uniform density of stars, these dark spaces could arise only from long holes and rifts extending through the Galaxy in the direction of the earth, and the brighter portions would have to be considered as long projections extending out from the direction of the sun. Indeed, one of these rifts, which in the summer and autumn may be seen in the southern portion of the Galaxy, is so striking that Herschel had to suppose an immense cleft in the stellar system to account for it. Now, the existence of long, narrow openings, all pointing to the sun, is so improbable that Herschel's views may be considered entirely untenable. The true constitution of the Galaxy is still one of the unsolved problems of astronomy. Probably it is a vast irregular ring of star-clusters, near the center of which the sun is situated. But no certain data exist for fixing the position of this ring among the other stars, and means of measuring the distances of the stars are too imperfect to enable such data to be collected. S. Newcomb.

**Gal'ba**, Servius Sulpicius: a Roman emperor; b. Dec. 24, B. C. 3, near Terracina; was adopted by his stepmother, a relative of the wife of Augustus; was prætor 20 A. D.; consul in 33; commanded with distinction in Gaul 39–41, in Africa 45–46, and attained great honors at Rome; held command in Spain 61–68; was then saluted emperor by his men, and went to Rome, where he succeeded Nero in 68, but his avarice and cruelty rendered him unpopular, and he was murdered by the prætorians Jan. 15, 69 A. D. Galba was the first emperor not of Augustan family. He was succeeded by Otho.

**Gal'banum** [Lat., from Gr. χαλβάνη, from Heb. *helb'nāh*, deriv. of *hālab*, be fat]: one of the fetid gums; a gum-resin brought from the Levant, India, and Persia. It is the concrete juice of some unascertained umbelliferous plant, probably a *Ferula*. It is antispasmodic, expectorant, and stimulant, and is used as an ingredient of plasters. Therapeutically, it is regarded as intermediate between ammoniac and assafœtida.

**Gale, Sweet Gale**, or **Dutch Myrtle** [*gale* is from O. Eng. *gagel*: Germ. *Gagel*, myrtle-bush]: the *Myrica gale*, a fragrant European and North American shrub, growing in cold, wet lands. It abounds in an essential oil. It has been used in medicine against the itch, and will keep away moths and other insect vermin. Hence the Scotch Highlanders make beds of the twigs, which are also sometimes used instead of hops as an ingredient in home-brewed beer. A decoction of the fresh leaves is considered an effective remedy against bugs. A yellow essential oil is distilled from the leaves.

**Galen**, Christoph Bernard, Freiherr von: soldier and prelate; b. at Bispink, Westphalia, about 1606: entered the service of the Elector of Cologne, and from 1637 to 1647 fought in several campaigns against the French and the Swedes. After the peace he took holy orders, and in 1650 was chosen Bishop of Munster, but the people of that ecclesiastical principality revolted, and Galen was obliged to lay siege to his own capital. He regained the city, which he fortified by a strong citadel to overawe the inhabitants. Inclined more to war than to the performance of religious functions, he served the emperor against the Turks, assisting in the victorious campaign of 1664, and when peace followed he sided with Charles II. against Holland. In 1672 he again took up arms against that republic, fighting on the side of Louis XIV., and when through the intervention of the emperor he was forced to make peace, he entered upon another war at the earliest opportunity, this time in alliance with Denmark and Brandenburg against Sweden in 1675. He succeeded in acquiring the duchy of Bremen, but died at Ahaus, Sept. 19, 1678, before the war was finished. He was a good type of the fighting prelate, and has been described by Sismundi as "a sort of mitered brigand, who raised troops for mercenary service, to be supported at the expense of the countries that they ravaged." F. M. Colby.

**Galen**: the Anglicized name of Claudius Galenus, an illustrious physician of antiquity; b. at Pergamus, in Mysia, in 130 A. D. After eleven years of study with the most eminent medical teachers of Pergamus, Smyrna, Corinth, and Alexandria, he became physician to the gladiatorial school of his native town. When thirty-three years old he went to Rome, and remained four years, winning great applause by his skill as a practitioner and success as a teacher. He returned to Pergamus, but was soon afterward summoned by Marcus Aurelius and Verus, the emperors, to attend them at Aquileia; went thence to Rome again and became physician to the family of Marcus Aurelius. He afterward returned to Pergamus, but probably visited Rome for the third (perhaps the fourth) time in his old age. The time and place of his death are not known with certainty. Suidas says that he died when seventy years old (about 200 A. D.), but Abulfaragius states that he died in Sicily when eighty-eight years of age, and there are good reasons for believing that this may be correct. Galen was a man of great learning, but exceedingly vain of his attainments and skill, and speaks, probably with good reason, in terms of contempt of the medical men of his time, particularly of those at Rome. He found the medical profession divided into several sects and parties, but after his time there was but one, the Galenic; and for 1,300 years his was by far the highest authority in the profession. Yet when tried by the standard of modern science Galen's theories and practice are often childish and worse than useless, and he seems to have accomplished many of his cures by means of the unbounded faith which the people had in him, and which he had in himself, as a wonder-worker. He was a laborious dissector of animals, and practiced surgery at Pergamus, but not at Rome. He wrote a vast number of treatises upon philosophy, logic, and medical subjects. Eighty-three genuine and many more spurious and doubtful medical works of Galen's are extant, besides numerous fragments, and large numbers are lost. Perhaps the most famous work was the *Ars Medica*, but his best treatises are those upon diagnosis and semeiology. The best edition of Galen is that by Kühn (20 vols., Leipzig, 1821–33).

**Gale'na** [from Lat. *gale'na*, lead ore, from Gr. γαλήνη lead ore]: the sulphide of lead, consisting of lead 86·6, sulphur 13·4, and the ore from which metallic lead is largely obtained. It crystallizes in cubes, has a blue-gray color and a highly metallic luster, like that of freshly cut metallic lead. Galena shows great diversity of physical characters. When distinctly crystallized it affords almost all the modifications of the cubic system, and when massive varies from a coarsely crystalline or laminated structure with large and brilliant cleavage surfaces to fine granular or fibrous. Galena generally, perhaps always, contains silver, sometimes in such quantity as to become a rich silver ore, and the diversity of physical characters which it exhibits has been supposed to be indicative of the percentage of silver in it, the fine-grained ore being thought to be the most argentiferous. No reliance can, however, be placed on this character, as the coarsely crystalline galena is sometimes very rich in silver, while granular and fine-grained ore may be nearly barren. Galena is a conspicuous element in many mineral veins, and is largely worked as an ore for lead or for the silver it holds. In the U. S. galena is of very frequent occurrence in the veins contained in the crys-

talline rocks of the Alleghany belt of New England, the Adirondacks, and Canada. It is also found in the Silurian rocks of the Shawangunk Mountains, at Rossie, N. Y., at Lexington, Ky., where it occurs in fissure-veins, and in the lead-regions of the upper Mississippi and Southern Missouri, where it fills or lines crevices called *gash-veins* in the Carboniferous and Lower Silurian limestones. Galena is met with throughout most of the Rocky Mountain silver-mining districts. Though not constantly present in the silver ores of this region, it is so abundant as to afford important aid in the process by which the silver is obtained from the ore.

Galena is frequently found in the ancient mounds of the Western U. S., and it is evident that the mound-builders attached some value to it; but no proof has yet been gathered that they smelted it or made any use of metallic lead. Probably they employed it for ornament, as they did the mica which they brought from North Carolina, and much of the copper they mined near Lake Superior. Some, and perhaps all, of the galena of the mound-builders came from Lexington, Ky., where they worked a large vein which contained much of it. Revised by CHARLES KIRCHHOFF.

**Galena**: city and port of entry; capital of Jo Daviess co., Ill. (for location of county, see map of Illinois, ref. 1–C); on the Galena (or Fevre) river, 5 miles from its junction with the Mississippi, and on the Chi. and N. W., the Chi., Burl. and Q., and the Ill. Cent. Railroads; 180 miles W. N. W. of Chicago and 445 miles by water above St. Louis. It is built on bluffs above the river, which by a lockage system constructed in 1891 has been made navigable by the largest steamboats. The city is named from the mines of lead sulphide (galena) which abound in the vicinity. Galena is the business center of the seventy-two lead-producing townships in Wisconsin and Illinois, which cover 1,000,000 acres of land, mostly very fertile. The city has abundant water-power, a large pork-packing interest, manufactures of woolens, furniture, castings, lumber, and flour, large smelting-works, and extensive manufactories of axle grease and hot-water heaters. Besides the trunk lines centering here, there is a heavy trade by river in zinc ore, pig lead, grain, flour, pork, provisions, and manufactured goods. In the beautiful public park is a bronze statue of Gen. Grant, who at one time lived in Galena. The city is picturesque by reason of the high and broken character of its site; it has beautiful houses and fine public buildings, notable among the latter being the U. S. custom-house and the high school. It has an excellent public-school system, two Roman Catholic schools, and a convent of Dominican nuns. Pop. (1880) 6,451; (1890) 5,635; (1900) 5,005. EDITOR OF "GAZETTE."

**Galena**: city; Cherokee co., Kan. (for location of county, see map of Kansas, ref. 8–K); on the Kan. City, Ft. S. and M., and the St. L. and S. Fr. Railways; 7 miles E. of Baxter Springs. It is in a rich lead and zinc region, and mining is the principal business. It has two weekly newspapers. Pop. (1880) 1,463; (1890) 2,496; (1,900) 10,155.

**Galeopithe'cus**: See FLYING LEMURS and INSECTIVORA.

**Gale'rius, or Maxim'ian II.**, GALERIUS VALERIUS MAXIMIANUS, called also ARMENTARIUS: a Dacian peasant, who served with such distinction in the Roman army that Diocletian gave him his daughter in marriage, and in 293 A. D. declared him Cæsar of the East. The failure of his expedition (297) against the Persians brought him into disgrace, but his second campaign won him great glory. He was the prime mover in the Diocletian persecution, for he always regarded the Christians with deep aversion. In 305 he assumed the title of Augustus, jointly with Constantius Chlorus; in 307 the revolt of Maxentius robbed him of Italy and Africa, Gaul and Britain having been already lost to Constantine, but he still reigned in the East, and distinguished himself by important works of internal improvement—draining lakes, clearing forests, etc. He died in 311. Revised by G. L. HENDRICKSON.

**Galesburg**: city; capital of Knox co., Ill. (for location, see map of Illinois, ref. 4–C); on the Atch., Top. and S. Fé and the Chi., Burl. and Q. Railroads, and the Fulton County Narrow-Gauge Railway; 53 miles N. W. of Peoria, 99 miles N. E. of Quincy, and 163 miles S. W. of Chicago. It is in a rich agricultural region; has important manufactures, and is the center of a large trade. It contains the shops and stock-yards of the Chi., Burl. and Q. Railroad, four brick-yards, agricultural-implement works, carriage and wagon factory, and other industrial establishments. The city is lighted with gas and electricity; has street railways, 2 opera-houses, public library, costly water-works, several hotels, and 5 banks; and contains 19 churches and 10 public-school buildings, including a high school. It is also the seat of Lombard University (Universalist), Knox College (non-sectarian), and St. Joseph's Academy (Roman Catholic). There are 2 daily, 5 weekly, and 3 monthly periodicals. Pop. (1880) 11,437; (1890) 15,264; (1900) 18,607.

**Galeworts**: the *Myricaceæ*, a family of monœcious or diœcious shrubs with reduced, apetalous flowers and often with a glandular or waxy pubescence, comprising thirty to thirty-five widely distributed species. There are five species in North America, all belonging to the genus *Myrica* and including the sweet gale (*M. gale*), bayberry (*M. cerifera*), and sweet fern (*M. asplenifolia*). CHARLES E. BESSEY.

**Galia'ni, FERDINANDO**: statesman and political economist; b. at Chieti, Southern Italy, Dec. 2, 1728; was educated for the Church, but devoted himself to the study of archæology, letters, history, and political and commercial science; visited England; published in 1750 his great work, *Della Moneta*; resided for ten years (1759–69) in France, and published shortly after his return to Naples his *Dialogues sur les blés*; became councilor to the Neapolitan board of trade 1769; its secretary 1770; Finance Minister 1782. D. in Naples, Oct. 30, 1787.

**Galic'ia**: a province of Austria, consisting of the old territories of Galicia, Lodomeria, Auschwitz, Zator, and Cracow, and divided into two governmental districts, Lemberg and Cracow. It is bounded S. by Hungary, from which it is separated by the Carpathians; E. and N. by Russia and Poland, toward which it has no natural boundaries, except in some places where the Dniester and the Vistula make the line of demarkation. The surface is a terrace, through which the Carpathian Mountains gradually sink into the great East European plain. The soil is fertile, but the climate is cold—long winters with deep snow and short hot summers. Grain, flax, hemp, and hops are grown, but the grape will not ripen. Fine horses and excellent cattle are reared, and the forests are stocked with deer and wolves. Of minerals, iron and rock-salt abound; the latter especially is of great importance. There is a class of nobles, who have warlike passions, a romantic temper, and elegant manners; and there is a peasantry, rude, filthy, ignorant, and intemperate. But there is no middle class, and there are no manufacturers and no merchants, except the Jews, who live in abject and miserable conditions, despised and ill-treated both by the peasantry and the nobility. In this unfortunate structure of society lay the possibility of the division of Poland; and since Galicia (in 1772) came to Austria it has made great advances in the track of modern civilization, in spite of the rebellions which have convulsed it, whose general character has been the murder of the nobility by the peasantry. The Ruthenians are mostly Roman Catholics of the Ruthenian rite; the Poles, Roman Catholics of the Latin rite; their number is about equal. Area, 30,307 sq. miles. Pop. (1880) 5,958,907; (1890) 6,578,364.

**Galicia**: a former province of Spain, originally a separate kingdom, comprising the northwestern part of the peninsula; bounded S. by Portugal and N. and W. by the Atlantic. In 1833 it was divided into four provinces, Corunna, Lugo, Orense, and Pontevedra. The surface is mountainous, traversed by several ranges of the Cantabrian Mountains, which reach the Atlantic in lofty and rugged promontories (Capes Ortegal and Finisterre), between which the estuaries of the rivers form excellent harbors (Ferrol and Corunna). The soil is fertile, the climate mild and moist; the ground partly covered with dense forests, affording also fine pasturage and arable lands. The inhabitants are a vigorous but not very intelligent race, which, however, on account of its industry and plain practical sense, forms one of the most honorable parts of the Spanish nation. Thousands of them each year go for employment to Portugal or to the other provinces of Spain. They are known as Gallegos. In language they are more closely allied to the Portuguese than to the Spanish. Pop. (1887) 1,893,895.

**Gal'ilee** [from Lat. *Galilæ'a* = Gr. Γαλιλαία, Heb. *Galil*, a wheel, therefore applied to a rolling country, which, however, had level ground in it]: a name given originally to the plain upon which was Kadesh-Naphtali (Josh. xx. 7); later we read of the "land of Galilee" in which were twenty towns given by Solomon to Hiram in return for services rendered in building the temple at Jerusalem (1 Kgs. ix. 11–

13); the area was still more extended in Isaiah's time (Is. ix. 1), and in the Roman period it was the name of the northernmost of the three great provinces of Western Palestine, including the ancient territories of Issachar, Zebulon, Asher, and Naphtali. Lower Galilee appears to have begun with the southern boundary of Esdraelon, and to have extended some 8 or 10 miles N. of Nazareth. All north of that was called Upper Galilee. The whole province is supposed to have had an area of 2,000 sq. miles. In the time of Christ it was the most densely peopled and thrifty portion of Palestine. According to Josephus, it contained 240 cities and villages (*Life*, 45), the very least of which had above 15,000 inhabitants, and was noted both for the fertility of its soil and the bravery of its inhabitants (*Jewish War*, 3, 3, 2). The population of the whole province, but especially the northern part of it, was largely heathen. This was so in the time of the Maccabees (1 Macc. v. 21, 22). Strabo (b. 54 B. C.) says the province was "inhabited generally by mixed tribes of Egyptians, Arabians, and Phœnicians." (*Geog.*, xvi. 2, 34). In Isa. ix. 1 and Matt. iv. 15 it is called "Galilee of the Gentiles." The few Jews who lived there were far less bigoted than their brethren in Judæa. Hence the greater part of Christ's life was spent in Galilee, and most of his disciples were Galileans. His early home was in Nazareth, his first miracle in Cana, his "own city" was Capernaum—all Galilean towns, and his popular designation was the "Prophet of Galilee." After the destruction of Jerusalem Galilee was the center of Judaism and numerous ruins attest the numbers and wealth of the Jews resident there. The Sanhedrin held its sessions in Tiberias on the Sea of Galilee, and thence issued the Mishna and Gemara—the two divisions of the Talmud. See Selah Merrill, *Galilee in the Time of Christ* (New York, 1881).

Revised by Samuel Macauley Jackson.

**Galilee** [from O. Fr. *galilee*, *galileye*. Prob. the same word as *Galilee*, a country. See the preceding article]: in certain ancient churches, a chapel, sometimes the entrance-chapel or porch, or, in other cases, a portion of the church whose floor was depressed one step below the rest. In the galilee monks assembled to receive visits from their female relatives, for it was considered less sacred than the rest of the building. The term is also applied to an unusual projecting or partly separated structure in the Cathedral of Peterborough, one in the Church of St. Mary at Melton Mowbray, and one at Lincoln; in modern usage it has no very exact meaning, and is given by local tradition.

**Galilee, Sea of**: See Gennesaret, Lake of.

**Galilei**, gă̆a-lē̆e-lā′ē̆e, Galileo, commonly called **Galile'o** (Ital. pron. gă̆a-lē̆e-lā′ō): philosopher and astronomer; b. in Pisa, Italy, Feb. 14, 1564. His father was a musician. In his boyhood Galileo studied the classics, invented small machines, became an accomplished musical performer, and showed great taste for painting, wherein he endeavored to detect the same law of harmony which he had learned from mathematics. His father wished him to study medicine, but his own inclination was for mathematical pursuits. The propositions of Euclid were taught him by Ostilio Ricci of Fermo, then master to the pages of the grand duke. At the age of twenty Galileo was already a distinguished geometrician. It was at this age that he noticed the swinging of a lamp in a church, and, observing that the oscillations were of equal duration, he inferred that this principle might be used to measure time exactly; but it was not until fifty years after, or about 1633, that he applied this observation to the construction of a clock. Galileo was also the inventor of the microscope, of the thermometer, the proportional compass, and of a telescope with a magnifying power of thirty. This last he presented to the Venetian senate, and was handsomely recompensed for it. By telescopic observations Galileo first discovered the mountainous character of the moon; he also detected the phases of the planet Venus, the satellites of Jupiter, the rings or ring of Saturn, the rotation of the sun, and its corruptibility inferred from the spots upon its disk. As is usual with discoverers, many of his inventions were disputed by inferior geniuses; among them, the Milanese Baldassarre Capra asserted priority in the contrivance of the proportional compass, but failed to prove his claim, and his pamphlet was adjudged libelous. But great as was Galileo in astronomy, he was still greater as the founder of the experimental philosophy, as a physicist, and as a mechanician. He was the first to formulate the principle of *virtual velocities*. In 1630 was published at Leyden his book entitled *Discorsi e dimostrazioni matematiche intorno a due nuove scienze*—a work that attracted little notice at the time, but which Lagrange, in his *Mécanique Analytique*, considers as Galileo's most substantial title to scientific glory. In his *Discorso intorno alle cose che stanno in su l'acqua e che in quella si muovono* he maintained and proved the principle illustrated in the so-called *hydrostatic paradox* that pressure in liquids is transmitted equally in all directions, declaring that the form of bodies did not affect their power of flotation. Having discovered the isochronism of the pendulum, Galileo endeavored to use it for the purpose of measuring the pulsations of the arteries. In an essay, now lost, entitled *De visu et coloribus*, he established the profound truth of the laws of *consonance and dissonance*, or of the unity and variety of colors. He also wrote a treatise on fortification; he maintained that longitude might be determined by the satellites of Jupiter. The sphericity of the earth had already been affirmed by the ancients, and also its motion as a body suspended and revolving in space. Eusebius of Cæsarea had stated the belief of Philotas that the earth moved and revolved around a central fire in an oblique circle (for the precursors of Galileo see the learned and impartial memorial presented in 1873 to the Royal Institute of Science and Letters in Lombardy by the distinguished Piedmontese astronomer, Prof. Giovanni Schiaparelli). Niccolò da Cusa, Domenico Maria Novara, of Ferrara, Celio Calcagnini, and Copernicus successively prepared the way for the convictions and the demonstrations of Galileo concerning the revolution of the earth. He was, then, in this respect, not so much a new discoverer as a bold, earnest, and able expounder of a system which, in spite of the hostility of churchmen—even the reformers Luther and Melanchthon wrote against the Copernican system as contrary to the authority of the Bible—was destined to triumph through the clearness of evidence made accessible after Galileo's time to the people, whose good sense was prompt to accept the conclusions. His teachings, however, encountered enemies and opposition in his own day, but the first to excite persecution were the men of science themselves, who were unwilling to be suddenly convicted of ignorance, to confess their mistakes, and to be sent back to school. It was these very men who forced Galileo to fly from Pisa and seek the protection of Salviati when he had ventured to contradict, by experiments made from the top of the Leaning Tower, the theorem of Aristotle which declared that *the velocity of the motion of falling bodies is in proportion to their weight*. Salviati not only received him well, but recommended him to the Venetian Sagredo, who secured him the appointment of professor in the University of Padua. At Pisa Galileo had received but 60 *scudi* annually; at Padua he had at first double that sum, and afterward, in 1610, 1,000 florins, which was a very large salary for that period, there being required of him only thirty hours of instruction during the year, or, to speak more precisely, sixty half hours.

At Padua Galileo enjoyed great liberty, and his real troubles only began some years later, when, not satisfied with teaching science, he ventured to declare "that in Scripture there were propositions which were false in the literal sense of the words; that even in matters of solemn dogma the forms of expression were sometimes inexact, out of due regard to the incapacity of the popular comprehension; and that in all natural questions philosophical argument should have more weight than mere scriptural declaration." This was certainly very bold. Cardinal Baronius answered with much moderation, that "the Scriptures were given to teach men how to rise to heaven, not how the heavens were made." The court of Rome did not choose to show the same forbearance—Galileo was denounced, and summoned to appear before the Sacred Congregation of the Index to receive an admonition. He obeyed the summons; the inquisitors solemnly declared the Copernican theory of the revolution of the earth false and contrary to Holy Scripture, and condemned in the most absolute terms the proposition in regard to the central position of the sun, with the earth revolving around it. The report, though untrue, that Galileo had been included by name in this condemnation soon spread through Tuscany, and he procured from Cardinal Bellarmin a certificate to the contrary. This certificate declared that the decision of the pope and the congregation against the Copernican system had simply been communicated to Galileo. Though now free to leave Rome, the great astronomer continued to press, in safe quarters, his overwhelming arguments in favor of the rejected system, until recalled to Florence by the prudent friendship of the grand duke. Urban VIII., who, when

only Cardinal Barberini, had greatly admired Galileo, and had declared himself of his opinion, being now pope, accepted the dedication of the *Saggialore*, and exhorted Galileo to come to Rome, where he was extremely well received in 1624. At this time he was occupied with the solar spots, as also with the tides, and he even returned again to discuss the subject of the earth's motion, notwithstanding the papal prohibition, at the same time, however, praying the grand duke "to consider it as mere poetry or as a dream; nevertheless, as the poets sometimes set a value upon their fancies, so I likewise have a certain esteem for this my novelty."

In 1632 Galileo published at Florence his celebrated *Dialogo sopra i due massimi sistemi del mondo, tolemaico e copernicano* (republished 1874 at Leghorn by Francesco Vigo). Urban VIII. was made to believe that the ignorant Simplicio was intended for him, and as there is no wound so deep as that of injured vanity, the pope now left the Congregation of the Index to do as they liked, on the ground that Galileo had violated the orders he had received. He was therefore summoned once more to Rome, and once more he obeyed the summons. Touching this trial much has been written to accuse, and much to defend, or at least to excuse, the Roman court. It has been asserted that Galileo did not retract until he had been subjected to torture, and that in uttering his retractation he added in a low tone, *E pur si muove* (Still, it does move). As to the latter tradition, it is of little consequence whether the protest was audible or suppressed by fear of the stake, but the question as to whether this great man was actually put to the rack can not fail to be of the greatest interest. It is quite certain that at the time many persons believed Galileo had been literally tortured. It is also most certain that the Church of Rome has done her utmost to keep secret the proceedings in the trial of Galileo, and the records exhibit certain *lacunæ* that may well have their significance. But there are besides the official records other authorities from which it can be proved that torture, though threatened, was not inflicted. See especially the testimony of the Tuscan ambassador, Niccolini. At any rate, it is certain that he was exposed to cruel moral torture, while no menaces were spared to make him quail before his judges. On June 22, 1633, Galileo, at the age of seventy years, on his knees and clad only in a shirt of sackcloth, was forced to pronounce, in the presence of his judges and a large assembly of prelates, a most humiliating formula of abjuration. (See *Parchappe*, chap. viii. On the subject of the trial of Galileo, see the documents published by Silvestro Gherardi in the *Rivista Europea*, 1870, with the arguments which accompany them; also Prof. Govi's interesting pamphlet, Turin, 1872.) Galileo was at first sentenced to imprisonment at the good pleasure of the papal government, but he was afterward allowed to retire under surveillance to his villa of Arcetri, on the Florentine hills, where he continued his work and his observations until he lost his sight. In this villa was constructed in 1873 the new astronomical observatory. Traditions of the blind Galileo are still preserved in that vicinity. Galileo died at the age of seventy-eight, on Jan. 9, 1642—the year of the birth of Isaac Newton—and was buried in the Church of Santa Croce at Florence. For fuller information concerning Galileo, see Nelli, *Vita de Galileo*; Cantù, *Illustri Italiani*; Parchappe, *Galilei*; Monsignor Marini, *Galileo e l'Inquisizione* (Rome, 1850); Philarète Chasles, *Galileo Galilei*; Libri, *Histoire de la vie et des œuvres de Galilei*; Favaro, *Galileo Galilei*; and the splendid collection in 4to of the *Opere edile ed inedili di Galileo Galilei*, published at Florence by Eugenio Alberi at the expense of the grand duke. In 1864, on the occasion of a centennial celebration of the birth of Galileo by the University of Pisa, a discourse was published by Prof. Silvestro Centofanti, and a comparison between Galileo and Bacon, as founders of the experimental philosophy, by Prof. Pasquale Villari.

ANGELO DE GUBERNATIS. Revised by J. J. KEANE.

**Galingale** [of same etymology as GALANGAL, *q. v.*]: any one of various plants, especially certain sedges of the genus *Cyperus*, and more particularly *Cyperus longus*, a bulbous sedge of Europe. Its bulbs have been employed in medicine, but are more used by perfumers, who extract from them a substance having a fragrance like that of violets. Other species, especially those found in tropical lands, yield perfumes.

**Ga'lion**: city; Crawford co., O. (for location of county, see map of Ohio, ref. 3–F); on the N. Y., L. E. and W. Railroad, and the Clev., Cin., Chi. and St. L. Railway; 58 miles N. by E. of Columbus. It has large railway-shops, foundry, machine-shops, several cigar-factories, brick and tile works, and steel-range works; 10 churches, several public and private schools, 3 banks, and 2 daily and 3 weekly newspapers. Pop. (1880) 5,635; (1890) 6,326; (1900) 7,282.

**Galipe'a**: See ANGOSTURA BARK.

**Gal'ipot** [Fr. *galipot*, perhaps of Germ. origin and connected with Germ. *Kleben*]: the concrete turpentine which collects upon pine-trees in the south of France; called also *barras*; it is an article of commerce, and after it is melted and strained enters into some pharmaceutical compounds in European practice. See TURPENTINE.

**Gall**, FRANZ JOSEPH, M. D.: phrenologist; b. in Tiefenbronn, Baden, Germany, Mar. 9, 1758; studied at Baden, Bruchsal, Strassburg, and Vienna, where in 1785 he took his medical degree. From childhood he had noticed and extensively compared the differences in the shapes of men's heads, believing that these differences would afford the best index to the mental and moral characters of persons examined. In 1796 he began to lecture at Vienna upon his new theory, since widely known as the "science of phrenology" (see PHRENOLOGY); but the announcement drew upon him much censure, ridicule, and opposition, and in 1805 the Austrian Government interdicted his lectures as dangerous to religion. But this prohibition simply served to rouse the curiosity of the public, and in Berlin the lectures were heard with great interest. In 1807 he repaired to Paris with his apostle Spurzheim; he became a practitioner of medicine, and in 1819 a citizen of France. His principal works are *Philosophisch-Medicinische Untersuchungen* (1791); *Recherches sur le système nerveux* (1808); *Anatomie et Physiologie du syslème nerveux* (1810–19; translated into English by Winslow Lewis, Boston, 1835); and *Sur l'origine des qualités morales el de facultés intellectuelles* (1822–25). D. near Paris, Aug. 22, 1828.

**Gal'lagher**, WILLIAM DAVIS: journalist; b. in Philadelphia, Aug. 21, 1808; the son of an Irish patriot and exile; removed in 1816 to Cincinnati; was apprenticed to a printer 1821; was for many years a journalist of Cincinnati; also edited journals in Xenia, O., and Louisville, Ky.; was employed in clerkships at Washington, D. C., 1850–53. Author of *Eralo* (3 vols., 1835–37, poems), and another original volume (1846), besides a compilation of poems (1841), and *Miami Woods, A Golden Wedding, and Other Poems* (1881). He also prepared a *Social and Statistical View of the Mississippi Valley*, and accomplished much in developing a taste for literature in the West. In 1853 he became a farmer near Louisville, Ky., and was later employed in the Treasury Department at Washington. He wrote much upon agricultural subjects. D. in 1894.

**Gallait**, găăl'lā', LOUIS: historical painter; b. in Tournay, Belgium, Mar. 10, 1810. Pupil of Ghent and Antwerp Academies; second-class medals, Paris Salon, 1835 and 1848; Legion of Honor 1841; Order of Leopold 1841; member of Brussels, Paris, Antwerp, Berlin, and Munich Academies. Works in the museums at Ghent, Liège, Versailles, and Brussels. D. in Brussels, Nov. 20, 1887.

W. A. C.

**Gal'la Ox**: a breed of domestic cattle found in Abyssinia. Like most of the cattle of India, it has a hump upon the shoulders, but it is chiefly remarkable for its monstrous horns, which, considering the small dimensions of the animal, far exceed in relative size the horns of any other breed. This breed is apparently in every way inferior to the ordinary cattle of Europe and the U. S.

**Gal'las**: a powerful native race of Eastern Africa, who for years gradually encroached upon the Abyssinians proper until they overcame them in 1889. They seem to have originated far to the S. of Abyssinia. They are divided into many tribes, are partly Mohammedan, while the majority are pagans. They are remarkable for their bravery and savage character. They are dark brown, and have frizzled hair.

**Gal'latin**: city; capital of Daviess co., Mo. (for location of county, see map of Missouri, ref. 2–E); on Grand river, and the Chi., Rock Is. and P. and the Wabash Railways; 76 miles N. E. of Kansas City and 55 miles E. of St. Joseph. It is in agricultural region, and has seven churches, a Y. M. C. A. building, a fine graded public school, and two weekly newspapers. Pop. (1800) 1,141; (1890) 1,489; (1900) 1,780.

EDITOR OF "DEMOCRAT."

**Gallatin**: town; capital of Sumner co., Tenn. (for location of county, see map of Tennessee, ref. 5–F); on the Louisville and Nashville and the Chesapeake and Nashville Railroads; 3 miles from the Cumberland river; 26 miles N. E. of Nashville. It is a center of agricultural, stock-raising, and lumbering interests, and has manufactories of cotton and woolen goods, flour, carriages and wagons, agricultural implements, worked wood, and foundry products. There are several churches, public and private schools, 2 banks, and 2 weekly newspapers. Pop. (1880) 1,938; (1890) 2,078; (1900) 2,409.

**Gallatin**, Albert, LL. D.: statesman; b. in Geneva, Switzerland, Jan. 29, 1761; the son of Jean de Gallatin by Sophia Albertina Rolaz du Rosey, his wife. Left an orphan in his infancy, he was educated under the care of a distinguished lady, a friend and relation of his mother. He graduated in 1779 at the University of Geneva, and being deeply imbued with the bold and liberal spirit of the times he declined offers of honorable and advantageous employment under one of the sovereigns of Germany, and in opposition to the wishes of his family emigrated to North America. He landed at Boston July 14, 1780, and soon after his arrival proceeded to Maine, where he served as a volunteer under Col. Allen; made advances to the Government for the support of the American troops, and in Nov., 1780, was placed in command of a small fort at Passamaquoddy, defended by a body of militia, volunteers, and Indians. In 1783 he became Professor of the French Language at Harvard College, and the following year, having received his patrimony from Europe, he purchased large tracts of land in Western Virginia, with a view of forming an extensive settlement. He was, however, prevented by the Indians, and in 1786 purchased a farm on the banks of the Monongahela, in Fayette co., Pa. In 1789 elected a member of the convention to amend the constitution of Pennsylvania, he united himself with the Republican party; in 1790 was elected to the House of Representatives of Pennsylvania, and continued to be re-elected till he took his seat in Congress; in 1793 was elected a Senator of the U. S., but his eligibility was contested on the ground of his not having been a sufficient length of time a citizen, and he lost his seat by a strict party vote. On this occasion the doors of the Senate were, for the first time, thrown open to the public. In 1794 he returned to Fayette County, and in October was again elected, by the concurring votes of all parties, to the Legislature. On the same day he was elected member of Congress for the adjacent district of Washington and Allegheny Counties, in which he did not reside. In Dec., 1795, he took his seat in Congress, and continued there during three terms, and had been re-elected for a fourth term when, on the accession of Mr. Jefferson to the presidency in 1801, he was appointed Secretary of the Treasury. While in Congress he paid particular attention to the financial concerns of the country. It was on his motion that the committee of ways and means was first organized; and he explained his views in *A Sketch of Finances*, published in 1796, and in *Views of Public Debt, etc.*, published in 1800.

In 1809 Mr. Madison offered him the State Department, but he declined it, and remained at the head of the Treasury Department until 1813, a period of twelve years. While at the head of the Treasury he exercised a great influence with the other departments and in the general administration of the Government, especially in regard to its avowed policy of retrenchment and financial reform. On the offer of the Russian mediation in 1813, Mr. Gallatin proceeded to St. Petersburg as envoy extraordinary of the U. S., without, however, resigning the office of Secretary of the Treasury, it being his intention to resume the duties of that arduous and difficult office if he was not successful in negotiating an honorable peace. Previous to his departure he drew up a number of bills that were necessary to carrying into effect the system of taxation that he had recommended to Congress in his annual report and in a letter addressed by him in reply to one from the committee of ways and means; these bills were reported by the committee on Jan. 26, 1812, and were finally passed by Congress at their special session held on May 24, 1813, in the form in which they had been recommended by Mr. Gallatin and reported by the committee. Great Britain refused the mediation of Russia, and agreed to treat directly with the U. S., whereupon Mr. Gallatin, having arranged with Lord Castlereagh that negotiations should be carried on at Ghent, proceeded there in 1814, and in conjunction with his distinguished associates negotiated and signed the treaty of peace. In 1815 he went to London, where, with Messrs. Adams and Clay, he negotiated and signed a commercial convention between the two countries. In 1816 Mr. Madison was desirous that he should resume the place of Secretary of the Treasury, but he declined, and went to France as minister of the U. S., where he remained until 1823. He was twice sent on extraordinary missions—in 1817 to the Netherlands, and in 1818 to England. He would not accept of a seat in the cabinet at Washington on his return in 1823. In 1824, when nominated for Vice-President of the U. S. by the Republican members of Congress, he declined the nomination. In 1826 he was appointed envoy extraordinary to England, returned to the U. S. in Dec., 1827, and resided in the city of New York. In 1830 he was chosen president of the council of the University of the City of New York. An early disciple of the school of Adam Smith, he was always strongly in favor of free trade, and assisted at the free-trade convention held at Philadelphia in 1831. The same year (1831) he became president of the National Bank, which position he resigned in 1839, when he was succeeded by his eldest son, James Gallatin. He had been for several years, and was at the time of his death, president of the New York Historical Society, and also president of the American Ethnological Society, organized under his auspices. D. at Astoria, L. I., Aug. 12, 1849. See Henry Adams, *Life of Albert Gallatin* (Philadelphia, 1879); also *The Writings of Albert Gallatin* (3 vols., Philadelphia, 1879). Revised by C. K. Adams.

**Gallatin, Mount**: a mountain some 10,000 feet high; near the northwest corner of Wyoming, and in the National Park. Near its base rise the Gallatin river and the east fork of the Madison.

**Gallatin River**: one of the head-streams of the Missouri; rises in Montana, near the National Park. Its general course is northward through one of the most beautiful, healthful, and fertile parts of Montana. Length, 125 miles.

**Gallaudet'**, Edward Miner, Ph. D., LL. D.: educator; b. in Hartford, Conn., Feb. 5, 1837; a son of Dr. Thomas H. Gallaudet. He was graduated at Trinity College; instructor in the Deaf and Dumb Institution, Hartford, 1855–57; in 1857 removed to Washington, D. C., to aid in organizing the Columbia Institution for the Deaf and Dumb. In 1864 he took the preliminary measures for founding the National Deaf-mute College at Washington, the only college for the deaf and dumb in the world (1893), of which he became president, acting also as Professor of Moral and Political Science. In 1886, at the request of the British Government, he visited England, and gave information to the royal commission on the education of the blind, deaf, and dumb regarding the system pursued in the U. S. In 1868 he published a report of his observations in the deaf-mute schools of Europe. He is also author of other reports on deaf-mute education; of *Popular Manual of International Law* (4th ed. New York, 1879); and of a memoir of his father (1888).

**Gallaudet**, Thomas, D. D.: educator and philanthropist; b. in Hartford, Conn., June 3, 1822; son of Dr. Thomas H. Gallaudet. He was educated at Trinity College, Hartford, and graduated in 1842; was a professor in the New York Institution for Deaf Mutes 1843–58; took orders in the Protestant Episcopal Church 1850; became rector of St. Ann's church, New York city, 1852, and instituted in it regular services for deaf mutes and their friends; was made rector emeritus in 1892; became general manager of the Church Mission to Deaf Mutes Oct., 1872; pastor of the sisterhood of the Good Shepherd at St. Barnabas House Apr., 1869; was chaplain of the Midnight Mission 1871–74; has done much to promote the instruction of deaf mutes elsewhere, and has written largely upon the subject. In 1885 he founded the Gallaudet Home for Deaf Mutes on a farm near Poughkeepsie, N. Y.

**Gallaudet**, Thomas Hopkins, LL. D.: educator and philanthropist; b. in Philadelphia, Dec. 10, 1787; of Huguenot descent; graduated at Yale in 1805; was tutor there 1808–10; studied 1811–14 at Andover Theological Seminary; studied law also; visited Europe 1814–15 in the interest of the Hartford Institution for Deaf Mutes, which he started, and to the superintendency of which he had been appointed; returned in 1816, accompanied by Laurent Clerc; was in charge of the asylum 1817–30, and afterward remained a director; was chaplain of the Retreat for the Insane at Hartford 1838–51; author of *Sixteen Discourses* (London, 1818);

*Bible Stories for the Young* (1838); *The Child's Book of the Soul*; *Youth's Book of Natural Theology* (1852); helped prepare a small English dictionary; wrote valuable articles for *Annals of the Deaf and Dumb*, etc. See his *Life*, by H. Humphrey (1858), and that by his son, Edward M. Gallaudet (1888); H. Barnard, *Tribute to Gallaudet*; Dr. Sprague, *Annals of the American Pulpit*. D. in Hartford, Conn., Sept. 9, 1851.

**Gall Bladder** [*gall* < M. Eng. *galle* < O. Eng. *gealla*: O. H. Germ. *galla* > Mod. Germ. *Galle* < Indo-Eur. *ghol-*, *ghel-* > Gr. χολή, gall, bile: Lat. *fel*, gall]: a pear-shaped membranous sac, the reservoir for the bile, situated in a fossa on the inferior surface of the right lobe of the liver. It is about 4 inches long, and 1 in width at its broadest part, and in its natural undistended condition holds about an ounce. The gall bladder consists of three coats—an external, derived from the serous membrane which lines the abdominal cavity; a middle coat, composed of muscular and fibrous tissue; and an internal mucous coat. A thick viscid mucus is secreted by the last-mentioned coat which sometimes plugs up the common bile-duct, thus giving rise to jaundice. The gall bladder receives the bile secreted by the liver through the hepatic and cystic ducts. It discharges its contents through the common bile-duct into the upper portion of the small intestine. Besides being greatly distended with bile in consequence of obstructed ductus communis, the cavity of the gall bladder may be almost entirely obliterated in consequence of obstruction in the cystic ducts. It also frequently contains biliary calculi. Many plant-eating mammals and some birds are without a gall bladder; and there are a few mammals which have two. It is absent in the deer, camel, elephant, and horse, but present in the ox, sheep, and hog.

**Galle**, or **Pointe de Galle**, point'de-găăl': town of Ceylon; on the southern coast of the island; is fortified, well built, and has a good harbor (see map of Southern India, ref. 8–F). Its trade, however, is insignificant, notwithstanding the fertility of the surrounding districts and the commercial advantages of its position. Pop. (1891) 33,505.

**Galle**, gaal'le, Johann Gottfried, Ph. D.: astronomer; b. in Pabsthaus, Germany, June 9, 1812; studied at Wittenberg and Berlin, and became astronomical assistant in the Berlin Observatory, under Encke; discovered three comets 1839–40. In 1846, following directions sent him by Leverrier, he found the planet Neptune, the discovery occurring on the evening of the very day on which the directions were received. In 1851 he became Professor of Astronomy at Breslau; twice received the Lalande prize; author of numerous papers and some treatises on climatology and astronomy.

**Gal'leass** [from Fr. *galéace*, *galléasse*, from Ital. *galeazza*, large galley, augment. of *ga'lea*, galley]: a sort of three-masted galley formerly built in Spain and Italy. There were enormous towering structures at either end. As many as 300 galley-slaves were employed in rowing one of these vessels. They were much larger than the galleys, and (unlike them) had guns in broadside.

**Gallenga**, Antonio Carlo Napoleone: historian and publicist; b. at Parma, Italy, Nov. 4, 1810; educated at the university in that city; became involved in the political agitation of 1831, and was obliged to leave Italy. A member of the organization of Young Italy, he is said to have been chosen to assassinate Charles Albert of Sardinia, but though prompted by political fanaticism to undertake the mission his courage failed when the time for action came. The years from 1831 to 1838 he spent chiefly in travel, visiting France, Corsica, Malta, Tangiers, Gibraltar, and the U. S. In 1839 he took up his residence in England, where in 1845 he was appointed to the chair of Italian Literature in University College, London. He returned to Italy to take part in the revolution of 1848, but on the failure of that movement resumed his work in London. In 1854 he again tried his fortune in Italy, and was a member of the Piedmontese and Italian parliament 1854–64. In 1874 he accompanied Victor Emmanuel to Berlin and to Vienna. Later he resided at Llandogo, in Wales. D. there Dec. 17, 1895. Among his writings are *Oltremonte ed Oltremare* (1844); *The Blackgown Papers* (1845); *Italy, Past and Present* (1841–49); *Italy in 1848* (1849); *Fra Dolcino and his Times* (1853); *Castellamonte, an Autobiography* (1854); all published under the pseudonym of L. Mariotti. More recent works are *Two Years of the Eastern Question* (1877); *The Pope and the King* (1879); *A Summer Tour in Russia* (1882); *Italy, Present and Future* (1887).

**Gal'leon** [Fr. *galion*, Span. *galeon*, from Ital. *galeone*, augment. of *galea*, galley]: a name given to a class of large ships formerly built in Spain. Some galleons were used in war, and had sometimes four gun-decks. Others were employed as treasure-ships in bringing the precious metals from America to Spain. They were large, clumsy structures, and were the easy prey of pirates and hostile navies. Their bulwarks were 3 or 4 feet thick.

**Gallery** [Fr. *galerie*; Ital. *galleria*, prob. of like origin with Ital. *galea*, Fr. *galée*, etc., in the original signification of wooden structure or framework]: originally a room long in proportion to its width. As such rooms, which were frequent in large English country-houses, were used for the family portraits, often numerous and important, and for other works of art, the term *gallery* has come to be used for rooms of whatever shape meant for the exhibition of paintings, sculptures, etc. The term is also used for long and narrow uninclosed or half-inclosed parts of buildings, and especially for a partial upper floor in a church or a theater, built in projection like a balcony from the inner face of the wall of the room, and supported by brackets or pillars.

Russell Sturgis.

**Galley** [M. Eng. *galeye*, from O. Fr. *galee*, *galie* > Fr. *galée*, from Ital. *galea*, prob. from Gr. (Spartan) κᾶλον, wood, ship]: a long, narrow ship, propelled partly by sails, but chiefly by oars, and used both in war and in commerce. Such ships were built by the Phœnicians, Carthaginians, Greeks, and Romans, and were of considerable size. They continued to be used by the peoples living on the shores of the Mediterranean until late in the seventeenth century, indeed, small boats of similar model are still to be found. The oars of the old-time galleys were in one or more banks or tiers, and often were worked by convicts or by slaves, who were sometimes chained to them. The swift piratical galleys of Barbary were rowed by Christian slaves. Several kinds of open boats are called galleys.

Galley, in printing, is the tray of metal or wood in which the compositor deposits the types from the composing-stick as often as the latter is filled.

**Gall-fly**: See Entomology and Gall Insects.

**Gall-gnat**: See Gall Insects.

**Galli** (in Gr. οἱ Γάλλοι): the name borne at Pessinus in Phrygia (Asia Minor) by the self-mutilated priests of the great Asiatic goddess who was known in Phrygia as Cybele-Agdistis, though she was worshiped in different countries under different names. Her religion was an impure worship of the procreative powers of nature; her priestesses devoted themselves to wickedness in the name of religion. The premature death of Atys, who had emasculated himself to avoid marrying Agdistis, was celebrated with a zeal that bordered on madness, and men often died of the cruel scourgings and mutilations inflicted by their own hands, or if they survived them it was to swell as eunuchs the number of the priests of the goddess. But when they had once become priests their lot was an enviable one, for they ranked as royal personages, and in Comana the Golden the chief priest of the great goddess was at the same time King of Cappadocia. See Maury, *Histoire des religions de la Grèce antique*, iii., p. 79 ff.; Duncker, *Geschichte des Alterthums*, i., p. 338 ff.; Mayer, *Geschichte des Alterthums*, i., p. 253 ff.; Guigniant, *Religions de l'antiquité*, vol. ii.; Perrot and Chipiez, *History of Art in Phrygia*, p. 23 ff.; *The Nation*, Apr. 27, 1893, p. 316.

J. R. S. Sterrett.

**Gal'lia**, commonly Angliceized as **Gaul**: the name given by the Romans to the regions inhabited by Celts in Italy and what is now France. When the Greeks first became acquainted with Southwestern Europe they called it Celtice and the inhabitants Celts. Afterward arose the designations Galatia-Galati and Gallia-Galli, and the latter—the shortest one, nearly synonymous with Celtice-Celts—was adopted by the Romans. Celtic Italy was called Cisalpine Gaul, and that part N. of the Po was called Transpadane Gaul; while what is now France was Transalpine Gaul, Gallia Ulterior; also Gallia Comata, or "long-haired Gaul," from the length of the hair worn by the inhabitants. Gallia Braccata, "breeched Gaul" (from the use of breeches as clothing), was also called Gallia Narbonensis, and was a strip along the Mediterranean coast of France.

Cisalpine Gaul, in a general way, may be defined as that part of Gaul which was between the summits of the Alps

on the N. and the Trebia and the Rubicon on the S. Traces of a Celtic language exist in the names of places still farther S., and Celts must early have had a strong foothold in Italy; and the native Celtic population was often re-enforced by immigrant tribes from Transalpine Gaul, but the population certainly contained a larger Italian or non-Celtic element as far back as history goes. The Roman power gradually trenched upon Cisalpine Gaul, and it finally received a special form of government under the Romans.

Transalpine Gaul, the Gallia of Cæsar, was divided in his time into Aquitania, which lay S. W. of the Garonne, whose people were probably of Basque race; Gallia proper, or the region of the Celtæ or Galli, extending from the Garonne to the Saône and Marne; and Gallia Belgica, bounded E. by the Rhine. But there were certainly Germanic tribes on the left of the Rhine, as well as many Celts in the heart of Germany at that time. It has been conceived that the Belgæ were Gauls (Celts) of the Cymric branch, but the point has never been established; and it is certain that a large Germanic element existed there. Julius Cæsar and his successors adopted, with a large degree of success, the policy of Romanizing Gaul, and in later times, chiefly under Frankish influence, it became to some extent Germanized, and most of its distinctively Celtic traits disappeared. See Celts.

Revised by C. K. Adams.

**Gallic Acid** ($C_7H_6O_5 = H_3C_7H_3O_5$): an acid discovered by Scheele, existing in most astringent parts of plants, associated with tannic acid, as gall-nuts, sumach, divi-divi, green and black tea, sandal-wood, walnuts, etc. It may be extracted from infusions containing at the same time tannic acid by first precipitating that acid by gelatin, evaporating the filtrate to dryness, extracting with alcohol, and dissolving the gallic acid from the residue, obtained on evaporating the alcohol in boiling water, which on cooling deposits crystals of gallic acid. It is purified by recrystallization and treatment with animal charcoal. Gallic acid is usually obtained by the fermentation of gall-nuts. The powdered gall-nuts are exposed to the air for a month or six weeks in a moist state, at a temperature of 20° to 25° C. (68° to 77° F.). The ferment appears to be the *Penicillium glaucum* and the *Aspergillus niger*. The mass becomes covered with these plants (mould), and the surface is frequently cleansed by removing this mould. When the fermentation is completed, the moist mass is pressed, and the residue is boiled with water to extract the gallic acid, which deposits in crystals as the solution cools. By redissolving in eight parts of boiling water, and treating the solution with animal charcoal, the coloring-matters are removed. By this fermentation the tannic acid of the nut-galls, which is a glucoside (see Glucosides), assimilates the elements of water and yields gallic acid and glucose. By the action of acids or alkalies the tannic acid is decomposed in the same manner. Tannic acid is rapidly converted into gallic acid by boiling in dilute sulphuric acid. The gallic acid crystallizes in long silky needles or in triclinic prisms, which are inodorous and have an astringent taste. They dissolve in 100 parts of cold and in three parts of boiling water. The solution reddens litmus. They are very soluble in alcohol, less so in ether, and soluble in glycerin to the extent of 40 grains in a fluid ounce. Heated to 210° C. (410° F.), gallic acid is converted into pyrogallic acid and carbon dioxide:

Gallic acid. Pyrogallic acid.

$$C_7H_6O_5 = C_6H_6O_3 + CO_2.$$

If exposed to the air, the aqueous solution of gallic acid, especially if alkalies are present, disengages carbon dioxide and deposits a black substance. Boiled with potassa, it is changed to black tanno-melanic acid. Warmed with concentrated sulphuric acid, it is changed to rufigallic acid. Gallic acid reduces gold and silver salts to the metallic state. It does not precipitate gelatin, which distinguishes it from tannic acid. With ferric salts (sesqui-salts) it produces a deep bluish-black color. Gallic acid is employed in photography, but is not as useful as pyrogallic acid as a developer. It is the agent most frequently employed to reduce silver in hair-dyes. The most effective dyes consist of two fluids, to be applied successively—first, an ammoniacal solution of nitrate of silver; second, an alcoholic solution of gallic acid. In medicine, gallic acid is used as an astringent, especially for internal use, as tannic acid, though more powerful, is rendered insoluble by gelatin. It is used to check hæmorrhages from the chest and uterus; is used in pyrosis and for night-sweats of phthisis. For external use it is inferior to tannic acid.

C. F. Chandler.
Revised by Ira Remsen.

**Gallican Church**: the Christian Church in France which claimed to be a distinctively national church, and openly asserted its independence of the Roman hierarchy and its right to administer its own government within certain limits. Within the church, Hincmar, of Rheims, was the first prominent defender of this independence, which four centuries later was declared in the Pragmatic Sanction of Louis IX. The principles upon which it acted are known as *Gallicanism*. They were thus set forth in 1682 in the *Declaration of the Clergy of France Concerning the Ecclesiastical Power*: "1. St. Peter and his successors, vicars of Christ, and likewise the Church itself, have received from God power in things spiritual and pertaining to salvation, but not in things temporal and civil. . . . Consequently kings and princes are not by the law of God subject to any ecclesiastical power, nor to the keys of the Church, with respect to their temporal government. Their subjects can not be released from the duty of obeying them, unabsolved from the oath of allegiance. . . . 2. . . . The decrees of the Œcumenical Council of Constance . . . remain in full force and perpetual obligation. . . . 3. Hence the exercise of the apostolic authority must be regulated by the canons enacted by the Spirit of God and consecrated by the reverence of the whole world. The ancient rules, customs, and institutions received by the realm and Church of France remain likewise inviolable; and it is for the honor and glory of the apostolic see that such enactments, confirmed by the consent of the said see and of the churches, should be observed without deviation. 4. The pope has the principal place in deciding questions of faith, and his decrees extend to every church and all churches, but nevertheless his judgment is not irreversible until confirmed by the consent of the Church." But this "declaration" merely reiterated in more formal phrase what had been often said before. The Church in France from its beginning had resisted the papal domination. As far back as the ninth century Hincmar, Archbishop of Rheims, took the side of his king, Charles the Bald, in his fight with Rome. It was then that the famous pseudo-Isidorian decretals first came into use. They were barefaced forgeries, but none the less used by Hincmar to assert his authority against Rome, for although they advocate the papal hierarchy they do so rather as the protector of episcopacy in its conflict with the civil government. The independent spirit showed itself in the refusal of Louis IX. in 1268 to give the pope (Clement IV.) control of the ecclesiastical taxes; later in the pragmatic sanction of Bourges in 1438 between Charles VII. and Pope Eugene IV., which greatly curtailed the papal pretensions in France. But it was in the seventeenth century that Gallicanism found its greatest defender, for then the eloquent, learned, and logical Bossuet raised his voice in its behalf. He was the virtual author of the "declaration" of 1682. Yet it was found impracticable to carry out the independence of the "declaration." The civil constitution of the French clergy in 1790 was a direct blow in favor of Gallicanism in its extremest form. Thus bishops were expressly forbidden to apply for institution to the pope. They were simply to notify him of their appointment "in attestation of the unity of faith and of the communion which they were bound to preserve with him" (Art. XIX.). The provision for the Church was, however, beggarly. Napoleon restored the Church in France to her former wealth (1802), and made the articles of Gallicanism part of the law of the state (1810). Under the Bourbons there were attempts to take away the liberty claimed, but they were unsuccessful. Under Napoleon III. all was quiet. So things remained till the Vatican Council (1870), whose doctrine of papal infallibility renders it impossible that Gallicanism or any other kind of independence should be tolerated in the Roman Catholic Church. Gallicanism is practically dead. But it did not die without a struggle. The infallibility dogma was vigorously opposed by Bishop Dupanloup and the French prelates at the council. Yet when it was passed they submitted, and now their speeches, if repeated, would be heretical. For the history of the Gallican Church, see W. Henley Jervis, *History of the Church of France from the Concordat of Bologna, A. D. 1516, to the Revolution* (2 vols., London, 1872); and *The Gallican Church and the Revolution* (1882).

Samuel Macauley Jackson.

**Gallico**, Paolo: See the Appendix.

**Gallie'nus**, Publius Licinius Valerianus Egnatius: son and successor of Valerian: was raised to the purple by his father in 253, and in 260 became sole emperor. His reign was greatly disturbed by the invasions of Germans, Franks, Goths, Sarmatians, Persians, and others; a dire pestilence decimated the people, and the so-called thirty tyrants created anarchy throughout the empire. Gallienus seems to have been a weak and sensual though personally brave man. He was killed by his own soldiers at the siege of Milan, in Mar., 268 A. D., in the fiftieth year of his age.

**Galliffet**, gäă'lĕĕ'fā', Gaston Alexandre Auguste, Marquis de: soldier; b. in Paris, France, Jan. 23, 1831. He entered the army in 1848; was commissioned colonel in 1867; served in the Army of the Rhine through the Franco-German war; promoted to be general of brigade Aug. 30, 1870; commanded the expedition on El-Goliah, Africa, and subdued the revolting tribes in 1872–73; and became commander of the Third brigade of infantry of the Eighth Army-corps and of the subdivision of the Department of the Cher on the reorganization of the army. In 1875 he was promoted to be general of division, and given command of the Fifth division of infantry, and in 1879 became commander of the Ninth Corps. The cavalry regulations of 1882 were drawn up by Gen. Galliffet, who ranks high as a cavalry officer.

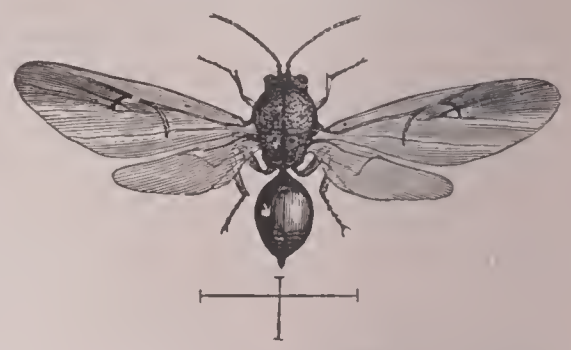
**Gallina'ceæ, Gallinaceous Birds**: See Gallinæ.

**Galli'næ** [from Lat. *gallus*, a fowl]: an order of birds embracing the fowls in the widest acceptation of the term, the equivalent of the old term *Rasores*, less the pigeons, and synonymous with *Gallinaceæ*. The *Gallinæ* are birds with stout legs and feet, short, strong claws, small heads, curved bills, and short, rounded wings. The palate is schizognathous, the vomer more or less abortive, the nostrils holorhinal, the mandible has a recurved process, and basipterygoid facets are present. The sternum has usually four deep notches, and the furcula is long, slender, and V-shaped. The gullet is dilated into a crop, the gizzard is powerful, the intestinal cæca are well developed and there are generally two carotids. The species of the order lay numerous eggs, the young are clothed with down and run about as soon as hatched. The *Gallinæ* include the mound-builders, curassows, grouse, pheasants, turkeys, and all related forms comprised in the families *Megapodidæ*, *Cracidæ*, *Phasianidæ*, and *Tetraonidæ*. The small Old World quail (*Turnicidæ*) are sometimes placed in a separate order (*Hemipodii*), but quite as often regarded as a sub-order or family of the present group.

The sand-grouse (*Pterocles*) are put in an order by themselves between the fowls and pigeons, and the pheasant-plovers (*Thinocoridæ*) are relegated to the *Grallæ*. The *Gallinæ* are divided into two great groups, the *Peristeropodes*, or pigeon-footed fowls, which have the hind toe rather long and on a level with the others, and the *Alectoropodes* or true fowls, having the hind toe short and more or less elevated. The *Gallinæ* are a widespread group, its members being found throughout the globe from the snows of the Arctic circle to the tropics. See Argus, Black Cock, Brush Turkey, Capercailzie, Curassow, Grouse, Guinea-fowl, Megapodes, Partridge, Peacock, Pheasant, Phasianidæ, Prairie Hen, Quail, Sage Cock, Tetraonidæ, Tragopan, and Turkey. F. A. Lucas.

**Gall Insects**: insects usually described as those which deposit their eggs in the tissues of plants, and as being confined to two of the seven orders of true insects. They may be more correctly defined as insects which live within abnormal growths or excrescences produced on different parts of plants, either by the action of the indweller or by that of its parent; the animal in the one case being the architect of its own dwelling; in the other, born within its already constructed abode. These swellings exhaust more or less the parts of the plant on which they occur, and are sometimes so numerous as to destroy the entire plant. Many different families of insects are represented by gall-producers, and they occur in all the orders except the two lowest—viz., the straight-wing insects (*Orthoptera*) and the nerve-wing insects (*Neuroptera*). Yet the gall-making habit is by no means common even to all the species of the genus to which gall-makers belong. Gall insects are preyed upon by a number of parasitic species which manage to reach them in their hidden recesses, and their galls are appropriated by a number of guest-insects or Inquilines. These do not properly come within the present scope, but full information may be obtained from the writings of Osten Sacken, Walsh, and Bassett in the *Proceedings* of the Philadelphia Entomological Society, while for recent work on the European species, and especially for interesting discoveries as to development and alternation of generation, Dr. H. Adler's work, *Ueber den Generationswechsel der Eichen-Gallwespen* (1881), should be consulted. The clearest idea of the different gall insects, their characteristics and habits, will be conveyed by briefly considering them by orders, and by mentioning a few species in each.

*Order Hymenoptera.*—By far the greater number of gall insects belong to the order *Hymenoptera*, or clear-wing flies, and the family *Cynipidæ*, or gall-flies proper, is essentially a gall-inhabiting one. It comprises two divisions or subfamilies, the *Cynipidæ psenides*, or true gall-makers, and the *Cynipidæ inquilinæ*, or guest gall-flies, which last do not construct galls of their own, but make use of the gall-substance produced by others. The typical genus, *Cynips*, has a curved ovipositor, which is more or less hidden within a valve, in repose. Most of the oak-galls are produced by species of this genus. With the ovipositor just mentioned the female pierces the plant-tissues, and therein deposits an egg, together with a small quantity of a peculiar poisonous fluid. Under the influence of this fluid the gall rapidly develops, and is generally fully formed before the egg hatches. The egg is whitish in color and soft. It invariably swells more or less by endosmosis of the surrounding juices, and the outer pellicle is so delicate that no shell is left in hatching. The larva is also whitish, very soft, and has an inconspicuous head and no legs. The body is more or less cylindrical, tapering to both ends, but more especially behind, and lies in a curved position within the cell. As the larva grows the gall-substance around its cell hardens into a cream or buff colored shell, which frequently separates entirely from its surroundings. Most insects, once out of the egg, go through somewhat sudden changes or transformations, especially from the larva to the pupa, and from the pupa to the imago or perfect state. But the chitinous integument of these gall-flies' larvæ is so delicate that the molts are not traceable in any exuviæ left within the cell; while the change from the larva to the pupa, and from this to the perfect state, is comparatively slow, and partakes rather of the character of continued and uninterrupted development. The fly, once perfected, remains for a considerable time within its cell, but finally eats its way out of its prison.



Fly belonging to the genus *Cynips*, the principal genus of Hymenopterous, gall-making insects. Hair-lines indicate natural size.

One of the most interesting biological features of these gall-flies is the fact that two entirely different galls, produced on the same tree at different seasons of the year, may be made by insects of genetically the same species, but belonging to different generations. Thus there is a large woolly gall, the deformation of a bud, which grows on the black oak in spring, and which produces in summer a gall-fly (*C. q. operator*) which is bisexual. The female oviposits between the acorn and cupule of the previous year's setting, and the result is a pip-like gall (*Q. operatola*) embedded in that position, and generally about half exposed. These fall with the acorn to the ground, and the second spring succeeding give forth flies which are all females, and which produce the woolly galls of spring. In the light of this dimorphism and this alternation of generations, the fact, long recognized, that certain galls produce nothing but females, becomes explicable, and there can be little doubt that all species known only in the female sex exist also in the bisexual form, though the gall producing this last may present an entirely different appearance to that producing the former.

Not only do the galls produced by successive generations of the same species differ, but the insects themselves so little resemble each other that they have been described as belonging even to distinct genera. Thus Adler has shown that from the eggs laid by the forms in the left column of the list on page 19, which represents the organic generation, there are hatched the forms in the second column, belonging to the sexual generation.

| | | | |
|---|---|---|---|
| *Neuroterus* | *lenticularis* | = *Spathegaster baccarum* | |
| " | *læviusculus* | = " | *albipes* |
| " | *numismatis* | = " | *vesicatrix* |
| " | *fumipennis* | = " | *tricolor* |
| " | *ostreus* | = " | *aprilinus ?* |
| *Dryophanta* | *scutellaris* | = " | *taschenbergii* |
| " | *longiventris* | = " | *similis* |
| " | *divisa* | = " | *verrucosus* |
| *Aphilotrix* | *radicis* | = *Andricus noduli* | |
| " | *sieboldi* | = " | *testaceipes* |
| " | *corticis* | = " | *gemmatus* |
| " | *globuli* | = " | *inflator* |
| " | *collaris* | = " | *curvator* |
| " | *fecundatrix* | = " | *pilosus* |
| " | *callidoma* | = " | *cirratus* |
| " | *malpighii* | = " | *nudus* |
| " | *autumnalis* | = " | *ramuli* |
| *Biorhiza aptera* | | = *Teras terminalis* | |
| " | *renum* | = *Trigonaspis crustalis* | |

To return to the galls made by the genus *Cynips*, the following forms may be mentioned: *Cynips q. spongifica* produces the well-known American oak-apple, a large, round, drab-colored swelling, filled with brownish spongy matter, and formed on the leaves of the black oak (*Q. tinctoria*). Those formed in spring produce both sexes, while those formed in late summer—the progeny, no doubt, of the former—produce only females, which have been described as a distinct species (*C. q. aciculata*), but which Walsh proved to be specifically related to the former. *Cynips q. inanis* produces the bastard oak-apple, which is found on the leaves of the red oak (*Q. rubra*), and differs from the preceding in being smaller, and in the more brittle central chamber being connected with the outer rind by radiating filaments. *Cynips q. saltatorius* covers the leaves of the different white oaks with minute, seed-like galls, inserted, each in a pocket, on the under side. When mature the galls fall to the ground, and there keep up a constant jumping or bounding movement. The ground covered with these animated galls presents a curious spectacle, and few persons at first comprehend that the motion is imparted by the sudden jerking of the larva within. *Cynips gallæ-tinctoriæ* produces the gall-nut of commerce (see GALLS) on *Quercus infectoria*, while *Cynips insana* produces on the same oak, in the country bordering the Dead Sea, the "mad apples" which Moore describes as

Bastard oak-apple (formed by *Cynips q. inanis* O. S.), found on the red oak, and showing the radiating fibers which support the central chamber. Color, drab.

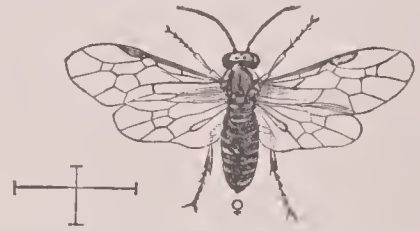
Prickly rose-gall (formed by *Rhodites bicolor*), growing on the leaf-stalk of the rose. Colors, green and rosy.

> Dead Sea fruits that tempt the eye,
> But turn to ashes on the lips.

As *Cynips* proper works particularly on the oak, so *Rhodites* works on the rose, and *Diastrophus* on the raspberry and blackberry. *Rhodites rosæ*, common to Europe and the U. S., forms a polythalamous, mossy gall on the twigs of the rose, known as the *bedegar* of the rose. *Rhodites bi-color* makes a cluster of pretty, round, and prickly galls on the leaf-stalk of the same plant; *R. radicum*, a large brown, irregular, polythalamous gall on the roots; and *R. ignota*, a gall, resembling somewhat a beet-seed, on the leaf-stalk of the same. *Diastrophus nebulosus* makes a large, irregular, red-brown, polythalamous swelling on the blackberry canes; and *D. cuscutæformis* forms a collection of one-celled galls of the same color, and more or less thickly covered with spinous fibers, on the same plant.

The next most extensive family of gall-making insects in this order is that of the saw-flies (*Tenthredinidæ*). These flies are generally of larger size than the true gall-flies, and but comparatively few of the species of a few genera in the family (which is a very extensive one) possess the gall-making habit. The females are characterized by having a saw-like ovipositor, by the aid of which they insert their eggs in the tissue of plants, mostly of the willow (*Salix*) family. These eggs are also accompanied with a peculiar poison, which causes the gall to fully form, in most cases, before the young larva hatches. The larvæ—called "false caterpillars"—are at once distinguished from those of other gall-making insects by the large head, but more especially by having twenty legs (six true and fourteen false or prolegs). *Nematus salicis-pomum* forms, on the leaf of the heart-leaved willow, the willow-apple gall, a beautiful growth, resembling a miniature apple, but perfectly tasteless. *Euura s. ovum* forms the willow-egg gall, a round or oval swelling, from one-third to half an inch long, growing from the side of the twig of the same species of willow. *Euura s. gemma* causes a curious and premature enlargement of the bud of the humble willow (*Salix humilis*), from which the larva issues when mature and enters the ground. *Euura s. nodus* causes elongated swellings of the stem of the long-leaved willow (*S. longifolia*).

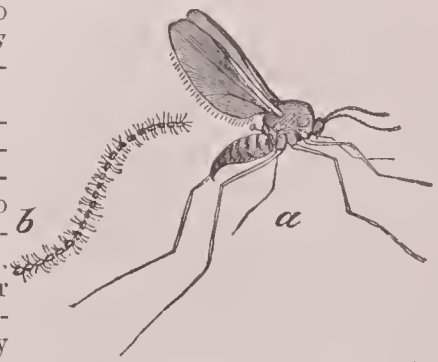
Willow apple-gall (formed by *Nematus salicis-pomum*), growing on the leaves of the heart-leaved willow (*Salix cordata*): *a*, *a*, galls; *b*, larva enlarged; *c*, gall cut open. Colors, pale green and rosy.



Saw-fly, belonging to the genus *Nematus*, the hair-lines showing natural size.

There is but one other Hymenopterous family—viz., the *Chalcididæ*—which furnishes gall insects, and the gall-making habit in it is very exceptional, being confined to the genus *Isosoma*, while the other genera of the family are parasitic. *Isosoma hordei* is the well-known joint-worm which does so much damage to wheat, rye, and barley by producing woody enlargements of the stalk.

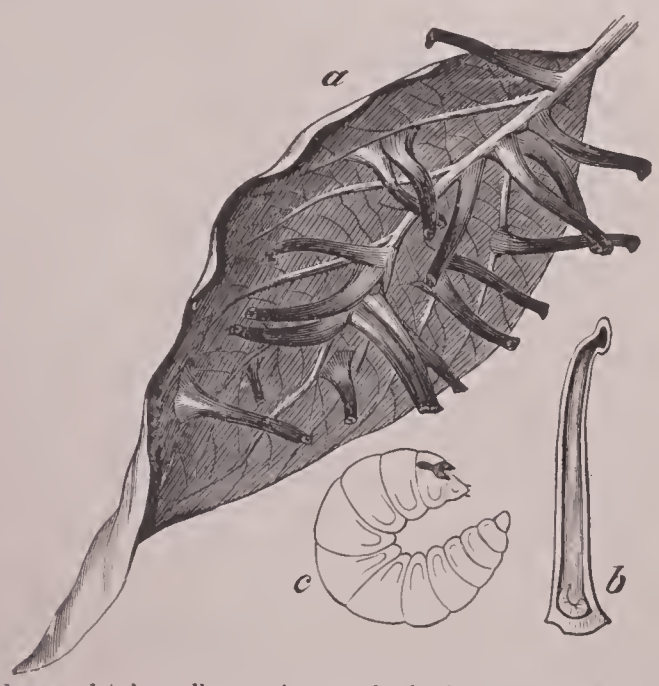
*Order Diptera or Two-wing Flies.* — The gall-making insects of this order belong mainly to two families—the *Cecidomyiidæ* and the *Trypetidæ*. The first contains by far the largest number of gall-making species, popularly known as gall-gnats or gall-midges. They are all of small size, and generally of obscure color, mostly black, and they look not unlike small mosquitoes. Many of the species so closely resemble each other that they are far more easily distinguished by the galls they produce than by any characters which the mature flies present. The female has a telescopic ovipositor,




Fly belonging to the genus *Cecidomyia*, the principal genus of Dipterous gall-making insects: *a*, female; *b*, antenna of male. Color, blackish.

with which she is enabled to thrust her eggs into the soft parts of plants, such as the bud or the epidermis of the tender leaf. The egg is very small, soft, elongate, and usually deep orange or reddish. It is also accompanied by some secretion which acts on the plant and causes the gall to form before the larva hatches. These larvæ are legless, but are easily distinguished from those of the true gall-flies—1, by being more elongate and narrow; 2, by being (with a few exceptions, in which they are white) of an orange color, varying to blood red; 3, by having a very small, pointed, and retractile head; 4, by a very characteristic horny, usually forked, process called the "breast-bone." This process lies under the skin on the anterior joints of the body near the head, and is either Y-shaped, clove-shaped, or oar-shaped. In either case, the tips of the prongs—which are either two or three in number, and can be exserted upon the retraction of the head and anterior joint—are always armed with sharp points, which no doubt serve to lacerate the walls of the gall, and thus assist the insect in obtaining its food, as well as in making a passageway for the future exit of the perfect insect. The gall-gnat larvæ either quit their galls and enter the ground to transform, or remain in them and spin a very delicate cocoon, like goldbeaters' skin, for the same purpose. In either case, the pupa, which usually is furnished with a pair of little horns on the head, works its way to the surface, in order that the perfect gnat may escape; whereas in the other two gall-making families just described the flies perfect within their respective galls, and either eat their own way out or pass through a passageway partly prepared by the larva. *Cecidomyia salicis-strobiloides* forms the pine-cone willow-gall, a deformation not unlike a pine cone, and quite common on the tips of the twigs of the heart-leaved willow. *C. s. brassicoides* forms the cabbage-sprout willow-gall, a series of deformations not unlike cabbage-sprouts, along the leaves of the long-leaved willow (*Salix longifolia*). The grapevine apple-gall (*Vitis pomum*) is a polythalamous gall found on the grapevine, and made by a yet unknown gall-gnat. In external appearance this gall so resembles a hickory-nut or a small apple that it has been looked upon by those not versed in entomology and vegetable physiology as a vegetable monstrosity produced by hybridization with those plants. Yet a glance at its internal structure, which shows a number of elongate cells, each occupied by an orange-colored larva, reveals its nature. The grapevine trumpet-gall (*Vitis viticola*) is a pointed, trumpet-shaped gall of a beautiful crimson color, growing numerously from the upper surface of the leaf of the grapevine. *Cecidomyia solidaginis* produces a common gall in the shape of curled and dwarfed leaves at the tips of the golden-rod (*Solidago*). The dogwood tube-gall (*Corni-tuba*) is a blunt-ended and tube-like growth quite commonly found on the under side of the leaf of the dogwood (*Cornus*).

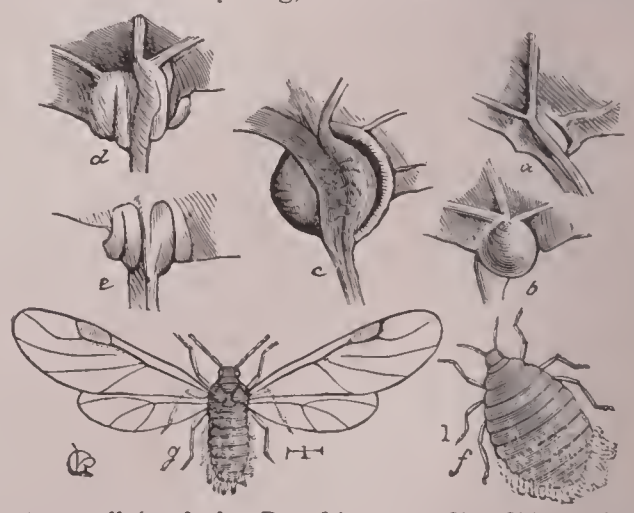
Pine-cone willow-gall (formed by *Cecidomyia salicis-strobiloides*), growing on the tips of twigs of the heart-leaved willow (*Salix cordata*). Color, glaucous green.




The dogwood tube-gall, growing on the leaf of the dogwood: *b*, a section of one of the tubes, enlarged, showing the larva at the bottom; *c*, larva, greatly enlarged, showing "breast-bone."

The second family of Diptera containing gall-makers is the *Trypetidæ*, but few of the species, however, having the habit. These flies have something of the form and size of the common house-fly, but are much more brightly colored, the wings being transparent and marked with various-shaped cloudings. The larva is white and maggot-like, and contracts when full grown to a brownish coarctate pupa within the gall. The fly escapes by continued fretting and moistening of a small space in its prison-wall, the face being temporarily very much swollen into a sponge-like mass for this purpose, and the gall-substance having generally become sufficiently soft by exposure to the weather to permit this kind of exit. The female has a boring ovipositor, by which she can force her eggs into the tips of herbaceous plants. *Trypeta solidaginis* forms the globular pithy swellings so commonly seen on the stem of golden-rod (*Solidago*).

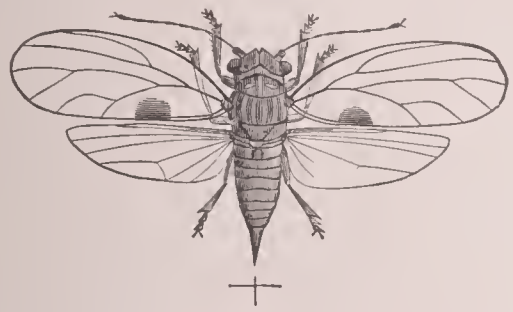
*Order Hemiptera, or Bugs.*—The American gall-making insects of this order, so far as known, belong solely to the Homopterous division, or whole-wing bugs, and are confined to two families—viz., the plant-lice (*Aphidæ*) and flea-lice (*Psyllidæ*). With the insects of the orders so far considered (where the insects undergo complete metamorphosis—i. e. the larva differs entirely from the imago in appearance), the gall is produced by the action of an irritating poisonous secretion inserted into the plant-tissue by the parent. With those now under consideration, in which the larva is born much more nearly in the image of the parent, the gall is also formed under the influence of a poisonous irritation, but this irritation is conveyed by the newly hatched insect, principally by the insertion of its proboscis, very much as the common bed-bug causes irritation and swelling of human flesh by the insertion of its beak. In the plant-lice the original architect of the gall breeds and dies within it, but her numerous young either issue as soon as born and found new galls, or else remain with their parent till full grown, when they also issue from their gall and scatter. In either case the gall—which in most instances is never securely closed—gapes or cracks open to allow their exit. Two interesting facts have been established in the life-history of these gall-making *Aphididæ*: 1, that the sexed individuals are wingless, that the female lays a single impregnated egg on the trunk or other non-deciduous parts of the tree, and that the species thus hibernate; 2, that with some species there is a migration in the hot summer months from the galls to the roots of grasses and herbaceous plants and a return immigration therefrom in the fall to the trunk of the gall-bearing tree. *Pemphigus vagabundus* forms a large, irregular growth, like the cockscomb flower (*Celosia*) on cottonwood. When found in early summer it is green and shiny, and contains the single wingless architect. By fall it becomes dry and dark, and is crowded with winged lice, which are all females. These leave the gall, and in all probability lay eggs from which hatch bisexual young, the females of which form the spring mother gall-lice. *P. populicaulis* makes a rose-tinted swelling at the juncture of the leaf and leaf-stalk of the same tree. *P. ulmi-fusus* makes a large spindle-shaped




Poplar-stem gall (made by *Pemphigus populicaulis*): *a*, incipient gall on the under side of the leaf; *b*, same on upper side; *c*, fully formed gall, showing slit from which the insects escape; *d*, *e*, double galls, one each side of midrib; *f*, wingless female; *g*, winged female, showing pterogostic characters of the genus.

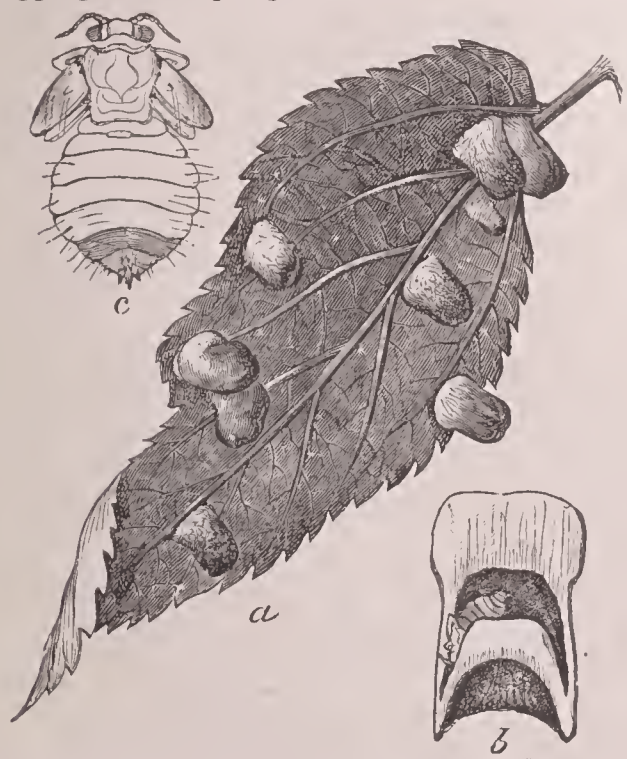
gall on the leaves of the red elm. *Byrsocrypta rhois* produces the sumach gall, a large, hollow, reddish swelling on the leaf-stem of the smooth and staghorn sumachs, and has life-habits similar to *Pemphigus*. *Colopha ulmicola* makes a compressed gall like a cockscomb on the upper side of the leaves of the white elm. *Schizoneura americana* lives on the under side of the leaves of the white elm (*Ulmus americana*), the edges of which it curls and distorts, forming a pseudo-gall. This curl is very similar to that made on the European elm (*Ulmus campestris*) by *Schizoneura ulmi*, though the insects are easily distinguished. *Pemphigus populimonilis* forms on the narrow-leaved cottonwood (*Populus balsamifera*) a series of more or less confluent moniliform swellings on the upper side of the leaf, each containing a single female, destined to become winged when it escapes from beneath, the winged insect occupying the entire cavity of the gall. *Hormaphis spinosus* makes a spinous deformation of the fruit-buds of the witch hazel (*Hamamelis virginica*), while *H. hamamelidis* makes conical galls on the upper side of the leaves of the same plant. *Phylloxera* forms galls, mostly on the hickory, sixteen distinct galls made by insects of this genus on hickory in the U. S. being observed by one writer. *P. vastatrix*, the notorious grapevine phylloxera, makes wrinkled pouch-like galls on the under side of the leaves of some vines. The mother-louse fills her gall with eggs, and the young hatching therefrom escape and found new galls, and become parthenogenetic mothers; this virginal reproduction continuing for several generations, until, with the fall of the leaf, the last generation creeps on to the roots.

The *Psyllidæ*, or flea-lice, as they may be called, form galls of various shapes and sizes on the stems and leaves



Insect belonging to the genus *Psylla*; hair-lines natural size.

of hackberry (*Celtis*). In life-habits they differ from all the other gall insects, and agree with their nearest relative, the plant-lice, only in being the architects of their own galls. The egg—glued in spring to a tender leaf or twig—soon




Hackberry mamma-gall (made by *Pachypsylla celtidis-mamma*); *a*, leaf with galls, natural size; *b*, section of gall enlarged, showing insect within; *c*, pupa, greatly enlarged, showing spines at tip of body, by which the gall is perforated for escape.

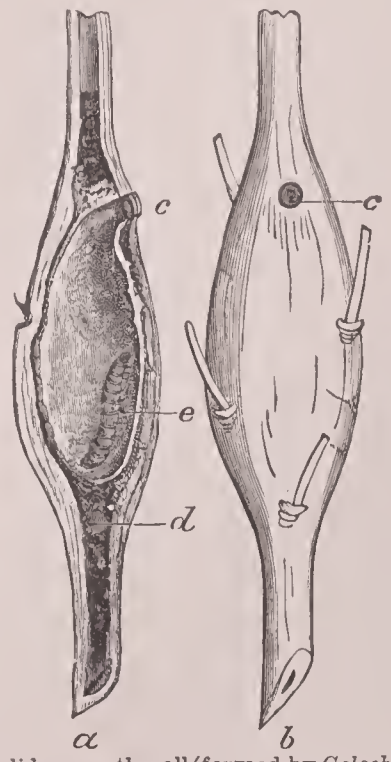
hatches, and under the irritation caused by the young *Psylla*, the gall soon imbeds it. Within this gall the insect dwells till it has acquired the pupa state, which is generally by the time the leaves begin to turn and drop. Then, by means of certain horny spines or thorns at the end of its body, this pupa works its way out of its prison, and once out soon becomes the perfect fly. The galls made by these flea-lice are usually quite hard and woody, and generally one-celled.

*Order Coleoptera, or Beetles.*—The gall-making insects of this order in the U. S. belong to two families—viz., the *Curculionidæ*, or weevils, and the *Buprestidæ*, or Buprestians. In the U. S. the habit is confined to three genera, so far as now known, though in other countries the genera might be multiplied, especially in the gall-making *Curculionidæ*, and even two families (*Sagridæ* and *Lamiadæ*) added. The insects issue through a passageway partly prepared beforehand by the larva. *Ampeloglypter sesostris* forms the grape-vine wound-gall, a simple woody swelling of the tender cane with a fissure on one side. The beetle doubtless inserts her egg in a hole first made by her snout, and the gall is due perhaps more to this action than to that of the larva which hatches from the egg, and which is a whitish, cylindrical, wrinkled, legless grub with a brown head. *Podapion gallicola* forms a swelling of the two-year old twigs of *Pinus inops*, and is the largest species of the sub-family *Apioninæ*. Among the Buprestians *Agrilus ruficollis* makes the raspberry gouty gall, a woody swelling of young raspberry canes, with numerous longitudinal slits. The beetle is one-fourth of an inch long, of a metallic-green color, with a bright coppery thorax. The larva is quite elongate and thread-like, with a large flattened head, and two small horns at the end of the body. Several are generally found in the same swelling, and probably it is to their action alone that the gall is due.

*Ampeloglypter sesostris*, a gall-weevil: the hair-line showing natural size. Color, shiny yellowish brown.

*Order Lepidoptera, or Scaly-wing Insects.*—The gall-making habit obtains in but few of the insects of this order, and

Grapevine wound-gall (formed by *Baridius sesostris*), and occurring on grape-canes. Colors, green and rosy.




Solidago moth-gall (formed by *Gelechia gallæ-solidaginis*), on the stems of golden-rod: *a*, a section; *b*, entire gall; *c*, *c*, the door through which the insect escapes; *e*, larva; *d*, excrement.

these are confined to the Heterocera, or moths, and almost entirely to a few genera in the family *Tineidæ*. The insects issue from the gall through a neatly contrived doorway. *Gelechia gallæ-solidaginis* forms elongate, hollow swellings on the stems of the golden-rod. The parent moth deposits an egg on the stem of the young plant, and the young larva eats its way into the stem through a minute hole which subsequently closes up. This larva, like the gall-making saw-fly larvæ, has legs, but is readily distinguished from these last by its smaller head and by having but ten instead of fourteen pro-legs. When mature, it lines its gall with silk,

eats a passage-way at the upper end, and stops up the hole with a little plug of liquid silk, so fitted that the moth in issuing can easily push it away from within, though it can not well be pushed inward from without. After completing this doorway the larva retires to the bottom of its chamber, casts its skin, and becomes a brown chrysalis, from which, in due time, the moth bursts. *Walshia amorphella* forms a somewhat similar, but more solid and woody, swelling on the stems of the false indigo (*Amorpha fruticosa*). *Gelechia*

Solidago gall-moth (*Gelechia gallæ-solidaginis*), with wings expanded and with wings folded.

*asterella* forms a similar gall on the asters. Among the *Tortricidæ*, the most common gall-making species is *Pædisca saligneana*, which causes a swelling of the stem of the golden-rod in the Northern U. S., the swelling being smaller, more irregular, and higher up on the stem than that of the *Gelechia*. Another tortricid is *Grapholitha ninana*, which forms a swelling of the stem of *Acacia felicina* in Arizona and New Mexico.

*Acarina, or Gall-mites.*—These minute animals are not, strictly speaking, true insects, but belong to the class of Arachnida (spiders, etc.) which are distinguished from true

Mite-gall, on leaf of wild cherry.

insects by having, among other characters, eight instead of six true legs. The more perfect galls produced by mites are pocket-shaped, and the mites which produce them belong mostly to the genus *Phytoptus*, which contains species of elongate form and possessing but six well-developed legs, the fourth pair being minute. See GALLS. C. V. RILEY.

**Gallinule**: a name for various birds closely related to the rails, but distinguished by having the beak extended upward so as to form a broad, bare frontal shield. The same thing occurs in the coots (*Fulica*), but those birds have lobed feet, while the toes of the gallinules are long and slender. The common species of the U. S. is the Florida gallinule (*Gallinula galeata*), or mud-hen, a bird about a foot long, of a general slaty-gray hue, lighter below, deepening into brownish olive on the back. It is widely distributed throughout the U. S., inhabiting marshes and the reedy borders of shallow streams and ponds. The purple gallinule (*Ionornis martinica*) is a much smaller bird, of a rich-blue color; a resident of Central and South America and the West Indies; found also in the Southern U. S. and straggling northward to New England. Closely allied but much larger species of the genus *Porphyrio* dwell in Southern Europe, Asia, Africa, and Australia. The African gallinule is said to be very destructive to other marsh-haunting birds, not only plundering their nests of eggs and young, but even lying in wait for and killing the little birds themselves. See NOTORNIS in the Appendix. F. A. LUCAS.

**Gal'lio**: proconsul of Achaia (Acts xviii. 12); elder brother of Seneca the philosopher; adopted as a son by Junius Gallio, a celebrated rhetorician. According to Eusebius, he committed suicide in 65 A. D. G. L. H.

**Gallip'oli**: a small, fortified maritime town of Italy; province of Lecce; 59 miles S. of Brindisi (see map of Italy, ref. 7–H). It is on a high rock, formerly a promontory, but now entirely surrounded by the waters of the Ionian Sea, and only connected with the mainland by a bridge of twelve arches. The port (or rather *road*), accessible only on the east side, is commanded by a strong castle. The town is supplied with good water, brought from the inland hills by an aqueduct which terminates in a superb fountain. This is an ante-Christian work, and the fountain is adorned with fine busts and bas-reliefs, and bears many Latin inscriptions. In 1429 the Turkish corsairs surprised the town and carried many of its inhabitants into slavery. In 1809 it was attacked by a British flotilla, which was vigorously repulsed. Gallipoli is a thriving commercial town, exports olive oil (which is stored in great tanks cut in the solid rock), and has some manufactories. It is the seat of a bishopric. Pop. (1890) 8,083.

**Gallipoli** (in Gr. Καλλίπολις): city of European Turkey; province of Roumili; at the northeast end of the Dardanelles, and about 110 miles W. S. W. of Constantinople (see map of Turkey, ref. 4–D). It is miserably built, but has two good harbors, large manufactures of earthenware and morocco leather, and carries on a very extensive trade. Gallipoli was the first European town that fell into the hands of the Turks in 1357, nearly a century before the fall of Constantinople. It is the key to Constantinople and the Black Sea, and was occupied by the allied armies of Great Britain and France in 1854. It has a Greek bishop. Pop. (1890) 15,500. Revised by C. H. THURBER.

**Gallipolis'**: city; capital of Gallia co., O. (for location of county, see map of Ohio, ref. 8–G); on the Ohio river, and the Col., Hock. V. and Tol. Railway and the Ohio Central lines; equidistant from Pittsburg and Cincinnati; 56 miles S. E. of Chillicothe. It is above the highest water-mark; has packet-line connections with Pittsburg and Cincinnati; manufactures lumber, leather, woolen goods, furniture, brooms, and flour, and contains Gallia Academy, public high school, several churches, court-house, 2 banks, and 1 daily and 3 weekly newspapers. Pop. (1880) 4,400; (1890) 4,498; (1900) 5,432.

**Gallipoli, Strait of**: See DARDANELLES.

**Gallisonnière**, găă'lĕĕ'sō'ni-ār', AUGUSTIN FÉLIX ELISABETH BARRIN, Count de la: soldier; b. in Anjou, France, 1742; served under his uncle, the Marquis de la Gallisonnière, in the marine service in Canada; entered the army, serving against Hanover; was made *maréchal de camp* 1788, and grand-seneschal of the sword for Anjou 1789, by virtue of which office he was president of the nobles in the states-general in that year. He was chosen to preside over the assembled Three Estates at the beginning of the Revolution, and was premier deputy of the nobles in the Constituent Assembly. Some time after he became an *emigré* and fought against the revolutionists, but in 1801 returned, and was in public life under Napoleon. When the Bourbons returned he was made lieutenant-general, but retired from public life in 1815. He wrote much upon the public affairs of his time. D. Mar. 2, 1828.

**Gallisonnière**, ROLAND MICHEL BARRIN, Marquis de la: sailor; b. in Rochefort, France, Nov. 11, 1693. He entered the French navy 1710; while having the rank of a captain was (1745–49) Governor-General of Canada, where he displayed great energy in naval construction and in establishing a line of forts between Canada and Louisiana. The Indians at first despised him for his small stature, but soon learned to love him and respect his abilities. His administration was marked by troubles with the British in Nova Scotia and the Ohio valley. He was the originator of the scheme for connecting Canada with Louisiana by means of a chain of trading-stations along the Ohio and Mississippi, not only to establish a ready communication between the two colonies, but also to circumscribe the English colonies within certain limits. Gallisonnière next was chief of the bureau of maps and charts, with the rank of *chef d'escadre*. He performed much excellent scientific work in this position. In 1756 he defeated Byng off Minorca (for which defeat Byng was afterward executed), but the fatigue and excitement of this action were too severe for Gallisonnière's health, and he was obliged to give up the command. He was very fond of botanical science; was deformed and of feeble health, but of very active mind. D. in Nemours, Oct. 26, 1756.

**Gallit'zin**: a Russian princely house whose origin is Lithuanian, the Prince Gedemin, the ancestor of the Jagellon princes, being also ancestor of the Gallitzins. The name comes from *Golitza* (leather gauntlet), a surname of Mikhail Ivanovitch Bulgak, one of the ancestors of the family, distinguished as the wearer of gloves of this kind. Ivan the Terrible in the sixteenth century made one of the family a boyar, and since that time there have been many diplomatists, generals, and politicians among the princes

of this house.—Prince Dmitri (1735–1803), father of the missionary Gallitzin, was a diplomatist and author of several scientific works.—His wife, Amalie von Schmettau (b. at Berlin, Aug. 28, 1748; d. near Münster, Aug. 24, 1806), abandoned the society of her infidel husband, became a Roman Catholic, and was as distinguished for piety and literary talents as she had previously been for social talents and personal beauty. She occupied herself in religious and philosophical controversies, and attained a wide influence among the aristocratic families of Germany, an influence which was greatly forwarded by the stirring events of the latter part of her life.—Prince Emmanuel (1804–53) was an active writer upon science and literary subjects, and an amateur musical composer and oil-painter.

**Gallitzin**, Demetrius Augustine, Prince: a son of the Russian ambassador at Paris, Prince Gallitzin, and of the Princess Amalie von Schmettau; b. at The Hague, Dec. 22, 1770. His father was a freethinker, but in 1787 the young man followed his mother's example and became a Roman Catholic, taking the name Augustine on changing his belief. He was an officer of the Russian guard, and served as a staff officer in the Austrian force in Brabant, but in 1792 was dismissed, along with the other foreign officers in the Austrian service; removed to the U. S., became a Sulpitian, studied theology at Baltimore, and in 1795 took priest's orders. He officiated at Conewago, Pa., and other places in the Middle Atlantic States. In 1799 he founded a colony in Cambria co., Pa., and there he laid out in 1803 the Roman Catholic town of Loretto, expending a large fortune in the work. He bore the name of "Father Smith," and labored with the greatest zeal and self-denial. In 1809 he resumed his original name. He wrote *A Defense of Catholic Principles in a Letter to a Protestant Minister* [1816]: *to which is added an Appeal to the Protestant Public* [1818] (4th ed. Baltimore, 1837); *A Letter to a Protestant Friend on the Holy Scriptures, being a Continuation of the Defense of Catholic Principles* (1847), and other works. D. at Loretto, Pa., May 6, 1841. His *Life* has been written by T. Heyden (Baltimore, 1869), by H. Lemke (Münster, 1861), and by Sarah M. Brownson (New York, 1873).

Revised by Samuel Macauley Jackson.

**Gallium**: one of the chemical Elements (*q. v.*); discovered in 1875 by the French chemist Lecoq de Boisbaudran, in a zinc blende which occurs at Pierrefitte, France. It owes its name to the Latin name of France, *Gallia*. It is of special interest for the reason that its properties were foretold by Mendeléeff some years before it was discovered, and it was described by him under the name ekaaluminium, as scandium was deseribed under the name ekaboron and germanium under the name ekasilicium. Gallium resembles aluminium in the composition and character of its compounds. Since its discovery it has been found in a number of zinc blendes, but in largest quantity in those found at Bensberg, on the Rhine, at Asturia, and at Pierrefitte; 430 grammes of the last variety yield 0·65 to 1 gramme of gallium. The metal forms two oxides—GaO and $Ga_2O_3$—and two chlorides—$GaCl_2$ and $GaCl_3$. Its atomic weight is 69·9, and its symbol Ga.

Ira Remsen.

**Gall-lice** and **Gall-midges**: See Gall Insects.

**Gall-nuts**: See Galls.

**Gallon**: the standard unit of liquid capacity in the U. S. and of liquid and dry capacity in Great Britain. The capacity of the gallon has been very variable. It will facilitate the understanding of its changes to bear in mind that this measure was originally designed to be a measure not of bulk, but of weight. To earry out to its full extent the notion on which it was founded would have required that every commodity measurable in bulk should have had its own gallon, each holding the same weight, but the bulks varying inversely as the specific gravities. As this would have led to endless complication, early usage led to the adoption of two different gallons only, related to each other in capacity in the inverse ratio of the specific gravities of corn (wheat) and wine (the wine of Gascony, at that time a British province, being taken as the standard); these being supposed to represent the average of the two classes of exchangeable commodities, wet and dry. The ratio here spoken of was assumed to be that of 143 to 175. In British legislation the earliest definition of the gallon is found in an act of the 9th of Henry III. (1225), which declares that "one measure of wine shall be through our realm, and one measure of ale, and one measure of corn—that is to say, the *quarter* of London." The quarter of London is here spoken of as a measure existing and known, but its capacity was not distinetly set forth until the fifty-first year of the same king (1266), when it was declared by statute that "an English [silver] penny, called a sterling, round and without any clipping, shall weigh thirty-two wheat corns in the midst of the ear, and twenty pence do make an ounce, and twelve ounces one pound, and eight pounds do make a gallon of wine, and eight gallons of wine do make a London bushel, which is the eighth part of a quarter." A statute of Henry VI., of 1423, revived eertain ordinances, aceording to which a different value of the gallon was derived from the mode of calculating tonnage. A ton of water was the weight of 32 cubic feet, and the eighth part of a eubic foot, or 216 cubic inches, was a gallon of water. Hence the wine-gallon measure, being enlarged so as to hold the same weight of wine, became 217·6 cubic inches, requiring the wheat-gallon to be modified also, so that this became 266·17 cubic inches.

The want of public standards in England was for some centuries a source of great eonfusion. An act of the twelfth year of Henry VII. (1496) provided that a new standard gallon-measure should be constructed, to hold 8 lb. of *wheat* of 12 *troy* oz. each. This was the origin of the gallon at present the standard in the U. S. In the reign of Elizabeth a quarrel between the excise officers and the dealers in herring led to the enactment of a statute (13 Eliz., 1570) that "32 gallons wine-measure, which is *about* 28 gallons by old standard, shall be the lawful assize of herring barrels, any old statute to the contrary notwithstanding." In 1700 the old difficulty between exeise officers and dealers broke out anew, and led to protracted litigations and to two legislative acts—first, the statute of William III. (1701), which not only established the Winchester bushel as the standard, but explicitly defined its eapacity; and, second, a statute of 5th Anne (1706), which in like manner established and fixed the wine-gallon. The Winchester bushel, as computed according to the terms of the statute, contains 2,150·4252 cubic inches, and the Winchester gallon 268·8 cubic inches. In 1818 a royal commission was appointed to inquire into the condition of British metrology, and to recommend measures for its reformation. As the result a bill was introduced into Parliament, which, with slight modifications, became a law June 17, 1824, and was put into operation Jan. 1, 1826. It fixed the capacity of the gallon by requiring that it should be such as to contain 10 lb. avoirdupois, or "70,000 grains troy, of distilled water at the temperature of 62° F., weighed by brass weights under the barometric pressure of 30 inches," and stating at the same time the eapacity thus determined to be $277\frac{274}{1000}$ eubic inches. This is the value of the *imperial* gallon, and since its introduction it is the only legal gallon in Great Britain for wet or for dry measure.

In the U. S. no system of measures has been established by act of Congress. The gallon has been inherited from Great Britain. The control over the subject is practically exercised by the Secretary of the Treasury. A resolution of the Senate of the U. S. of May 1, 1830, having ordered an examination to be made of the weights and measures in use in the several custom-houses, and these having been reported to be diseordant, Secretary MeLane instructed F. R. Hassler, chief of the coast survey, who had reported the inaccuracies, to superintend the construction of a set of uniform and standard weights and measures to be supplied to all the custom-houses. Prof. Hassler's report, which was the basis of the new standards, stated the "legal capacity" of the gallon to be 231 cubic inches, and that of the bushel—the Winchester bushel being assumed to be legal—2,150·42 cubic inches; but he placed the temperature of eomparison at 39·83° F., and proposed (as he afterward practiced) the adjustment of these measures by making the gallon contain $58{,}372\frac{1754}{10000}$ grains of distilled water of this density, and the bushel $543{,}391\frac{89}{100}$ grains. The British standard temperature of comparison being 62° F., it follows that the so-called Winchester bushel of the U. S. and the Winchester bushel of Great Britain, when compared at any eommon temperature, differ in capacity by more than a cubic inch and a half, the first-mentioned being the larger. Congress has since given legal sanction to the proceedings of the Treasury Department above described, by the passage of a joint resolution (approved June 14, 1836) directing that a complete set of all the weights and measures adopted as standards be delivered to the Governor of each State of the U. S.

Revised by F. M. Colby.

**Gallop**: See Gaits.

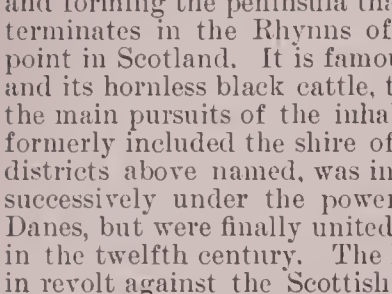
**Gallotan'nic Acid** ($C_{14}H_{10}O_9+2H_2O$): the variety of tannic acid or tannin which is found in the gall-nuts of *Quercus infectoria* and other species of the oak, in sumac, and in Chinese gall-nuts. It differs from caffe-tannic, catechu-tannic, morin-tannic, querci-tannic, and quino-tannic acids in certain important properties, although it resembles them in possessing a slight acid reaction, a rough astringent taste, coloring ferric salts blue-black or green, precipitating albumen and gelatin, and converting animal membranes into leather. Revised by Ira Remsen.

**Galloway**: a district in the south of Scotland, comprising the county of Wigtown and the stewartry of Kirkcudbright, and forming the peninsula that projects toward Ireland and terminates in the Rhynns of Galloway, the southernmost point in Scotland. It is famous for its small breed of horses and its hornless black cattle, the raising of which is one of the main pursuits of the inhabitants. The province, which formerly included the shire of Dumfries, in addition to the districts above named, was inhabited by the Picts, who fell successively under the power of Romans, Anglians, and Danes, but were finally united to the kingdom of Scotland in the twelfth century. The lords of Galloway were often in revolt against the Scottish throne until after the turbulent rule of the Douglas family in East Galloway, when the lordship of the province was attached to the crown. For a further account of the region, see Wigton or Wigtown and Kirkcudbright.

**Galloway**, Charles Betts, A. B., D. D.: bishop; b. in Kosciusko, Miss., Sept. 1, 1849. He was educated in the University of Mississippi; chosen professor in Madison College, Mississippi, in 1869; entered the ministry of the Methodist Episcopal Church South; stationed in Black Hawk 1870, Fort Gibson 1871, Yazoo City 1872–73, Jackson 1874–77, Vicksburg 1878–81, and Jackson 1882; editor of the New Orleans *Christian Advocate* in 1882–86; and was elected bishop in the latter year. He was a fraternal messenger to the Methodist Church of Canada in 1886, and to the Wesleyan Methodist Church of England in 1892, and delegate to the Centennial conference in Baltimore in 1884, and to the Ecumenical conference in Washington, D. C., in 1891. His publications include *Methodism, a Child of Providence* (1877); *Handbook of Prohibition* (1886); *Aaron's Rod in Public Morals*; and *Discussion with Hon. Jefferson Davis on Prohibition* (1888).

**Gallows**, găl'lŭs or găl'lōz [M. Eng. *galows* < O. Eng. *galga*, gallows, cross: Goth. *galga*, cross: Mod. Germ. *Galge*, gallows; cf. Lith. *żalga*, pole]: the structure by means of which capital punishment by hanging is inflicted. The culprit stands upon a platform, or drop, beneath a cross-bar elevated upon two upright supports. A rope or halter hangs from the cross-bar, and a noose at its end is placed around the criminal's neck. He is hanged by the falling of the drop, or in some cases is drawn up from the platform by a heavy weight at the other end of the rope.

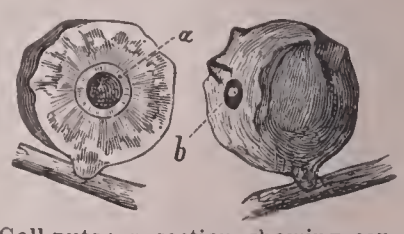
**Galls** [plur. of *gall*, from O. Fr. *galle*: Ital. *galla* < Lat. *galla*, gall-nut]: in the language of naturalists, abnormal growths or excrescences produced on growing or living plants by one or more insects or closely allied mites, which develop and are nourished therein. These deformations are found on all parts of plants, and present a great variety of form, color, and texture—from the simple pouch-like bulging of the leaf to the most perfect and complicated structure. Many of them resemble familiar fruits, flowers, and vegetables, while a few, like fruits, are eaten by man. Take, in illustration, those occurring on the oaks. The bud may prematurely develop into a bunch of lanceolate leaves or become aborted into an acorn-like chamber. The tender leaf of spring, and even the blossoms, are beset with several green, and mostly globular, gall-growths. The more mature leaves furnish an infinite variety, from two-hundredths of an inch to over 2 inches in diameter, either globular, pedunculated, conical, cup-shaped, or clavate, and with a surface either smooth, reticulate, wrinkled, downy, woolly, or prickly. The fruit is deformed by large globular excrescences growing from the cupule; by hard cells within the cupule, and set in cavities with fimbriated mouths; by pip-like bodies between the acorn and cupule; or, finally, by stony chambers or indurations in the meat itself, without external indication. The internal structure of galls is as varied as the external, but there is invariably a cell, within which the insect is nursed and nourished. This cell, in most succulent galls, is merely a cavity of various form in the general tissue; but it more often takes on the character of an oval chamber more woody than the surrounding substance, and which, though lying generally secure in said substance, is not unfrequently suspended to the general envelope by radiating fibers, in the same way that the hub is connected by spokes to the felly of a wheel; while more rarely it is entirely separated from its envelope and rolls around loosely therein. Galls are technically separated into two groups—viz., the "monothalamous," or one-celled galls, each nourishing a single individual; and the "polythalamous," or many-celled, nourishing many individuals under a common envelope. Galls are produced either by the action of a peculiar poisonous fluid injected with the egg by the mother gall insect, so that the young larva finds its habitation already prepared; or by the mechanical irritation (aided, most likely, by some similarly poisonous property) of the young larva, which is then the architect of its own house. In the former case the egg is generally inserted by the parent in the plant-tissues; in the latter, it is generally attached to the surface. The secretory organs of the plant are influenced by this poison very much in the same way that the human secretory system is influenced in producing the smallpox pustule when vaccine matter is inserted into a child's arm. Galls, in a general sense, partake not only of the chemical character of the plant-juices, but of the consistency of the part upon which they are found. Few families of phanerogamous plants are free from these growths, but none have thus far been found on fungi or on mosses. The term "galls" is sometimes applied to those animal swellings produced by dipterous larvæ, mostly belonging to the genus *Œstrus*, or by mites dwelling in or under the skin of birds and mammals. It is also applied to some of the swellings on trees and shrubs produced by the growth of cryptogamic parasitic plants. It should not be applied, as it sometimes is, to those plant-swellings and nodosities which are caused by the punctures of insects which always dwell exposed thereon, the difference between a gall and a mere swelling being that the architect of the former is hidden from view, and of the latter always exposed. See Gall Insects.



A "monothalamous" gall: Being the American oak-apple (formed by *Cynips q. spongifica*) found on the black oak, and showing (*a*) the central cell in which the larva develops, and (*b*) the hole through which the fly issues. Colors, drab inside; yellowish brown outside.

A "polythalamous" gall: Being the wool-sower gall (formed by *Cynips q. seminator*): *a*, showing a section; *b*, one of the pip-like kernels, showing woolly wing and the hole through which the fly escaped. Colors, light buff and rosy.

Gall-nuts are hard, woody, spherical swellings, of an olive-gray or bluish and more or less wrinkled exterior and yellowish-brown interior, formed by *Cynips gallæ-tinctoriæ* on the twigs of a species of oak (*Quercus infectoria*) common throughout Syria and Asia Minor. They are exported from Smyrna, Aleppo, and other parts of the Levant, as well as from the East Indies, to all portions of the civilized world, and used for tanning and dyeing purposes, but more especially in the manufacture of writing-inks. They have no odor, but taste somewhat bitter, and are powerfully astringent. They give the following analyses: Tannic acid, 65; gallic acid, 2; ellagic and luteo-gallic acids, 2; brown extractive substance, 2·5; gum, 2·5; starch, 2; sugar, 1·3; chlorophyll and volatile oil, 0·7; woody fiber, 10·5; water, 11·15—total, 100. They produce black dyes when mixed with solutions of sulphate of iron. In the



Gall-nuts: *a*, section, showing central chamber; *b*, hole from which the fly has issued.

manufacture of ink they are bruised and exhausted by three successive boilings, each time with a redueed quantity of water; and while the solution is warm a certain proportion of sulphate of iron and gum arabie, also in warm solution, is added, and the whole allowed to remain for some time till all sediment is deposited. Gall-nuts are principally exported to the U. S. from Smyrna and Trieste, and they are so common near Aleppo that they are sometimes ealled Aleppo galls. Those gathered before the fly issues are known in commerce as "blue galls," and are most esteemed. The seeond gathering, or "white galls," from which the fly has eseaped, are of inferior quality. Notwithstanding reeent diseoveries in ehemistry and in the art of dyeing, these galls are still an important article of commeree. See DYESTUFFS, GALL INSECTS, and GALLOTANNIC ACID.

C. V. RILEY.

**Gall-stones**: See CALCULUS.

**Galluppi**, gäl-loop'pē, PASQUALE: philosopher; b. in Tropea, Calabria, Italy, Apr. 2, 1770. In 1819 he published the first two of his six volumes entitled *Saggio filosofico sulla Critica della Conoscenza*. In 1821 appeared his widely known and often reprinted *Elementi della Filosofia ad uso dei giovinetti*. His greatest work, *Lettere sutte vicende della Filosofia relativamente ai principii delle Conoscenze Umane da Cartesio fino a Kant inclusivamente*, was published at Messina in 1827. In 1831 he was appointed Professor of Logie and of Metaphysies in the University of Naples, and the year following he published the first two volumes of his *Filosofia della Volontà*, the last two appearing in 1839, and other smaller works in the meantime. Being eleeted a member of the Institute of France, he wrote for it two memoirs—one on transcendental idealism and absolute rationalism, the other on the theodiey of the ancient philosophers. D. in Naples in Nov., 1846.

**Gal'lus** [Lat. *gallus*, a coek; used as a proper name], C. AQUILIUS: a Roman eques; distinguished as a jurist; pupil of the pontifex Q. Scævola; prætor B. C. 66, along with Cieero. His life was devoted to the elueidation and application of the principles of law, and his opinions and ediets are quoted or referred to by Cieero and in the *Digest*. Gallus presided at the trial when Cicero delivered his oration *Pro P. Quintio*. A glowing eulogium is passed on the upright charaeter and judicial eminenee of Gallus by Cieero in his oration in defense of A. Cæeina. Besides the slight notiees above mentioned, nothing of the produetions of Gallus has been preserved. D. before 44 B. C.

Revised by M. WARREN.

**Gallus**, C. CORNELIUS: the friend of Vergil; distinguished as a poet and soldier; b. at Forum Julii about 70 B. C. At the age of twenty his poetical abilities had attraeted attention, and at the time of Cæsar's death (B. C. 44) he had attained sufficient distinetion to make his adherenee to Oetavianus desirable. He commanded a division of the army against Antony at the battle of Aetium, and soon after was sent to Egypt, of whieh he was made governor after its reduction to a Roman province. His conduct while in this offiee was made the subjeet of complaint to Augustus, who removed him from his position. The exaet nature of his offense is not known. The senate instituted an investigation, and eondemned him to exile, with loss of his estates, upon which he put an end to his life. Gallus eomposed four books of elegies, in which he sang the praises of Lyeoris, and translated into Latin the poems of Euphorion of Chalcis. His poetry was greatly admired by his eontemporaries, and is praised by Vergil and Ovid. All his writings, with the exeeption of one pentameter, have perished, though certain epigrams in the Latin *Anthology* are falsely attributed to him. The life of Gallus has been made the basis of a treatise on the manners and customs of the Romans in the time of Augustus, by W. A. Beeker (revised by Göll, Berlin, 1880–82), translated by Rev. F. Metealfe (London, 1853). (See Teuffel, *Gesch. d. Röm. Lit.*, § 232; C. C. Völker, *Comment. de C. Cornetii Galli vita et scriptis*, 2 parts, Bonn, 1840, and Elberfeld, 1844.) D. 27 B. C. Revised by M. WARREN.

**Galofaro**: See CHARYBDIS.

**Galt**, gawlt: city (founded about 1816); Waterloo co., Ontario, Canada (see map of Ontario, ref. 4–C); on Grand river, and on the Grand Trunk and Canadian Paeific Railways; 57 miles W. of Toronto, and 25 miles from Hamilton. It is a prosperous city in a wealthy agricultural section, and is one of the largest iron-manufaeturing eenters in Ontario. It has 7 churches, 3 large public schools, a collegiate institute, abundant water-power, gas and electric lights, and water-works. Pop. (1881) 5,187; (1891) 7,535.

EDITOR OF "REPORTER."

**Galt**, Sir ALEXANDER TILLOCH: Canadian statesman; b. in Chelsea, London, England, Sept. 6, 1817, and received his early education there. He was the youngest son of John Galt, Seottish novelist; entered the employ of the British American Land Company in 1833; removed to Canada, and was ehief eommissioner of the eompany 1843–55. In 1849 he entered Parliament as a member for Sherbrooke County; voted against the Rebellion Losses Bill, and, together with many prominent Canadians of that time, signed the manifesto for annexation to the U. S. He was Minister of Finance of Canada 1858–62, 1864–66; of Dominion of Canada in 1867, and was one of the ablest Ministers of Finanee Canada has had. He materially eontributed toward the union of the British North Amerieau provinces; was a member of the Confederation eonferenees held at Charlottetown, Quebec, and London; appointed (1875) a commissioner to attend the conferenee on fisheries question, under the treaty of Washington, held at Halifax, Nova Seotia; conducted (1879) negotiations on behalf of Canada for a commercial treaty with France and Spain; was high eommissioner in Great Britain for the Dominion of Canada 1880–83; and delegate of Canada at the International Monetary eonferenee at Paris in 1881. He beeame president of the Alberta Railway and Coal Company 1889; was president of the Guarantee Company of North America; was created a Knight Commander of the Order of St. Michael and St. George in 1869, and awarded the grand cross of that order in 1878. He reeeived the honorary degree of LL. D. from Edinburgh University in 1883; eontributed at an early age to magazines, and was author of *Canada from 1849 till 1859* and of pamphlets. D. in Montreal, Sept. 19, 1893.

NEIL MACDONALD.

**Galt**, JOHN: author; b. in Irvine, Ayrshire, Seotland, May 2, 1779. He was employed for a time in mereantile pursuits; studied law; spent three years in traveling in the Levant and Southern Europe, and after his return to London assisted his father-in-law, Dr. Alexander Tilloeh (1759–1825), in the management of *The Star* newspaper. He afterward produced a large number of dramas, novels, and other writings of unequal merit, many of them marked by great originality. Among his best works are *The Ayrshire Legatees* (1820–21); *The Annats of the Parish*; *Lawrie Todd*; *Life of Byron*; and an *Autobiography*. He was in Canada as agent for the Canada Company 1826–29, and founded the town of Guelph, Ontario. D. Apr. 11, 1839.

**Galton**, Sir DOUGLAS: See the Appendix.

**Galton**, gawl'tŭn, FRANCIS, F. R. S.: seientist; a eousin of Charles R. Darwin; b. in Duddeston, Warwiekshire, England, in 1824; was edueated at King's College, London, and Trinity College, Cambridge; traveled extensively in Africa; entered the British eivil service in the Board of Trade; and was general secretary of the British Assoeiation 1863–68; president of the Anthropological Sections 1877 and 1885; and president of the Anthropological Institute 1885–86. Besides books of travel, etc., he has written *Meteorographica* (1863), in which he demonstrated the existence and established the theory of anti-eyclones, and made the first attempt to chart, on a large scale, the progress of the elements of the weather; *The Art of Travel* (1867), whieh has run through six editions; *Hereditary Genius* (1869); *English Men of Science: their Nature and Nurture* (1874); *Inquiry into Human Faculty and its Devetopment* (1883); *Natural Inheritance* (1889); *Finger Prints* and *Hereditary Genius* (1892); *Deciphering of Blurred Finger-prints* (1893).

**Galton Whistle**: See RECORDING APPARATUS, PSYCHOLOGICAL, in the Appendix.

**Galuppi**, gäl-loop'pē, BALTHASARE: father of eomic opera; b. near Veniee, island of Burano (whenee he is often ealled BURANELLO), in 1703. He was educated in the eonservatory Degl' Incurabili. He composed fifty-four operas. D. in Veniee, 1785.

**Gal'va**: town; Henry eo., Ill. (for loeation of county, see map of Illinois, ref. 3–C); on the C., B. and Q. Railroad, and the Rock I. and Peoria Railway; 45 miles S. E. of Rock Island, 48 miles N. N. W. of Peoria. It is in a rich agrieultural and coal region, on one of the highest points of the dividing ridge between the Mississippi and Illinois river-basins, and, besides coal-mining, has considerable manufacturing interests. There are 2 banks and 2 weekly newspapers. Pop. (1880) 2,148; (1890) 2,409; (1900) 2,682.

**Galvani**, gäl-vaa'nĕe, Alvisio, or Luigi: the discoverer of dynamic electricity; b. in Bologna, Sept. 9, 1737. He was in youth strongly inclined to enter the priesthood, but was deterred by his friends, and in 1762 graduated M. D. at Bologna: became a lecturer upon anatomy there, and gave special attention to comparative anatomy; made important observations upon osteology and the kidneys and ears of birds, and in 1786 was led to the discovery of electric currents by the accidental contact of the dissected legs of a frog with a scalpel, which provoked muscular contractions. D. in Bologna, Dec. 4, 1798.

**Galvanic Battery**: See Battery, Voltaic or Galvanic.

**Galvanism** [deriv. of *Galvani*, because of his researches in this field]: the science of electrical currents produced by chemical action. The word is now little used except in medicine. See Battery, Voltaic or Galvanic, and Electricity.

**Gal'vanized Iron** [*galvanize*, liter., to render *galvanic* or subject to the action of galvanic electricity, as though galvanized iron were prepared by this process]: sheet or other iron coated with zinc by dipping it into a bath of melted amalgam of zinc and mercury, containing a little sodium. The iron is first cleansed with sulphuric acid, and is then washed and scoured. Before galvanizing it is usually dusted with sal-ammoniac powder. The process was invented by C. F. Mallet in France, and improved by H. W. Crawfurd, of England, in 1837. It is a very useful treatment for iron roofs, telegraph wire, ships' bolts, etc., the zinc acting as a paint. Sometimes, before tin-plating, sheet-iron is covered with a film of zinc, which makes the tin-plating more permanent.

**Galvanom'eter** [*galvano*, compounding form of *galvanic* + Gr. *μέτρον*, measure]: an instrument for the measurement of the electric current by means of the deflecting action of the latter upon a suspended magnet. The essential parts of every galvanometer are the deflecting coils and the needle. The galvanometer needle now in use differs greatly from the magnetized sewing-needles used in the instruments of Nobili and of Melloni. It sometimes takes the form of a steel disk magnetized transversely, the face of which is polished and serves as a mirror, or of a steel ring likewise magnetized transversely, or of a tubular bell magnet. Sometimes several parallel strips of steel are attached to the back of a light mirror of silvered glass or to a support of aluminium, glass, or mica. In some ballistic galvanometers the needle consists of a cylindrical bar magnet, a centimeter or more in diameter and several centimeters long. In instruments of the very highest sensitiveness, on the other hand, bits of steel wire $\frac{1}{5}$ mm. in diameter and 2 mm. long are used. In one form of galvanometer (the electro-dynamometer of Weber) and in some instruments of the d'Arsonval type the "needle" contains no iron, a suspended coil-carrying current constituting the deflected part.

*Standard galvanometers* are of such construction that the current can be calculated in absolute measure from the dimensions of the instrument, the deflection of the needle, and the strength of the field in which the latter swings. The law of action of galvanometers of this class may be derived as follows: If a circular coil of wire-carrying current be placed in a vertical position, its axis perpendicular to the lines of force of the earth's field, each element of the coil will exert a force upon a magnet pole situated anywhere in the neighborhood, tending to move the pole along the lines of force due to the current. This force is $\frac{dlim}{d^2}$, where $i$ is the strength of the current, $m$ is the strength of the magnet pole, $d$ is the distance from the pole to the wire. In the case of a short needle, of length $\lambda$, suspended in the axis of the coil at a distance $x$ from the plane of the latter, with freedom of rotation in a horizontal plane, the active component of the sum of such forces due to the entire coil is

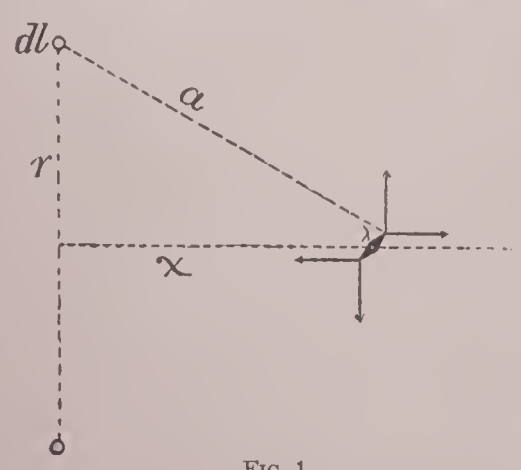


Fig. 1.

$$F_1 = \frac{2\pi rnmi}{x^2 + r^2} \frac{r}{\sqrt{x^2 + r^2}} \cos \vartheta = \frac{2\pi r^2 nmi}{(x^2 + r^2)^{\frac{3}{2}}} \cos \vartheta,$$

where $r$ is the radius of the coil (Fig. 1), $n$ is the number of turns of the wire, and $\vartheta$ is the angle which the deflected needle makes with the plane of the coil. An equal and opposite force upon the other pole of the magnet furnishes with the above a couple, the moment of which is $\lambda F_1$. When the needle is driven from its position of rest in the magnetic meridian by this couple, it comes to equilibrium in a new plane. The couple due to the earth is then balanced by that due to the current. The former is $\lambda F_e = \lambda m H \sin \vartheta$, where $F_e$ is the effective force exerted by the earth's magnetism upon either pole of the needle, and $H$ is the horizontal intensity of the magnetic field. Since the needle is in equilibrium,

$$\lambda m \frac{2\pi r^2 ni}{(x^2 + r^2)^{\frac{3}{2}}} \cos \vartheta = \lambda m H \sin \vartheta,$$

and

$$i = \frac{H}{\frac{2\pi r^2 n}{(x^2 + r^2)^{\frac{3}{2}}}} \tan \vartheta.$$

This equation gives the current in terms of the dimension of the coil, its distance from the needle, the deflection and the strength of the field in which the needle is suspended; and when the strength of the field is known in terms of the c. g. s. system of units, the current is obtained also in absolute measure. It will be seen that neither the magnetic moment of the needle nor the moment of inertia of the suspended parts enters into the equation. The quantity $\frac{(x^2 + r^2)^{\frac{3}{2}}}{2\pi r^2 n} = G$ is sometimes called "the constant of the coil," the equation for the tangent galvanometer being written in the form $i = GH \tan \vartheta$.

In the *sine galvanometer* sometimes used the needle is mounted in the plane of the coil, and the latter is free to revolve upon a vertical axis.

In making measurements with such an instrument the coil is caused to follow up the needle in its deflection. Under these conditions the moment due to the current has always its maximum value, $\lambda m . \frac{2\pi ni}{r}$, and the equation for current takes the form $i = \frac{r}{2\pi n}, H \sin \vartheta$.

Standard galvanometers are frequently made with more than one coil. Sometimes, as in the Helmholtz-Gaugain pattern, with the needle midway between them. In this

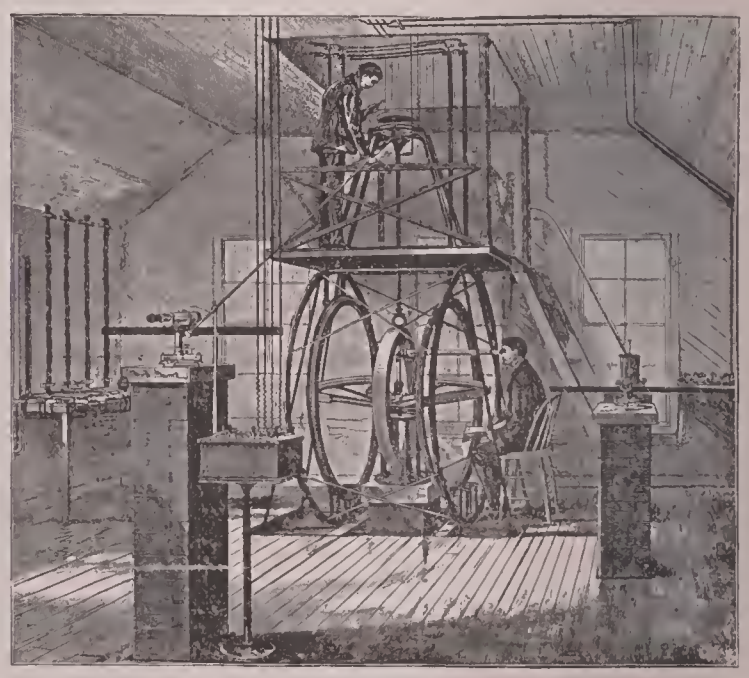


Fig. 2.—Large tangent galvanometer of Cornell University.

form the coils are of equal size, and the distance between them is equal to their radius. A notable example of the development of this type is the large tangent galvanometer

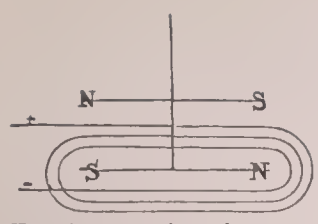



Fig. 3.—Astatic galvanometer.

of Cornell University (designed by Prof. William A. Anthony). This instrument (see Fig. 2) has six coils arranged symmetrically around a central needle and mirror. The largest pair have a radius of 1 meter, and each coil consists of a single turn of copper, the conductors being about 2 cm. in diameter. This instrument is capable of measuring currents from 0·001 ampère to 250 ampères, and its constants are known to within the hundredth of 1 per cent. Wide range of sensitiveness is sometimes attained by making the distance between coil and needle variable, as in the Thomson graded galvanometers, or by turning the coil upon a horizontal axis, as in the instruments of Obach, or by a combination of both motions, as in the "swinging arm galvanometer" of Moler.

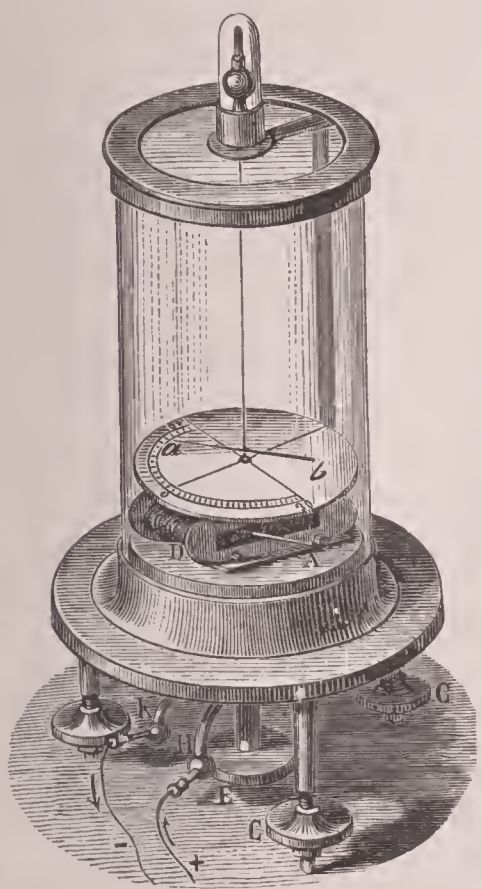



Fig. 4.—Galvanometer.

*Sensitive Galvanometers.*—To render a galvanometer very sensitive the quantities $G$ and $H$ must be reduced to the smallest practicable values. To this end the needle is placed nearly in the plane of the coil, the radius of the latter is diminished, and the number of turns ($n$) is increased. The strength of the field is reduced by the use of controlling magnets, so placed as to counteract the earth's horizontal intensity. By proper adjustment the directive force at the needle may be diminished indefinitely. To extend this method of sensitizing to its limit, the torsion of the suspension fiber must therefore be made as small as possible. The best results have been obtained by using long fibers of quartz (introduced by C. V. Boys, *Philos. Magazine* (5), vol. xlv., p. 489, 1887). Another method of increasing the sensitiveness of galvanometers is by means of an astatic pair of needles. As used by Nobili and by Melloni, this consisted of two similar sewing-needles magnetized and mounted one above the other with poles opposed—the lower one within the coil of the galvanometer, the upper just outside (see Fig. 3).

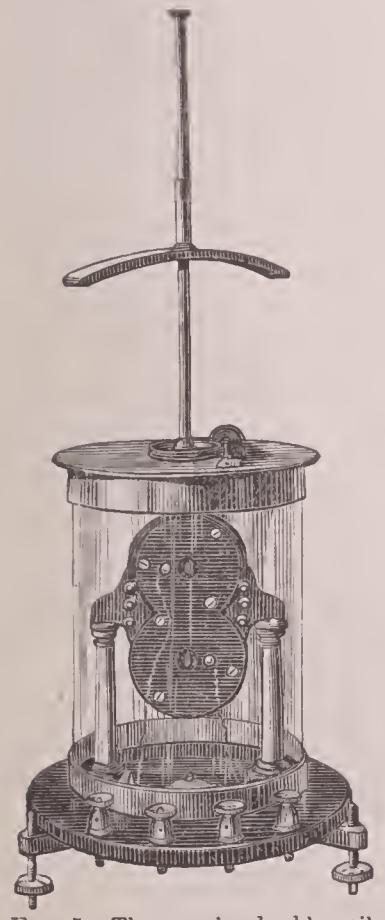


Fig. 5.—Thomson's double-coil astatic galvanometer.

The astatic galvanometer of the type used by Melloni in his classical researches on radiant energy is shown in Fig. 4. Later, the same principle was extended by Thomson and others to galvanometers of high sensitiveness (Fig. 5), in which instruments a pair of coils surrounds each needle. The highest degree of sensitiveness as yet attained has been reached by the combination of the devices above described — an astatic system consisting of two sets of parallel steel strips 2 to 4 mm. long, mounted upon a filament of glass which also carries a minute mirror 2 mm. wide by 4 mm. high, made of the thinnest of microscope cover-glass. The entire weight of the suspended parts may be less than

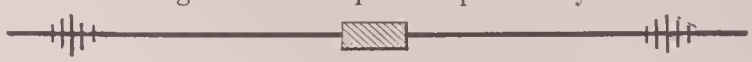


Fig. 6.—Needles and mirror of a sensitive astatic galvanometer.

50 mg. (see Fig. 6). The glass filament hangs from a quartz fiber which is sometimes as much as half a meter long and a few ten-thousandths of a millimeter in diameter. This instrument has four coils arranged pairwise, with an air-space of about 3 mm., within which the needles hang freely, the center of each set in the axis of one of the pairs of coils. Fig. 7 shows such a galvanometer, and Figs. 8 and 9 the essential parts of the same instrument arranged so as to exhibit the relative positions of the needles, mirror, and coils. Three galvanometers of this type constructed independently during the years 1890–92—in Berlin by B. W. Snow, in Cambridge, Mass., by W. S. Franklin, and in Ithaca, N. Y., by E. F. Nichols and the writer—gave very nearly the same sensitiveness. Each of these instruments was found capable of indicating the hundred-thousandth of one micro-ampère (or $1 \times 10^{-11}$ ampères). This extreme sensitiveness is taken advantage of (in the bolometer) to measure infinitesimal degrees of heat by noting the change in electrical resistance of metallic strip or wire.

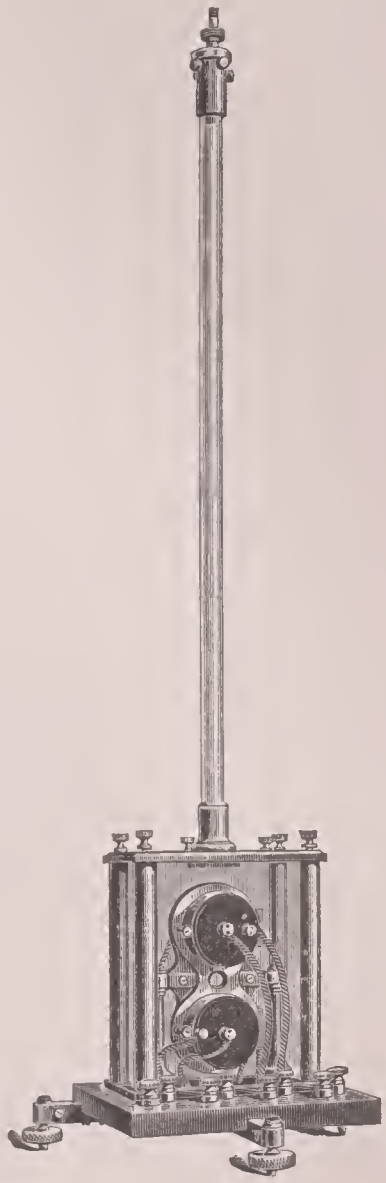


Fig. 7.—A sensitive astatic galvanometer with four coils.

*The d'Arsonval galvanometer* depends upon entirely different principles from those forms already described. A coil of wire suspended in the field of a permanent magnet is traversed by the current to be measured. It carries a pointer which moves over a scale, or sometimes a mirror, the deflections of which are noted by means of a telescope and scale. Exceeding promptness of action and almost complete freedom from external magnetic disturbances give this form of instrument great

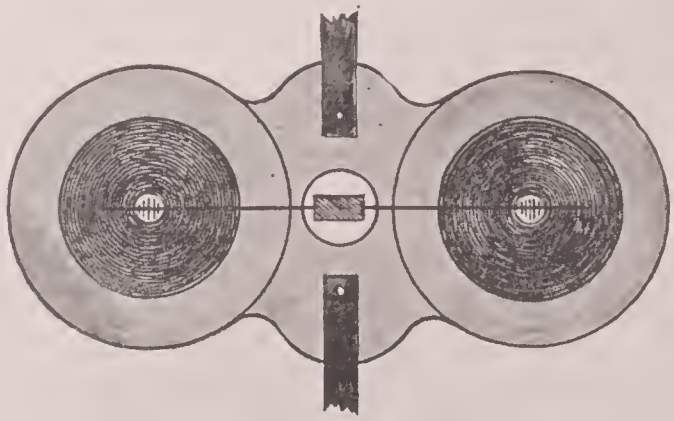


Fig. 8.—Needles, mirror, and rear coils of a sensitive astatic galvanometer.

value in many kinds of electrical measurement. By varying the length and the gauge of the wire in the coil the d'Arsonval galvanometer may be made to cover a wide range of sensitiveness. It is easy to construct, and is a type to which, under various modifications, belong many of

the best commercial galvanometers (ammeters and voltmeters).

Electro-dynamometers are galvanometers in which the needle consists of a bobbin of wire, carrying current. Such a coil when suspended with freedom of motion about a vertical axis tends to come to rest with its axis in the magnetic meridian, a position from which it will be deflected by the action of currents in neighboring coils. The current is sometimes supplied from a separate battery, more frequently the same current traverses the fixed and the mov-

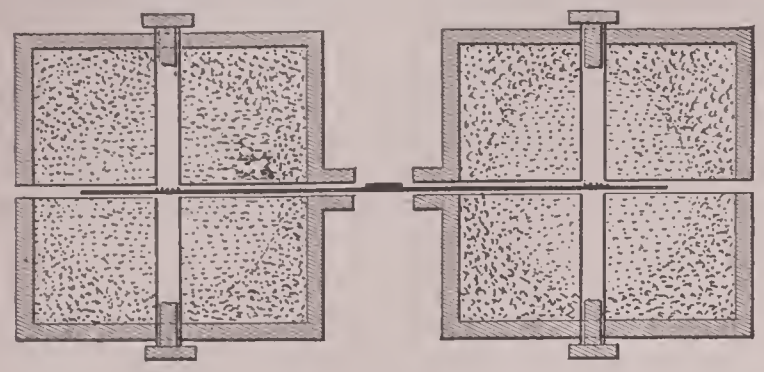


FIG. 9.—Cross-section of coils of a sensitive astatic galvanometer.

able coils. The electro-dynamometer can not be given so wide or so high a degree of sensitiveness as the galvanometer, nor has it so wide a range of usefulness. It possesses one great advantage, however, in being applicable to the measurement of alternating currents. See ELECTRICITY, CURRENT, AMPÈRE, MAGNETISM. See also Wiedemann's *Elektricität*; Gray's *Absolute Measurements in Electricity* (vol. ii., ii.), or any of the larger text-books on electricity.

E. L. NICHOLS.

**Galvan'oplasty** [*galvano-*, compounding form of *galvanic* + *plasty* < from deriv. of Gr. πλάσσειν, shape]: the art of working in metals by the aid of electricity. See ELECTROLYSIS, ELECTROTYPE, NICKEL-PLATING, PHOTOGRAPHY, ELECTRO-PLATING, etc.

**Gal'veston**: city (settled 1838), port of entry, and railway and commercial center; capital of Galveston co., Tex. (for location, see map of Texas, ref. 6–J); on Galveston island, between the Gulf of Mexico and Galveston Bay; on the Gulf, Col. and S. Fé, International and Gt. Nor., M., K. and T., Gal., Ho. and Hen., Gulf and Interstate, Gal., Ho. and Nor. (Southern Pacific) and Gal. and W. Railroads; 214 miles E. S. E. of Austin. It has three direct lines of steamship communication with New York, Pensacola, Key West, and the coast ports of the State, and twenty-four lines with Liverpool, Bremen, Copenhagen, Belfast, Hamburg, Havre, Rotterdam, Cuba, Mexico, and other foreign ports. During the calendar year 1900 the foreign imports aggregated $1,391,934, and the foreign exports $93,049,304. From June 30, 1900, till June 1, 1901, the total foreign imports were $925,688, and the total exports $99,642,268, showing total foreign trade of $100,567,956. In the commercial year ending Sept. 1, 1900, Galveston shipped to domestic and foreign ports 1,734,678 bales of cotton. The domestic exports are cotton, wool, hides, oil-cake and oil-meal, cotton-seed oil, fish-oil, cement, and poultry. The domestic imports are drugs, boots and shoes, hats, dry goods, chemicals, and like commodities. The foreign exports are cotton, cotton-seed oil, oil-cake and meal, wheat, grain, flour, copper and iron ores, cattle, lumber and timber, provisions; the foreign imports include fire-brick, tiles, chemicals, cement, liquors, earthenware, prepared vegetables, fancy woods, etc. During 1900 the entrances at the U. S. custom-house were 409 steam and sailing vessels, of 723,880 combined tonnage, and the clearances were 418 steam and sailing vessels, of 763,248 combined tonnage, in the foreign trade; 182 steam and sailing vessels, of 278,831 combined tonnage entered, and 209 steam and sailing vessels, of 295,065 combined tonnage, cleared in the coastwise trade. The census returns of 1890 show that 187 manufacturing establishments, representing 55 industries, reported. These had $4,831,345 capital, employing 1,916 workmen, paid out $1,224,949 annually in wages, used materials to the value of $3,238,057, and produced merchandise to the value of $5,665,147. The assessed valuations in 1900 were real property, $22,519,230; personal, $4,441,282; total, $26,960,512; and the tax rate $15 per $1,000. The city debt is $2,743,354. The city owns property to the value of $3,261,000. In 1900 there were 38 churches of various denominations for white citizens and 4 for colored, with 57 associations to promote church enterprises and 7 charitable institutions: the Ball High School, erected by George Ball at a cost of more than $100,000, and presented to the city, and 6 district schools for white pupils, one of which was erected by Henry Rosenberg at a cost of $100,000; a central and 2 district schools for colored pupils, and 24 private schools; a public library, and a library of Galveston County, and the Texas Court of Appeals; 2 national and 7 other banks, with combined capital of $12,600,000; and 1 semi-monthly, 1 monthly, 3 daily, 1 semi-weekly, and 7 weekly periodicals. Among new buildings are the U. S. custom-house, the John Sealy Hospital, the school of medicine of the State University and Breckinridge Hall connected therewith; the union depot, Grace Episcopal Church, Letitia Rosenberg Woman's Home, Galveston Orphans' Home, Y. M. C. A. building, the latter four the gifts of Henry Rosenberg; a county court-house, and several modern mercantile buildings. The U. S. Government spent $7,180,000 in the construction of a system of jetties at the entrance to the harbor, which secured a deep-water outlet on the Gulf coast, with a channel 26 to 30 feet deep. The city has gas and electric plants, a water-works system valued at $1,550,000 and supplied from artesian wells; numerous hotels, a fine beach on the Gulf side of the island extending 30 miles; and a healthy climate. Pop. (1880) 22,248; (1890) 29,084; (1900) 37,789.

On Sept. 8, 1900, the most terrible storm and tidal wave in the history of the U. S. visited Galveston, causing a loss of life of 6,000 in the city, and of 1,000 to 2,000 additional outside the city, and destroyed and damaged property to the value of $17,058,275. E. E. TALMAGE.

**Galvez y Gallardo**, gaal'veth-ee-gaăl-yaar'dō, BERNARDO: soldier and administrator; b. in Macharaviaga, Spain, July 23, 1746. He entered service as a cadet, and in 1778 went to Louisiana, where he became Governor in 1779. War having broken out with Great Britain, he was placed in command of the Spanish forces in the West Indies; captured Baton Rouge 1779, and Mobile Mar. 14, 1780, and after a severe struggle took Pensacola May 8, 1781; subsequently he occupied Jamaica. For his services he was named captain-general of Louisiana and Florida and captain-general of Cuba, and in 1783 was created Count of Galvez. In June, 1785, he became Viceroy of Mexico, succeeding his father, Matías de Galvez. D. in Tacubaya, near Mexico, Nov. 30, 1786.

HERBERT H. SMITH.

**Gal'way**: county of Ireland, in the province of Connaught. Its western part along the Atlantic is wild and mountainous; the eastern part is flat. Good breeds of cattle and sheep are reared here. The fisheries are considerable, but agriculture is neglected. Area, 2,447 sq. miles. Pop. (1891) 214,256.

**Galway**: town of Ireland; capital of the county of Galway (see map of Ireland, ref. 9–D). It is on Galway Bay, at the mouth of the Corrib, 50 miles N. N. W. of Limerick and 127 miles W. of Dublin by rail, and has a considerable retail trade, thriving fisheries, and some manufactures and commerce. It is the terminus of the Midland Great Western Railway; has one of the queen's colleges for Ireland and a Roman Catholic bishopric. The town, with its suburbs, is virtually a county within itself. Pop. (1891) 13,746.

**Galway Bay**: an inlet of the Atlantic; 20 miles long and from 18 to 8 miles broad; on the western coast of Ireland; protected from the swell of the ocean by the Arran Isles, and affording many advantages for the construction of a harbor of refuge.

**Ga'ma** (or **Grama**) **Grass** [from *Gama*, a cluster of the Maldive islands, *grass*]: the *Tripsacum dactyloides*, a very large grass of North and tropical America, cultivated to a considerable extent as a forage-plant in the warm regions of both continents. The name is given in the extreme western parts of the U. S. to various species of buffalo-grass (chiefly *Bouteloua*), which furnish good pasturage for stock.

**Gama**, VASCO, da: Count of Vidigueira; navigator; b. at Sines, in Portugal, about 1469; became a skilled mariner and a gentleman of king's household, and in 1497 was dispatched in command of the royal squadron to the East Indies by way of the Cape of Good Hope, lately discovered by Diaz. The Indian Ocean was then unexplored. Gama coasted the eastern shores of Africa, and visited India, returning to Lisbon in 1499. Cabral's expedition and the discovery of Brazil followed. Gama made his second voyage, with twenty ships, in 1502–03, and became involved in hostilities with the towns of the Malabar coast, which he

punished severely. In 1499 he received the title of admiral of the Indies. In 1524 he was sent out as viceroy. D. at Cochin, India, Dec. 24, 1525. His body was taken to Portugal and buried at Vidigueira.

**Gama'la** [Heb., deriv. of *gāmāl*, camel, from a fancied resemblance in form to that animal]: a strong fortress and town of Palestine, besieged in vain by Agrippa, but taken by Vespasian after a brave resistance, when the survivors, 9,000 in number, perished. It probably was at El Husn, a steep hill opposite Tiberias, and on the east side of the Sea of Galilee. See Selah Merrill's *East of the Jordan*.

**Gama'liel** [Heb., God's recompense; *gāmal*, repay, do good to + *ēl*, God] THE ELDER: a famous Jewish teacher and member, perhaps president of the Sanhedrin, described by Luke as "a Pharisee, a doctor of the law, had in . . . honor of all the people" (Acts v. 34). Paul was "brought up at the feet of Gamaliel" (Acts xxii. 3). It was he who gave the sensible advice to abstain from persecuting the apostles, lest it should turn out that they were fighting against God, and his authority gave temporary efficacy to his counsels (Acts v. 38–40). Tradition says he became a Christian, (*Recognitions of Clement*, i., 65), but the Jewish writings, in which his learning, justice, and wisdom are commemorated, do not allude to this conversion, and it is indeed highly improbable. D. about 57 A. D.—GAMALIEL THE YOUNGER, grandson of the above (b. about 50 A. D.; d. about 116), was also a famous rabbi; president of the school at Jamnia, and strove to blend Platonism with Judaism.

**Gamarra**, gä-maar'rä, AGUSTIN: Peruvian general and politician; b. at Cuzco, Aug. 27, 1785. He joined the Spanish army in 1809, and fought against the patriots until Jan., 1821, when he went over to them; subsequently he served with distinction under Arenales, Santa Cruz, and Sucre, and was chief of staff at the battle of Ayacucho, Dec. 9, 1824. In 1827 he commanded an army of observation on the frontier of Bolivia, finally marched into that country, and forced the treaty of Pisagua, June 2, 1828; for this he was made grand marshal. In Aug., 1829, he aided in the deposition of Lamar, and was made provisional president of Peru, his term extending to Dec. 20, 1833; his administration was unpopular, and there were several revolts. In the political turmoil of 1834–35 Gamarra fought successively for Bermudez, Santa Cruz, and Salaverry; finally revolted against Salaverry, and was driven from the country (Oct., 1835). Santa Cruz having formed the Peru-Bolivia confederation, Gamarra joined the Chilians against it, marched into Peru Aug., 1837, was proclaimed provisional president, and after the final defeat of Santa Cruz was elected constitutional president (Aug. 15, 1839), with the title of Restorer. In 1841 he declared war against Bolivia, invaded that country, and was defeated and killed at the battle of Yngavi, Nov. 20, 1841. HERBERT H. SMITH.

**Gambet'ta**, LÉON: French statesman; b. in Cahors, Oct. 30, 1838. He studied law, was admitted to the bar in 1859, practiced as an advocate in Paris, and suddenly sprang into prominence by his defense of the editor of the *Réveil* Nov. 17, 1868, for having published the Baudin subscription. In 1869 he was elected a member of the Chamber of Deputies for Marseilles, and took his seat among the irreconcilable Left. He was not so strongly opposed to the war with Prussia as the rest of the party, and after the first reverses of the campaign he declined to take part in any popular movement against the Government; but immediately after the catastrophe of Sedan he stepped forward as one of the principal promoters of the republic. Proclaimed a member of the provisional government Sept. 4, 1870, he took charge of the Department of the Interior, and organized, so far as the provinces were concerned, the national defense with great talent and marvelous energy. After the war he was the recognized leader of the Left, president of the Chamber of Deputies 1879, and Prime Minister 1881–82. D. in Paris, Dec. 31, 1882.

**Gam'bia**: a deep and powerful river which traverses the region of Western Africa known as Senegambia. It falls into the Atlantic at Bathurst, in lat. 13° 28′ N.

**Gambia**: a British colony at the mouth of the river Gambia (see map of Africa, 4–A). Area, 2,700 sq. miles; of the settlement proper, 69 sq. miles. Bathurst is the principal station, and exports gold-dust, ivory, wax, hides, and horn. Pop. (1891) 14,266, of whom 64 were whites. Pop. of Bathurst, 6,000.

**Gam'bier Islands**: a group of islands of coral formation in the Pacific Ocean, in lat. 23° 8′ S., lon. 134° 55′ W.; under the protectorate of France. Vessels going from Chili to Tahiti visit them to take in fresh water. Pop. 445.

**Gambier**, JAMES, Baron, G. C. B.: sailor; b. in the Bahamas, Oct. 13, 1756; entered the British navy; commanded the frigate Raleigh, and took part in the reduction of Charleston, S. C., in 1780; served with distinction against the French in 1781 and 1794; rear-admiral 1795; vice-admiral 1799; admiral 1805; bombarded Copenhagen, and was made a baron 1807; was one of the commissioners who drew up the Treaty of Ghent 1814. D. Apr. 19, 1833.

**Gam'bir**, or **Gam'beer** [the Malayan name]: *Terra japonica*, a variety of catechu. It is the solid astringent extract obtained by infusing the leaves and shoots of the *Nauclea* (*Uncaria*) *gambir* in warm water, and evaporating the solution to dryness. The best gambir is made at Riouw, in the isle of Brittany, in the Eastern Archipelago. It is principally exported from Singapore, in brown masses covered with matting. Its fracture is even and dull. It dissolves almost completely in boiling water, and its solution gives precipitates with glue and with sulphuric acid. Its peculiar properties, which make it useful in tanning leather, are due to tannic acid, which is called catechu-tannic acid, as it differs from gallo-tannic acid in giving a grayish-green precipitate with ferric salts, while the latter gives a bluish-black precipitate, and in giving no precipitate with tartar emetic.

**Gambling and Gambling-houses**: Same as GAMING AND GAMING-HOUSES (*q. v.*).

**Gamboge**, găm-bōj′ or găm-booj′, or **Camboge** [deriv. of *Cambodia* or *Camboyia*, the place of growth of the tree]: the dried juice from the trunk of a tree growing in Cambodia and Siam, the *Garcinia morella*, variety *pedicellata*, family *Guttiferæ*. Gamboge is a brittle resinous substance, odorless, but of acrid taste, orange yellow in mass, and a splendid pure yellow in powder. It consists essentially of a gum and resin, without volatile oil. The resin, known as *gambogic acid*, forms on the average about 80 per cent. of good gamboge, and is the ingredient that yields the color and the medicinal power. Gamboge is exported from Canton and Calcutta in cylindrical rolls called pipe gamboge, and, though of inferior quality, in irregular masses called cake or lump gamboge. Medicinally, gamboge is a powerful irritating cathartic, producing watery discharges, and in full dose nausea and vomiting as well. From its harshness it is not used alone, but generally as an ingredient of the compound cathartic pill of the Pharmacopœia. In the arts gamboge is used as a pigment. It readily diffuses in water, forming a yellow emulsion. It is employed also to stain wood in imitation of box, to stain marble yellow, and the resin dissolved in alcohol is an ingredient of the gold-colored lacquer used for brasswork.

Revised by CHARLES E. BESSEY.

**Gambrell**, JAMES BARTON, D. D.: Baptist minister and editor; b. Aug. 21, 1841, in Anderson co., S. C., but while still an infant was taken to Mississippi, where he was brought up on a farm and educated at the University of Mississippi. During the civil war he was a captain of scouts in the Confederate army. He became a preacher in 1867, and has been pastor of several churches, and was for fifteen years editor of *The Southern Baptist Record*. He is a trustee of Mississippi College, of the University of Mississippi, and of the Southern Baptist Theological Seminary. He was chairman of the State Prohibition executive committee for Mississippi, member of the national Prohibition executive committee, secretary of the convention board of the Mississippi Baptist convention, and special agent of Mississippi College to raise an endowment. In June, 1893, he was elected president of Mercer University, Georgia. W. H. WHITSITT.

**Game-laws**: laws regulating the killing and taking of game. Under the English common law all game was regarded as the property of the king, and heavy penalties were imposed upon those who encroached upon the royal prerogative by engaging in the hunting of such animals. To kill a deer, it is stated, was considered almost as heinous an offense as to kill a man. But the severity of the punishment was relaxed in favor of offenders belonging to the nobility or the higher classes of society; so that, by force of custom, they came to enjoy a peculiar privilege and exemption. But at an early period the laws concerning the taking of game were defined by statute. The statute now in force has abolished all distinction of class in regard to the nature of the liability incurred by violating the law, and requires

all persons desiring to hunt game, either upon their own land or that of another, to take out a yearly certificate by which permission is conceded. If the land belongs to some third person, his consent that a certificate may issue must be obtained. Poaching is punished with great severity. No person is authorized to sell game without procuring a license conferring the power. Minute and stringent regulations are established determining the times of the year when game may be taken by those possessing the privilege. The policy of British legislation is to confine the right to kill game to the aristocratic and land-holding classes; and the laws prohibiting interference with their privileges are consequently made very rigid and strictly enforced. In the U. S. the right to kill game is enjoyed equally by all citizens, and the only common-law restriction against its exercise arises from the necessity of avoiding the commission of a trespass upon the lands of other persons. But statutory provisions have been adopted in a large number of the States prohibiting the act of taking certain valuable kinds of game except at certain seasons of the year.

T. W. Dwight.

**Game'lion** (in Gr. Γαμηλιών, from γαμεῖν, marry): the seventh month of the Attic year, so called because it was the month in which marriages took place. It corresponded with the last half of January and the first half of February. See Unger's *Zeitrechnung der Griechen und Römer* (Munich, 1892). For succinct statements, see Reinach's *Traité d'épigraphie grecque*, pp. 473–503; Freund's *Triennium philologicum*, iii., pp. 37–47; and Gow's *Companion to School Classics*, pp. 78–84. J. R. S. S.

**Gaming and Gaming-houses** [M. Eng. *gamenen* < O. Eng. *gamenian*, deriv. of *gamen*, *gomen*, game, sport > Eng. *game* and *gammon*]: in law, the playing of games of hazard for money or some article of pecuniary value and the houses devoted to such purposes. At common law gaming was not recognized as a criminal offense, and was only made punishable when it had been employed as a means for the commission of fraud. Thus cheating by the use of false dice or deceptive cards subjected the defrauder to indictment, and he was punished by fine and imprisonment. Public gaming-houses, or houses kept for the purpose of affording a place for people to gamble for money or other valuables, also were deemed common nuisances, and might be suppressed; but in order to sustain an indictment it was necessary that the house be used commonly for gambling purposes, although not necessarily by more than a particular class of persons. But in all cases where the persons engaging in gaming were the victims of no imposition, acted of their own free consent, and the play was fairly conducted, not only was the act not deemed sufficiently reprehensible to deserve legal punishment, but the courts would lend their aid to enable the winner of money to recover it from the loser. But the pernicious influence of gaming upon social morals, and the passion for indulging in it which is apt to be created in its votaries, as well as the great opportunities which are afforded for deluding and defrauding the inexperienced and the young, have led to the enactment of statutes both in Great Britain and in the U. S. making the practice unlawful and imposing penalties upon those engaging in it or providing means for its repression. The provisions of these statutes vary in detail, but in general they provide for the summary conviction and punishment of the proprietors of gaming-houses, and for the confiscation of the gaming implements, and declare that contracts by way of gaming or wagering shall be void, and that no suit shall be brought to enforce the payment of the money won. Under such statutes bills and notes given for money won at play are void on account of the illegal consideration. They also frequently provide that if any money or property be deposited with a stakeholder to await the result of a game or wager, the depositor, whether he lose or not, may bring suit against the stakeholder or winner (if he receive it) to recover it, and sometimes impose a forfeit or penalty on those who practice gaming. Revised by F. Sturges Allen.

**Gam'marus** [Lat. *gam'marus*, *cam'marus*, from Gr. κάμμαρος, κάμμορος, a kind of lobster]: a genus of amphipod crustaceans occurring in both fresh and salt water, but without common name except that of beach-flea or sand-hopper, which they share with most amphipods. They are an important element in the food of various fishes.

J. S. K.

**Gam'ut** [formerly *gammut*, from Fr. *gamme*, name of the Gr. letter γ (gamma) + Fr. *ut*, do (in music)]: in music, the name formerly given to the series of notes forming the diatonic scale. The first attempt to adjust in a scientific manner the elements of the diatonic scale is usually ascribed to Guido d'Arezzo, a Benedictine monk of the tenth century. He had diligently studied music, such as it then was, and by practice in his monastery became so sensible of the needless difficulties imposed upon learners for want of a clear and scientific arrangement of the various tones that he undertook the remodeling of the whole musical system. He commenced by adding one note below the lowest then in use. To this new or supplementary note he gave the name of *gamma*, from the third letter of the Greek alphabet. He had also been much impressed with the recurrence of certain syllables in the following verse of a hymn to St. John, then in frequent use:

*Ut* queant laxis *Re*sonare fibris,
*Mi*ra gestorum *Fa*muli tuorum,
*Sol*ve pollute *La*bii reatum,
Sancte Joannes.

To the six notes of the hexachord he therefore appropriated these syllables—viz., Ut, Re, Mi, Fa, Sol, La, and the scale thus formed (*Si*, for the seventh grade, being added afterward) acquired the name of the *gamm-ut*, or *gamut*. The scale as thus regulated by Guido appears to have embraced two octaves and a sixth in its range—i. e. the original gamut, its repetition in the octave, and six notes of a further series. Revised by Dudley Buck.

**Ganancial System**: See the Appendix.

**Gananoque**, găn-ăn-ōk': village of Leeds co., Ontario, Canada; near the Grand Trunk Railway, on the St. Lawrence, opposite the Thousand islands (see map of Ontario, ref. 3–G). It has a great water-power, and is a place of summer resort. Pop. of sub-district, 3,000.

**Gandu**: a kingdom of Upper Sudan, Western Africa; situated on both sides of the Niger, from 11° to 14° N., and inhabited by people of the Fulah race. Capital, Gandu.

**Ganga**: See Sand-grouse.

**Gan'ges** [viâ Lat. from Gr. Γάγγης, from Sanskr. *Gañgā*, Ganges]: the principal river of Hindustan. Its sources are in the Himalayas, its mouth in the Bay of Bengal. Its entire length is about 1,500 miles. It begins its upper course, under the name of Bhagirathi, in lat. 30° 54′ N. and lon. 79° 7′ E., at an elevation of 10,300 feet, in the Himalaya Mountains, where, according to the celebrated old Sanskrit epos, *Ramáyana*—which in many places is simply an allegorical description of the Ganges and its influence on human life—it became entangled in the hair of Siva on its descent from heaven to earth. It issues from under an immense bed of snow, piled up between three peaks from the height of 13,800 feet to 22,000 feet; rushes out from the Himalaya in wild torrents; joins the Alaknanda; receives the name of Ganges; and, having descended more than 9,000 feet during a course of 160 miles, it enters at Hardwar, at an elevation of 1,024 feet, the plain of Hindustan, and begins its middle course. From Hardwar to Soti, where the lower course of the Ganges (the Delta) begins, the distance is nearly 1,100 miles. At Hardwar the Ganges becomes navigable—above Cawnpore only for river-craft and passenger steamers, but below Allahabad for large vessels. In spite of the frequent shoals which it forms at one season and removes the next, thus altering its banks from year to year, the middle channel of its bed is everywhere practicable for large vessels after its confluence with the Jumna. Below Allahabad it receives from the left the waters of the Gumti, Gogra, Gandak, and Kusi, and from the right the Son, and passing by the large cities of Benares, Patna, Behar, and Murshadabad on its way to Calcutta, it forms a most splendid highway of communication and traffic through one of the most fertile and most thickly peopled regions on the earth. The Delta of the Ganges begins at a distance of 200 miles from the sea, and forms a perfect wilderness of creeks and rivers, some of which are salt, and all of which are subject to tidal influences. The northern arms unite with the waters of the Brahmaputra; the southernmost, the Hugli, opens the widest and deepest passage to the Bay of Bengal. According to the poet, this delta was formed by Siva squeezing the water from his hairs and letting it run out between his fingers, but according to the naturalist, it was formed, as all other deltas were formed, by the mud which the river carries along with it, and which, in the case of the Ganges, is of an amount so immense that its annual average has been computed at 534,600,000 tons. This large tract of low, flat, alluvial land is yearly inundated by the Ganges from the

beginning of May to the beginning of November. In the middle of August only the houses built on mounds and the tops of the trees are seen; the whole landscape is one sheet of water, where large vessels and small boats, steamships and rafts, swarm and float along. In November, when the waters have subsided, acres of land have been carried away, and in other places acres of land have been formed. Large islands are thrown up and attach themselves to the mainland, while the river retires from its old channel and forms a new one many miles off. Thus formerly Rajmahal stood on the bank of the river, now 7 miles away. The river is worshiped by the natives as the goddess "Ganga." Not only are pilgrimages made to particular places on its shores, where ablutions are performed, the dying exposed, and the dead thrown in, but the whole Hindu mythology is connected with it. Revised by M. W. HARRINGTON.

**Ganglion**, găng'gli-ŏn [viâ Fr. from Low Lat. *ganglion*, tumor, from Gr. *γάγγλιον*, tumor under the skin]: in general, an accumulation of gray nervous matter. More exactly, a ganglion, wherever found, consists of nerve-cells and nerve-fibers mingled in various proportion and bearing relations (not fully known) to one another, of blood-vessels, and of a framework of connective tissue. The term (plu. *ganglia*) is also applied to parts of the gray matter of the brain and spinal cord, having more or less definite shapes and boundaries, and being the seat of certain functions. The optic thalami and corpora striata in the brain are such ganglia. Ganglia answering to the specific definition given above are found attached to the posterior roots of the spinal nerves (and some cranial), upon the terminal branches of many nerves, and in greatest abundance and of greatest size in the so-called sympathetic nervous system. (See GANGLIONIC NERVOUS SYSTEM.) A ganglion may be round or flat, or of any shape (semilunar ganglion), of microscopic size, or as large as a finger-nail. In the Invertebrata the nervous system is wholly made up of such ganglia united by nervous trunks (bundles of nerves). The exact functions of ganglia are not well known. Those situated on the posterior branches of the spinal nerves seem to play an important part in maintaining or regulating the nutrition of the muscles and body in general, while the ganglia of the sympathetic system play a similar *rôle* in relation with the internal organs.

The term GANGLION is also used to designate certain cyst-like bodies located in the tendons of the hand and elsewhere. Revised by WILLIAM PEPPER.

**Ganglion'ic Nervous System**: an appendage of the cerebro-spinal system, existing in a rudimentary condition in nearly all Vertebrata, and attaining its most complete development in man. It consists of ganglia placed in front of the vertebral column, on either side of it, from the base of the skull to the coccyx, or lowest bone of the spine. These ganglia are united by vertical nervous cords, which form a chain on each side. There are 4 pairs of ganglia in the head, 3 in the neck, 12 in the dorsal region, 4 in the lumbar, 5 in the sacral region, and 1 ganglion upon the coccyx. This single ganglion is the point of union of the two chains. According to some anatomists there is a similar junction of the two chains in a ganglion situated on the anterior communicating artery of the brain, the ganglion of Ribes. From these ganglia nerves proceed in two directions: (1) to the spinal nerves and thence to the spinal cord, and (2) to various organs and to other ganglia near organs. These ganglia, of large size and great importance, are placed upon or near to the heart, lungs, stomach, liver, kidneys, intestines, uterus, bladder, etc. They are nearly all symmetrically placed on either side of the median line, and, together with intricate networks of nerve-fibers coming to and going from them, constitute what are called plexuses. Thus there are cardiac plexuses, a solar plexus, a hypogastric plexus, etc. Some of the nerves connecting the vertebral chain of ganglia with the visceral ganglia are so important as to be designated by special names. Thus the cardiac nerves extend from the cervical ganglia to the cardiac plexuses; the splanchnic nerves connect the dorsal ganglia with the semilunar ganglia, which lie behind the stomach and go to form the great solar plexus. All the ganglia referred to above are visible to the naked eye, but there are innumerable microscopic ganglia; they are found between the muscular fibers and under the mucous membrane of various organs.

The functions of the ganglionic nervous system are motor, sensory, and nutritive, and are only imperfectly known. The following are the chief movements which are controlled by the sympathetic: In the head certain movements of the iris (ophthalmic ganglion), of muscles of the internal ear (otic ganglion), of muscles of the soft palate (sphenopalatine ganglion); in the chest, the cardiac contractions by the cervical ganglia and cardiac plexuses; in the abdomen, the peristaltic movements of the stomach and intestines, the evacuative movement of the bladder and uterus. The most striking peculiarity of this motor energy is that it is wholly withdrawn from the influence of volition—that it is manifested in an automatic, necessary way. It is also to be remembered that this motor energy is in part derived from the spinal cord by means of the fibers connecting the two systems. Motor energy is also shown in the range of the ganglionic nervous system in the movements of blood-vessels, arteries chiefly, and this so-called vaso-motor function is worthy of separate study. The anatomical basis of this function lies in this, that blood-vessels possess a muscular coat, and receive numerous filaments from sympathetic ganglia; some of the larger vessels even bear plexuses. Experimentation shows that if the ganglia or nerves supplying blood-vessels be removed or severed, the vessels relax and remain dilated, while, on the other hand, if these nervous elements be irritated (as by electricity), the vessels diminish in size by contraction of their muscular coats. In the parts supplied by vessels whose nerves have been cut are observed redness, increased heat, and greater activity of nutrition. This law, that the ganglionic nervous system controls vascular contractility, was enunciated by the distinguished American physiologist Brown-Séquard. It has since been shown that this function of the sympathetic nervous system is in great part borrowed from the spinal cord, the same effects being produced by section of ganglionic nerves and certain parts of the spinal axis; the chief vaso-motor center of the body being in the medulla oblongata. The peristaltic movements of the stomach and the processes of secretion in its glands are produced by reflex actions, taking place chiefly within the circuit of the great sympathetic; yet active mental exertion or an emotion may arrest these actions, producing acute indigestion; and, *vice versa*, an intense irritation of the stomach may cause many cerebral symptoms—headache, vertigo, mental depression. An emotion may produce jaundice, an evidence of disturbance of the secretory function of the liver by a cerebral influence. The various intestinal functions are done by the agency of ganglia and nerves of the abdominal sympathetic; but we find that irritation of the intestines (worms, undigested food) may set up violent actions of the spinal cord (convulsions in infants) or cerebral depression (melancholia in the adult); and the action of cold upon the skin of the body is a well-known cause of increased peristaltic action and secretion in the bowel (diarrhœa). Turning now to purely local vascular movements, it is a matter of common observation that we blush or turn pale in consequence of unexpressed mental states (emotions). The above facts justify the following generalizations: That while many local movements (muscular and vascular) and secretions are under the immediate control of ganglia of the sympathetic system, the relations existing between this and the cerebro-spinal are most intimate, and that actions of a reflex order are constantly taking place, involving the activity of both systems, an impression made upon terminal cerebro-spinal nerves being capable of producing actions in organs supplied by ganglionic nerves, and an irritation of terminal nerves of the sympathetic being capable of setting up actions in the brain and spinal cord, and in parts supplied by nerves issuing from them.

(2) The sensations arising in the ganglionic nervous system are usually vague and dull: in perfect health there are no visceral sensations. When excessively excited, however, the ganglia and nerves of this system are capable of evolving most intense pain (colic, passage of calculi, angina pectoris).

(3) As regards the relations of the ganglionic nervous system to nutrition, properly speaking—i. e. intimate tissue-changes independent of vascular modification—we know very little. Certainly there is sufficient presumptive evidence to point to a very intimate relationship between the sympathetic ganglia and nutrition, and certain profound nutritional disorders like Addison's disease seem to implicate the sympathetic nervous system.

Revised by WILLIAM PEPPER.

**Gangra**: the metropolis of Paphlagonia, Asia Minor, where a council was held in the middle of the fourth cen-

tury—the exact date is uncertain—and canons passed against Bishop Eustathius and his followers, who constituted a sect which advocated these ascetic practices, viz.: The prohibition of marriage; that women should abandon their husbands and children, dress as men, and cut off their hair; that slaves should run away from their masters on the plea that the masters were not pious enough; that prayers should not be made in the houses of married people, nor the Eucharist be received from a married priest (an important incidental proof of the commonness of marriage of priests in the fourth century); the prohibition of all enjoyment of the flesh; that there should be fasts on Sunday, but not on the regular ecclesiastical fast days, and private religious meetings; that the commemoratory services to martyrs should not be observed. SAMUEL MACAULEY JACKSON.

**Gangrene**, găng'grēēn, or **Mortification** [from O. Fr. *gangrene* > Fr. *gangrène* < Lat. *gangraena* = Gr. γάγγραινα, gangrene, eating sore, deriv. of γραίνειν, gnaw, eat]: the death of portions of the body in the midst of living parts. The portions most frequently affected are the hands and feet, because in these the circulation of the blood is most apt to be seriously interfered with, but the internal organs, as not infrequently the lungs, may likewise be involved. Numerous causes of depression of general vitality predispose to gangrene, the active cause, however, always being micro-organismal infection. Of the causes which lead to depraved nutrition the majority are operative by interfering with the circulation. Thus in old age the blood-vessels are diseased and circulation is sluggish, in cases of tumor or other forms of pressure the ingress or egress of blood may be prevented by constriction of the artery or vein of a part; in chronic ergot-poisoning (see ERGOTISM) the blood-vessels are kept in a state of continuous constriction, as may also be the case in various nervous affections. Besides these circulatory disturbances, injuries, chemical irritants, and certain diseases like diabetes may determine the occurrence of gangrene.

Two varieties are usually described: the *moist* and the *dry*. The former occurs when the part is full of blood, as in pressure on a vein; the latter when the area is anæmic from obstruction of the inflow of blood, as in old age or ergotism. The disease begins with development of a small black spot, which may be the seat of intense pain; gradually the process extends, pain ceases, and sensation in the part is lost. If the gangrene is dry, the affected part becomes dry or mummified very slowly, has a leathery appearance, is cold and dead. In moist gangrene the part is boggy from presence of fluid, crackles on pressure from the decomposition gases contained, is bluish green in color, of foul odor, and is covered with blebs which loosen the skin and make it apt to be rubbed off. These processes continue, and if the patient be not overwhelmed by the blood-poisoning the dead part may be removed at a line of demarkation which forms above the area of disease. A form of rapidly fatal gangrene, called *hospital gangrene*, takes origin in wounds, and is particularly common and destructive in military hospitals in times of war.

The treatment of gangrene varies widely with the cause, and the experienced surgeon alone may judge when amputation is advisable or when nature should be allowed to take her course. The latter plan is usually pursued in the dry gangrene of old people. Stimulants for general support and local warmth to the part are always called for.

WILLIAM PEPPER.

**Gangue**, găng [Fr.]: in mineralogy and mining, the mineral substance which surrounds an ore or a mineral lying within the same vein.

**Ganjam**, găăn-jăăm': district of the province of Madras, British India; lying along the Bay of Bengal, between lat. 18° 18′ and 19° 40′ N. Its area is 8,311 sq. miles; pop. 1,800,000, chiefly Hindus. It produces rice, maize, sugar, oil, and different dyestuffs. The principal town is Berhampur.

**Gannet** [O. Eng. *ganet*, a seafowl, deriv. of *gan-*, the root found in *gōs*, goose < Teuton. *gans*]: any one of various seafowls of the genus *Sula*; belonging to the order *Steganopodes*, and related to the pelicans. They have all four toes united by a web, sharp, strong beaks, and a small pouch beneath the throat. External nostrils are absent, as in the cormorants. The skeleton is remarkably light and pneumatic and numerous air-sacs are present just below the skin, especially about the breast. Gannets, although heavy, are good swimmers, and are birds of powerful flight, capturing the fish upon which they feed by plunging headlong downward from heights of 100 to 200 feet, and transfixing them with their pointed beaks. Some species breed upon rocky cliffs, while others build rude nests upon the stunted bushes of low, sandy islets. They lay a single chalky-looking egg, the young are naked and helpless, grow slowly, and require at least two months to attain their full size. The best known, as well as largest, species is the common gannet (*Sula bassana*), known in Scotland as the solan-goose, a bird 3 feet in length and 6 in spread of wing. The primaries are black, the rest of the plumage snowy white except the top of the head, which is washed with yellow. Young birds are dark brown, with white spots above, below grayish white, feathers edged with dark brown, quill and tail feathers blackish. This species breeds at a few localities in the British islands, notably Bass Rock, and at two or three places in the Gulf of St. Lawrence. In winter it ranges south to the Madeiras and Gulf of Mexico. Other species of gannets are found in Australia, the Indian Ocean, on the west coast of America, and in the Gulf of Mexico. In the latter locality occurs the down-gannet or booby (*Sula leucogaster*), so named from its stolid actions and apparent indifference to danger. F. A. LUCAS.

**Gan'nett**, EZRA STILES, D. D.: grandson of President Stiles of Yale; b. in Cambridge, Mass., May 4, 1801. He was a student at Phillips Academy, Andover, a graduate of Harvard College in the class of 1820, and of the Cambridge Divinity School three years later, and passed at once into the ministry as colleague pastor with Dr. W. E. Channing, being ordained in Federal Street church, Boston, June 20, 1824. In that charge he remained till his death. His published discourses were numerous. He founded *The Scripture Interpreter*, edited for some years *The Monthly Miscellany*, and was joint editor with Dr. Alvan Lamson 1844–49 of *The Christian Examiner*. D. near Boston, Aug. 28, 1871.

**Gannett**, HENRY: geographer; b. in Bath, Me., Aug. 24, 1846. He was educated at the Lawrence Scientific School, Hooper Mining School, and Harvard College; was assistant in the Harvard College observatory 1870–71; topographer of the Hayden national survey 1872–78; geographer of the tenth and eleventh censuses; and has been chief topographer of the U. S. Geological Survey since 1882. He has been a voluminous writer, contributing extensively to the publications of the Hayden and U. S. Geological Surveys, the census publications, the *Encyclopædia Britannica*, and numerous educational and statistical works. His *Dictionary of Attitudes* (in the U. S.) (2d ed. 1891) is of great value. He has also published a *Manual of Topographic Surveying* as a monograph of the U. S. Geological Survey.

M. W. H.

**Gannett**, WILLIAM CHANNING, A. B.: clergyman; b. in Boston, Mass., Mar. 13, 1840. He graduated from Harvard College in 1860; entered the ministry of the Unitarian Church; and held pastorates in Milwaukee, Wis., Lexington, Mass., St. Paul, Minn., and Rochester, N. Y. He was one of the first to engage in educational work among the colored people in the South, and for many years has been one of the editors of *Unity*, an organ of the Western Unitarians. His publications include *Ezra Stiles Gannett*, a biography of his father, containing a history of the Unitarian movement (1875); *A Year of Miracles*; and *The Thought of God*, poems in collaboration with Rev. Frederick L. Hosmer.

**Ganoids**: See FISHES.

**Gansevoort**, PETER: soldier; b. at Albany, N. Y., July 17, 1749; appointed major Second New York Regiment 1775, and accompanied the army of Montgomery in its invasion of Canada; lieutenant-colonel 1776, and commanded Fort George; the following year, while in command of Fort Stanwix, he successfully withstood a siege of nearly three weeks by both the British and Indian forces under St. Leger, and thereby prevented the latter from co-operating with Burgoyne. For this service the thanks of Congress were tendered him. In 1781 the State of New York appointed him brigadier-general, and in 1809 he was appointed in the U. S. army with the same rank. D. July 2, 1812.

**Gan'ymede** [Lat. *Ganyme'des*, Gr. Γανυμήδης]: son of Tros, the first King of Troy; because he was the "most beautiful of mortal men" he was stolen by the gods to become cup-bearer to Zeus. In vase-paintings Zeus himself carries Ganymede off, but in plastic art the eagle of Zeus is the kidnapper. Originally the eagle was merely the messenger of Zeus (cf. the marble group in the Vatican), but in later pederastic times Zeus himself, in the form of an eagle,

carries off the boy, who yields himself willingly (cf. the marble group in St. Mark's, Venice). See Roscher, *Lexicon*, and Baumeister, *Denkmäler*, s. v.; Langl, *Griechische Götter und Heldengestalten*, p. 90 ff.; O. Jahn, *Archæologische Beiträge*, p. 12 ff.; Overbeck, *Kunstmythologie*, p. 515 ff. Also Gayley, *Classic Myths in English Literature* (Boston, 1893). See HEBE. J. R. S. STERRETT.

**Gap**, găap: a poorly built but beautifully situated town of France; capital of the department of Hautes-Alpes; on the Luye (see map of France, ref. 8–H). It stands in a wide valley, about 2,400 feet above the level of the sea, is surrounded by hills covered with vineyards, and is approached by stately walnut avenues. It has some manufactures of woolen, linen, and silk goods, hats, leather, and dressed skins; is the seat of a bishopric; and has a cathedral rebuilt since 1866. In the beginning of the seventeenth century it is said to have had about 16,000 inhabitants, but in 1692 it was burned to the ground by Duke Victor Amadeus of Savoy, and it has never fully recovered from that calamity. Pop. (1896) 11,376.

**Gapes**, gāps [plur. of *gape*, deriv. of verb *gape* < M. Eng. *gapen*; cf. Germ. *gaffen*, yawn]: a disease of fowls and other birds, caused by the presence of trematode worms (*Fasciola trachealis*) in the windpipe. The number of worms present is sometimes so great as to choke the bird. More commonly they cause inflammation and difficulty of breathing. A feather moistened with spirits of turpentine may be thrust into the windpipe, and turned about till the worms are removed. Similar organisms have been found in the air-passages of mammals, but their presence is not easily detected, nor is there any effective treatment.

**Garabit Viaduct**: a lofty arched railway bridge at Garabit, France; about 10 miles S. of St.-Flour, department of Cantal. It spans a gorge through which the river Truyère flows, the railway crossing at an elevation of 401 feet above the river. Its builder, M. Eiffel, has described it in *Le Viaduc de Garabit* (1888). (See *Arched Bridges* under BRIDGES.)

**Garaman'tes**: the ancient name of a people of the great desert of Sahara. They were not Negroes, and had a town called Garama (now *Germa*). They were warlike nomads, and were engaged in the caravan trade across the desert, and their descendants probably exist under other names.

**Garancin**: See MADDER.

**Garay**, JANOS: author; b. at Szegszard, Hungary, Oct. 10, 1812; studied at the University of Pesth; published in 1834 an heroic poem, the *Csatár*, which was soon followed by a number of historical dramas, but it is by his lyrical poems and ballads, the first collection of which appeared in 1843, that he is more favorably known. His prose tales, published in 1845 under the title of *Sketches with the Pen* (*Tollrajzok*), were also successful. In 1848–49 he was Professor of the Hungarian Language and Literature in the University of Pesth. Soon after this, his health failing, he gave up literary work, and after four years of illness and poverty died at Pesth, Nov. 15, 1853. His last and best-known work was *Saint Ladislaus* (*Szent László*, 1852). Among his other writings are a collection of historical ballads and legends styled *Arpádok* (1847); *Shells from the Balaton Lake* (*Balatoni Kagylók*, 1848); and *Christopher Frangepan's Wife* (*Frangepán Kristáfné*, 1846).

**Gar'bo**, RAPHAEL, del: painter; b. in Florence in 1466. He was a pupil of Filippo Lippi, and had great facility in drawing. There are some beautiful angels by him in a chapel of S. Maria Sopra Minerva at Rome. At Monte Olivete at Florence there is a *Resurrection* with such exquisite little figures that they caused him to be called Raffaellino (little Raphael) del Garbo. D. 1524.

**Garcia**, CALIXTO: See the Appendix.

**Garcia**, gaăr-see'a, or (Span. pron.) gaăr-thee'aă, JOSEF, Hidalgo: painter; b. in Murcia, Spain, in 1656. He began painting at fourteen under Villacis, then worked under Gilarte, after which he went to Rome, where he received advice from Brandi, Salvator Rosa, and Carlo Maratta. On his return he established himself at Valence. At Madrid, with G. Carreno, he painted the cloister of San Filippo il Reale. In 1703 Philip V. appointed him court-painter. D. 1712.

**Garcia**, MANUEL DE POPULO VICENTE: father of Mmes. Malibran and Viardot; b. in Seville, Spain, Jan. 22, 1775; was a fine tenor singer, an able instructor, and a writer of operas, of which *The Caliph of Bagdad* is the best. D. in Paris, June 2, 1832.—His son MANUEL (b. in Madrid, Mar. 17, 1805) attained a world-wide fame as a teacher of vocal music, chiefly in Paris and London, and was author of works on musical instruction.

**Garcia Moreno**, gaăr-see'aă-mō-rā'nō, GABRIEL: politician; b. in Guayaquil, Ecuador, in 1821. He was educated at Quito and in Europe, and gained some repute as an author, his best-known work being the *Defensa de los Jesuitas* (1851). Siding with the clerical party against Franco and others, he was made chief of a provisional government at Quito 1859; put down the revolt of Franco; and in 1861 became president for four years under a new constitution. His administration was marked by excessive subserviency to the Church leaders and the great cruelty with which he put down numerous rebellions. He interfered in the civil war of New Granada, thereby increasing the miseries of both countries. Disorders continued until the end of his term in 1865. He was again made president for six years in 1869, and had been re-elected for the ensuing term when he was assassinated in Quito, Aug. 6, 1875.

HERBERT H. SMITH.

**Garcilaso de la Vega**, gaăr-thĕe-laa'sō-de-laa-vā'gaă: one of Spain's most celebrated poets; b. in Toledo in 1503. At the age of seventeen he was sent to court, receiving there the honorary position of a *contino* in the body-guard of Emperor Charles V. He won his first military honors in the expedition against the rebellious *Comuneros*, then accompanied the emperor to the coronation at Bologna in 1530; was in the service of the Viceroy of Naples in 1532–34, by whom he was intrusted with important diplomatic missions; and in 1535 distinguished himself by his bravery in the expedition against Tunis, at the end of which he returned to Naples. In the following year he accompanied his sovereign in the invasion of the Provence, and died from the wounds received in the attempt to storm a tower. Together with his older friend Boscan, he introduced in Spanish literature the meters of Italian poetry, with which he had become acquainted during his repeated sojourns in Italy. Garcilaso's poetical works (composed from 1526–36) consist of thirty-seven sonnets, five canzones, two elegies, an epistle in blank verse, and three pastoral poems, all of which are imitations of the poetical forms of Petrarca, Ariosto, and especially of Sannazaro, though his eclogues also show the influence of Theocritus and Vergil. His poems were first published in the edition of Boscan's works (1543), of which they constitute the fourth book, and in 1580 were edited, with a commentary, by the lyric poet Herrera. The best biography of Garcilaso is by Eustaquio Navarrete, published in the *Documentos inéditos para la historia de España*, by Salvá y Baranda (1850, vol. xvi.). D. in Nizza, Oct. 14, 1536.

H. R. LANG.

**Garcin de Tassy**, gaăr'săń'de-taă'see', JOSEPH HÉLIODORE SAGESSE VERTU: Orientalist; b. in Marseilles, France, Jan. 20, 1794; studied Oriental languages under Silvestre de Sacy; was appointed professor in the Institute in 1838, and published *Mémoires sur les particularités de la religion musulmane dans l'Inde* (1832); *Histoire de la littérature indoue et de l'indoustani* (2 vols., 1837); *La poésie philosophique et religieuse chez les Persans* (1864); *Rhétorique et prosodie des langues de l'Orient musulman* (1873), etc. D. in Paris, Sept. 2, 1878.

**Gard**, gaar: a department of France; bordering on the Rhône and the Mediterranean, and watered by the Rhône and its affluents, the Gard and the Cèze. From the Cévennes, which occupy its northwestern part, the country slopes down toward, and becomes marshy along, the Mediterranean. Wine, olives, and silk are the main productions; coal is found. Area, 2,253 sq. miles. Pop. (1896) 416,036.

**Garda, Lago di**, laa'gō-dee-gaar'daă [Ital., Lake of Garda]: the ancient *Lacus Benacus*, the largest and one of the most beautiful lakes of Northern Italy; stretches nearly from N. to S. on the boundary between the Lombardian and Venetian territories. It is 33 miles long, 10 miles broad, receives several small streams from the Alps, and sends its waters through the Mincio to the Po. It is very rich in fish. On account of its fine climate and the beauty of its scenery its shores are lined with elegant villas.

**Gardafui, Cape**: See CAPE GARDAFUI.

**Gardaia**, gaăr-dī'aă, or **Ghardaia**: town of Algeria; in the Sahara; in lat. 32° 28′ N. and lon. 4° 38′ E. It is situated in an oasis watered by artesian wells 900 feet deep. It was fortified by the French in 1882, and forms one of the

principal stations on the caravan route from the Mediterranean to the interior of Africa. Pop. (1896) 45,622.

**Garden**, Alexander, M. D., F. R. S.: scientist; b. in Scotland in 1728; graduated at Aberdeen in 1748; was a student under Dr. John Gregory; settled in 1752 at Charleston, S. C., where he acquired much wealth. He was an able botanist and zoölogist, and in 1773 was chosen a member of the Royal Society. In 1783 he went to England, being a loyalist, and his property was confiscated, but afterward given to his son. He became vice-president of the Royal Society. Linnæus named the beautiful genus *Gardenia* in his honor. D. in London, Apr. 15, 1791.

**Garden** and **Gardening**: See Horticulture.

**Garden City**: city; capital of Finney co., Kan. (for location of county, see map of Kansas, ref. 7–B); on the north bank of Arkansas river and on the Atch., T. and S. F. Railroad; 418 miles W. of Kansas City, Mo. It has 6 churches, 2 fine brick school-buildings, a large flouring-mill, a broom-factory, a combined opera-house and hotel costing $100,000, and a system of water-works costing $60,000. The town was laid out in 1879, a U. S. land-office was established in 1883, and the place was made a city in 1886. Pop. (1890) 1,490; (1900) 1,590. Editor of "Sentinel."

**Garden City**: town in Queens co., N. Y. (for location of county, see map of New York, ref. 8–K); now a part of the Borough of Queens, New York city; originally laid out by Alexander T. Stewart for a town of modern dwellings; subsequently made the seat of the bishopric of the Protestant Episcopal diocese of Long Island. It comprises about 10,000 acres of level meadow, formerly known as the Hempstead Plains; was purchased by Mr. Stewart a few years before his death (1876), and is held by the heirs of his widow. It is tastefully laid out, has an abundant water-supply, independent illuminating-gas plant, and a steam-heating system for the various buildings. The Cathedral of the Incarnation, erected by Mrs. Stewart as a memorial of her husband and opened Apr. 9, 1885, is one of the most beautiful pieces of Gothic architecture in the U. S. It has five organs, which can be played from one keyboard by means of electrical connections. In the crypt lie the remains of Mr. and Mrs. Stewart. The memorial school of St. Paul (opened 1884) for boys is one of the largest institutions of its kind in the U. S., and that of St. Mary (erected 1892) for girls is a model in arrangement and equipment. The residence of the bishop forms the third of the ecclesiastical buildings, standing within parks of their own, adjoining the main park of 30 acres, in which there is a hotel. Pop. (1893) estimated, 600. One of the editors of the "Chevron."

**Garde'nia** [Mod. Lat., named in honor of Dr. Alexander Garden, of Edinburgh and Charleston, S. C. (1728–91)]: a genus of plants of the order *Rubiaceæ*, including some of the most beautiful and fragrant shrubs and trees known. Among them the *Gardenia grandiflora* and other species of China yield a valuable yellow dye; and the *Gardenia campanulata* of Chittagong is used in medicine. Many species are cultivated in greenhouses. Some of these are called Cape jasmine, and came originally from Eastern Asia and South Africa. Excellent timber and resins are produced by various species.

**Gar'diner**: city: Kennebec co., Me. (for location of county, see map of Maine, ref. 9–C); on railway and on the Kennebec river; 37 miles from its mouth, and 6 miles S. of Augusta. It is divided by the Cobbossee river, which here empties into the Kennebec, forming in its passage through the city a very valuable water-power. The Cobbossee is spanned by eight dams within a mile from its mouth, with a total fall of 133 feet above low tide. The city contains many sawmills driven by water and 2 by steam, 4 large paper-mills, manufactories of furniture, sash, blinds, and doors, a shoe-factory, woolen-factory, iron-foundries, machine-shops, etc. Gardiner has a public library, water-works, and paved business streets lighted by electricity. It is the headquarters of the ice business on the Kennebec, one of the largest industries of the city. Pop. (1880) 4,439; (1890) 5,491; (1900) 5,501. Editor of "Home Journal."

**Gardiner**, Colonel James: soldier; b. at Carriden, Scotland, Jan. 11, 1688; served in the Dutch and then in the English army, and was wounded in the battle of Ramillies. Throughout the war of the Spanish succession he fought in the army of Marlborough with conspicuous bravery, and in 1715 he served in Scotland, where he gave a signal proof of his daring in firing the barricades of the Highlanders at Preston; but from an early period his character was stained by the recklessness and profligacy of his private life. In 1719, however, he was profoundly impressed by the truth of Christianity, owing, it is said, to a vision of Christ upon the cross, and from this time his life was characterized by an earnest faith and blameless moral conduct. In 1730 he was raised to the rank of lieutenant-colonel, and in 1743 became colonel of the Enniskillens. At the battle of Prestonpans he was deserted by his dragoons, but placing himself at the head of a small body of infantry he fought till surrounded by superior forces and struck down by a blow from an ax. Died a few hours later, Sept. 21, 1745. His *Life* was written by Dr. Philip Doddridge (1847).

**Gardiner**, John: lawyer; son of Dr. Sylvester Gardiner (1707–86); b. at Boston, Mass., 1731; studied law in the Inner Temple, and was called to the bar in England, and practiced in London and in Wales; was one of the counsel for Wilkes in 1764; became in 1766 attorney-general of St. Kitt's, West Indies; removed after the Revolution to Boston, Mass., and in 1786 to Pownalboro, Me. (then Massachusetts); was in the Massachusetts Legislature 1789–93; procured the abolition of the laws of primogeniture in Massachusetts, the prohibition of special pleading, and the repeal of the anti-theatrical laws. Drowned Oct. 15, 1793.

**Gardiner**, Samuel Rawson: historian; b. at Ropley, Hampshire, England, Mar. 4, 1829; studied at Christ Church, Oxford; was appointed Professor of Modern History in King's College, London, and published *The History of England from the Accession of James I. to the Disgrace of Chief Justice Coke* (1863); *Prince Charles and the Spanish Marriage* (1869); *England under the Duke of Buckingham and Charles I.* (1875); *The Personal Government of Charles I.* (1877); *The Fall of the Monarchy of Charles I.* (2 vols., 1881); *History of the Great Civil War* (3 vols., 1886–91); *History of England from the Accession of James I. to the Outbreak of the Civil War*—a uniform edition of his earlier works (10 vols., 1887). In 1882 a civil list pension of £150 a year was granted him.

**Gardiner**, Stephen, D. D., LL. D.: diplomatist and ecclesiastic; b. at Bury St. Edmunds, England, about 1483; was educated at Cambridge, and became master of Trinity Hall (1525); became Wolsey's secretary, and in 1528 was sent by Henry VIII. to Rome to further his application for divorce; became Secretary of State 1529; Bishop of Winchester 1531; ambassador to France 1533; chancellor of Cambridge University 1540; opposed, as far as he dared, the Reformation; came into great power on Cromwell's fall; married the king to Catharine Parr 1543; envoy to Flanders 1545; was imprisoned during Edward VI.'s reign, and deprived successively of his chancellorship and his bishopric; restored to his bishopric by Queen Mary and made Lord Chancellor 1553, in which capacity he crowned her. D. in London, Nov. 12, 1555. He was a severe opposer of Protestantism, an able and ambitious public officer, and a man of extraordinary learning. Gardiner's principal writings are *De vera obedientia* (London, 4to, 1534–35: translated, very badly, by Michael Wood, 1553; reprinted under caption *The Royal Supremacy in Matters Ecclesiastical in pre-Reformation Times*, London, 1870); *Sacrament of the Alter* (1551); and various tracts on religious and literary subjects. Ascham defends Gardiner, who was his benefactor.

**Gardiner's** (or **Gardner's**) **Island**: an island lying E. of Long Island; belongs to East Hampton township, Suffolk co., N. Y. Area, 3,300 acres. It is chiefly devoted to pasturage. It was colonized by the English in 1639. Here (in 1699) Capt. Kidd buried his treasures, which were afterward dug up. Its northern point is in lat. 41° 8′ 18″ N., lon. 72° 8′ 13″ W.

**Gardner**: town; Worcester co., Mass. (for location of county, see map of Massachusetts, ref. 3–F); about 26 miles from Worcester. It is the center of the chair-manufacturing interest in the county. It contains numerous cane and wood seat chair-manufacturing establishments, which give employment to 2,000 persons. Over 200 different varieties of chairs are made and shipped to all parts of the world, and the value of the annual product is over $2,000,000. The township is traversed by the Worcester Division and the main line of the Fitchburg Railroad, which intersect at Gardner station. Pop. of township (1880) 4,988; (1890) 8,424; (1900) 10,813. Publishers of "News."

**Gardner**, Augustus Kinsley, A. M., M. D.: physician and author; b. in Roxbury, Mass., July 31, 1821. He studied

three years at Harvard College, graduating in medicine in 1844; after which he studied in Europe; settled in New York, where he occupied prominent positions in various hospitals, dispensaries, and asylums; was for a time Professor of Diseases of Females and Clinical Midwifery in the New York Medical College; author of *Old Wine in New Bottles* (1848); *Causes and Treatment of Sterility* (1850); *Conjugal Sins*; *Our Children* (Hartford, 1872); *Ships and Shipbuilders of New York*; and of many professional and other papers. He gave special attention to the subject of importing foreign birds as destroyers of insect larvæ; to the establishment of drinking-fountains in New York; to the investigation of the swill-milk business; to the reformation of the established code of medical ethics; and to the influence of the sewing-machine on health. His enlarged edition of Tyler Smith's *Lectures* and his translation of Scanzoni's *Diseases of Females* are standard text-books. D. in New York city, Apr. 7, 1876.

**Gardner**, Charles K.: soldier; b. in Morris co., N. J., in 1786. He entered the U. S. army as ensign Sixth Infantry May, 1808; subsequently served as captain Third Artillery and major Twenty-third Infantry. In the war of 1812, under Maj.-Gen. Brown, he participated in the battles of Chrystler's Fields, Chippewa, and Niagara, and at the siege and defense of Fort Erie; appointed adjutant-general Mar. 12, 1814. In 1818 he resigned from the army, and during the administration of President Jackson was first assistant postmaster-general; auditor of the treasury for the P. O. Department under Van Buren's administration; subsequently commissioner to investigate and settle affairs connected with the Indians in the Southern States; was postmaster of the city of Washington during Polk's and surveyor-general of Oregon during Pierce's administration; he was then transferred to an office in the Treasury Department, which he held till 1867. He was the author of a *Compendium of Infantry Tactics*, *Dictionary of the Army* (1853), etc. D. in Washington, D. C., Nov. 1, 1869.

**Gardner**, Elizabeth Jane: See the Appendix.

**Gardner**, George: botanist and traveler; b. in Glasgow, Scotland, May, 1812; studied at the University of Glasgow, and qualified as a surgeon. From his youth he had a strong interest in botany, and in 1836, aided by Sir Joseph Hooker and others, he went to Brazil to collect and study plants; beginning at Rio de Janeiro, he explored the Organ Mountains, Pernambuco, the rivers São Francisco, Piauhy, and Ceará, returning in 1841 with over 6,000 species of plants. He was elected to the Linnean Society, and published several important monographs on Brazilian botany. In 1844 he was appointed superintendent of the botanical garden of Ceylon; subsequently he traveled in India and became one of the editors of the Calcutta *Journal of Natural History*. Besides botanical papers he published *Travels in the Interior of Brazil* (1846). D. in Neura Ellia, Ceylon, Mar. 10, 1849. Herbert H. Smith.

**Gardner**, John Lane: soldier; b. in Boston, Mass., Aug. 1, 1793. He entered the U. S. army in 1812; saw active service first in Canada; wounded in the attack under Gen. Wilkinson on La Cole's Mill Mar. 30, 1814; afterward on the staff of Gen. T. A. Smith. From 1820 to 1830 he served as assistant quartermaster-general, with the rank of captain. In 1833 he was made major in the Fourth Artillery, and served with this regiment during the Florida war. In Oct., 1845, he was promoted to the full rank of major; commanded his regiment throughout the Mexican war, and was made lieutenant-colonel for "gallant and meritorious service" in the battle of Cerro Gordo, and colonel for Contreras. In 1849–50 he commanded the district of Florida, and was in command of Charleston harbor in 1860. Though having less than fifty effective men in Fort Moultrie, he obtained, unknown to the Secretary of War, six months' provisions, and announced his intention to defend the fort to the last extremity. Secretary Floyd thereupon relieved him from command. Maj. Anderson, on removing his command to Fort Sumter, secretly carried thither the provisions which Col. Gardner's foresight had secured. Gardner was promoted to be colonel of the Second Artillery July 23, 1861, and in the following year, being disabled for active service, he was at his own request placed on the retired list, and employed on recruiting service. In 1865 he became brigadier-general. D. in Wilmington, Del., Feb. 19, 1869.

**Garefowl**, sometimes **Gairfowl**: a name of the great auk. See Auk.

**Garfield**, James Abram, LL. D: twentieth President of the U. S.; b. in Orange, Cuyahoga co., O., Nov. 19, 1831. He graduated at Williams College, Massachusetts, 1856; studied and practiced law; and was a member of the Ohio Senate 1859–60. In the civil war he entered the military service in 1861 as colonel Forty-second Ohio Volunteers, and served in Southeast Kentucky, where (Jan., 1862), in command of a brigade, he forced Humphrey Marshall and his command to evacuate Kentucky, and for this service was promoted to be brigadier-general of volunteers Jan. 11, 1862; also served at Shiloh, Corinth, etc. In 1863 he was appointed chief of staff, by Gen. Rosecrans, with whom he continued to serve until Dec. 5, 1863, having in the meantime (Sept. 19, 1863) been promoted to be major-general of volunteers for gallantry at the battle of Chickamauga, when he resigned to take his seat in the Thirty-eighth Congress, to which he had been elected, and was re-elected to each succeeding Congress, serving as chairman of the committees on military affairs, banking, and appropriations. Elected U. S. Senator from Ohio Jan. 13, 1880; nominated for President of U. S. by the Republicans at Chicago, Ill., with Chester A. Arthur for Vice-President, June 8, 1880, and elected Nov. 2, 1880. He was shot and mortally wounded July 2, 1881, by an assassin, who was lying in wait for him in the Baltimore and Potomac Railroad station in Washington, D. C., as the presidential party was about leaving for an extended pleasure-trip through New England. President Garfield was removed in a critical condition Sept. 6, 1881, from the White House at Washington in a specially arranged car to Long Branch, N. J., where he died Sept. 19, 1881. A bronze statue of him was unveiled at Washington, D. C., May 12, 1887.

**Garfish** [O. Eng. *gār*, lance]: any one of several fishes: (1) Those of the genera *Belone* and *Tylosurus* and family *Scomberesocidæ*, partly marine and partly fluviatile. The *Belone belone* of the European seas is a long, active fish, with alligator-like jaws. It is prized as food, like *Tylosurus marinus* of the American coasts. There are fresh-water species in various tropical countries. (2) The names gar and alligator-gar are given in the U. S. to the gar-pikes, of the genus *Lepidosteus*, of the family *Lepidosteidæ*. They are remarkable for their ganoid scales and the power of turning the head from side to side—a power which no other fishes possess. They somewhat resemble the true gars (*Belone*) in appearance, but are worthless as food. Three species are found in the Northern lakes and Western and Southern rivers, and in tropical America.

**Gar'ganey**, or **Summer Teal** [*garganey* is from Ital. dial. *garganel'lo*, probably a corruption of Lat. *querquedu'la*]: the *Anas querquedula*, a wild duck of Europe, Africa, and Asia, highly prized as food. It is 16 inches long, and beautifully variegated with white, brown, and green.

**Gargano**, gaär-gaa'nō: a mountainous peninsula of Southern Italy; in the province of Capitania, stretching 20 miles into the Adriatic. The northern range of its mountains is still famous for its honey, as it was in the time of Horace; the southern range is naked and cheerless.

**Gargaron** (in Gr. τὸ Γάργαρον), or **Gargara** (τὰ Γάργαρα): the highest of the three peaks of Mt. Ida in the Troad, now called Kaz-Dagh (Snow Mountain). Upon it there was a "demesne and fragrant altar" of Zeus, who from this vantage-ground watched the war around Troy, and here he had his famous interview with Hera. There are no ruins on the summits of Mt. Ida, but there is a large rude inclosure lying between the peaks, though it seems to be of modern or mediæval construction. At the foot of Mt. Ida lay *Gargara* the city, between the promontory and the peak. See a paper by Clarke in *The American Journal of Archæology* (1888, p. 290 ff.), locating Gargara at *Kozlu*, and giving a plan of the city and a view of the masonry of the city walls. J. R. S. Sterrett.

**Garget-root**, gaar'get-root', **Poke**, or **Skoke** [*garget* is from O. Fr. *gargate*, Ital. *gargatta*, throat, dimin. of *gorga*, throat]: the *Phytolacca decandra* (order *Phytolaccaceæ*), a large perennial herb of the U. S., naturalized to some extent in Southern Europe. Its root is useful in veterinary practice, and in the diseases of mankind it has some power as an alterative. Its young shoots are used as a potherb, but should be so used only when very young, and care should be taken to boil them thoroughly, otherwise they may prove a powerful irritant poison. The berries afford a rich but fugitive purple, employed in France for coloring wines; but the berries

share in the poisonous properties of the plant. The root, when given to cattle, is cut up into plugs, which are thrust into potatoes or turnips, and thus eaten. The root is poisonous to horses. Several other species of *Phytolacca*, growing in China, India, Cayenne, Chili, etc., share the properties of this plant, and are used as potherbs to some extent.

**Gargoyle** [from O. Fr. *gargoille* > Fr. *gargouille*: Span. *gárgola* < Lat. *gurgu'lio*, throat]: in architecture, the carved lower end or outlet of the water-spout from the roof of a building. In mediæval times these were often curiously shaped in imitation of men, beasts, birds, and fanciful creatures.

**Garhwal**, gŭr-waal′: a feudatory state and a district of the Kumaon division, Northwestern Provinces, British India, in the Himalaya Mountains; between the meridians of 77° and 81°, and bordering on Thibet on the N. The kingdom of Garhwal or Tehri is the western and smaller, but more populous, containing an area of 4,180 sq. miles and a population of 750,000. The district contains 5,500 sq. miles and 350,000 inhabitants. This region is the basin of the Alaknanda and Bhagirathi, the sources of the Ganges, and is considered sacred by the Hindus. It is rugged, full of ravines, and infertile. There are no cities and very little agriculture. The inhabitants are nearly all Hindus.

M. W. H.

**Garibal′di** (Ital. pron. găă-rĕĕ-baal′dĕĕ), Giuseppe: Italian soldier and patriot; b. in Nice, July 4, 1807. In his youth he made many voyages as a sailor, but having taken part, in 1833 and 1834, in the movement of the Young Italians, which ended in the unhappy expedition of Savoy, he was driven into exile. In 1836 he went to South America, having served in the meantime in the French navy. He at once offered his services to the republic of Rio Grande, and showed such zeal in her defense that after having fought many a hard battle, and won especial glory in that of San Antonio, Feb. 6, 1846, he received the well-merited title of "the hero of Montevideo." Roused by the events of 1848, in April of that year, he, with his wife Anita, a Spanish American, and a few brave comrades, left Montevideo and returned to Italy. At the moment of his arrival the army of Charles Albert, at first successful in Lombardy, had begun to give way. Garibaldi offered him his services; they were refused. Finally, however, the provisional government of Lombardy, when the affairs of those provinces were already drawing near their sad conclusion, intrusted Garibaldi with the command of a body of volunteers. With these the brave Nizzard obtained some successes, though of small military importance. Lombardy having fallen once more wholly into the hands of the Austrians, Garibaldi offered his sword to the republic of Rome, and the supreme command was given to him and to Gen. Roselli. The glory of the defense of Rome against French intervention in 1849 chiefly belongs to Garibaldi. Escaping after the fall of the city, with 3,000 of his followers, in the hope of being still able to effect something against Austria, he took refuge in San Marino, but being surrounded on all sides by the Austrian forces, he found himself obliged to disband his troops. His plan then was to make his way, with a few faithful companions, to Venice, which still held out. But the news soon arrived that Venice too had fallen. Nothing then remained but to seek a place of safety for his wife and himself; but Anita, exhausted by fatigue and privation, died in childbirth near Ravenna. Garibaldi then repaired to Chiavari in Liguria, and there the government of the King of Sardinia offered him the choice between prison and exile. He sailed for Tunis, but through the intrigues of the French consul that town refused to receive him. Thereupon he went back to the island of Maddalena, near which lies the little islet of Caprera. Here he provided for himself for some time by hunting and fishing, but finally went to the U. S., and for a time lived in New York. There he was prosperous in business, and was able on his return in 1854 to purchase the northern part of Caprera. Here he remained until 1859, in which year he organized and commanded the band of the "cacciatori delle Alpi," or Alpine chasseurs—a body of volunteers that made the whole Lombard campaign, having crossed the Ticino eleven days before the French troops. After the peace of Villafranca, so unfortunate for Italy, Garibaldi formed in Central Italy the corps of the "cacciatori degli Apennini," or chasseurs of the Apennines, and trained them with the view of throwing himself upon the papal provinces and once more liberating Rome. The policy of Piedmont prevented him from carrying out this plan; but, on the other hand, Count Cavour assisted him in the expedition against Sicily with all the means he could dispose of without compromising his government. The island being in a state of insurrection, on May 5, 1860, Garibaldi sailed mysteriously from Quarto in Liguria with 1,000 armed comrades, and with astonishing boldness landed on May 11 at Marsala, gave battle near Calatafimi on the 15th to the Bourbon army, which he defeated with his single thousand, and on May 27, after various partial but successful engagements and some most skillful manœuvering, entered Palermo, assuming the dictatorship of the island. On July 20 he gained a new and decisive victory over the Bourbon troops; on the 28th the fortress of Messina fell into his hands. On Aug. 25 he gave battle at Reggio in Calabria, conquered, and then marched upon Naples. King Francis fled to Gaeta, and Garibaldi alone entered triumphant into Naples to be proclaimed dictator of the Two Sicilies. Garibaldi, with a body of Piedmontese sent by Count Cavour, gained the victory of Volturno, after which took place a *plebiscito* or universal vote for the annexation of the kingdom of the Two Sicilies to that part of Italy which was then governed by King Victor Emmanuel. The annexation being voted on Nov. 9, 1860, Garibaldi retired to his island solitude of Caprera. But he did not cease to occupy himself with his beloved Italy. The cession of Nice and Savoy to France having taken place, he entered the Italian Parliament and protested energetically against surrendering to a foreign power a portion of the Italian soil. In May, 1862, he undertook for Venice the expedition of Sarnico, which, through the intervention of the Italian Government, was broken up in its very beginning; then that of Rome, which ended in the fatal battle of Aspromonte, where not the enemies of Italy, but Italian riflemen, assailed him, wounded him with a ball in the foot, and took him prisoner on Aug. 29, 1862—a day of mourning for Italy. On Dec. 19, 1862, Garibaldi, amnestied and with his wounds healed, returned to Caprera. In 1864 Gen. Garibaldi visited Great Britain, where he was received with most enthusiastic demonstrations by all classes. On the breaking out of the war of 1866 for the liberation of Venice, Garibaldi assumed the command of a body of volunteers, with whom he advanced into the Trentino, and the only Italian victories of the inglorious campaign of that year were those obtained by the Garibaldians. The following year Garibaldi once more attempted with his volunteers to liberate Rome; he entered the Campagna, defeated the papal troops at Monterotondo on Oct. 25, 1867, and marched upon Rome; but near Mentana, meeting the French and papal army under the command of Gen. Failly—who by order of Napoleon III. was to make upon Italians the first trial of the "miraculous" powers of the newly invented *chassepot*—he was defeated in spite of the most heroic efforts. Garibaldi was for some time held a prisoner in the fortress of Varignano, near Spezzia; afterward he was permitted to return to Caprera. In 1870 the misfortunes of France and a warm appeal from Gambetta touched him, and decided him to hasten with his sword, his courage, his fortune, and his sons to the aid of the French republic against the Germans. In France he received the command of a corps calls the "volunteers of the Vosges"; his son Ricciotti on Oct. 19 obtained a small victory over the Germans; and that these latter advanced no farther in that direction was wholly due to the corps commanded by Garibaldi. Returning to Caprera, he published three romances of little importance; and in 1875 became a member of the Italian Parliament. His career as a legislator, however, was not conspicuous for its wisdom or good judgment. He was an ardent republican, and declined the honors and titles offered him. D. June 1, 1882. Sept. 20, 1895, an equestrian statue of Garibaldi, 21 feet high, was unveiled in Rome. C. K. Adams.

**Garigliano**, găă-rĕĕl-yaa′nō [Ital., from Arab. *garil*, marsh]: a river of Southern Italy; the largest and most important stream of the Neapolitan provinces; receives the waters of Lago di Fucina; flows sluggishly through a widely extended, almost stagnant, swamp, and enters the Mediterranean 9 miles E. of Gaeta. It is the Liris of the ancients, separating Latium from Campania, and is reputed for its muddy waters and its fat eels. In the surrounding swamps—the marshes of Minturnæ—Marius sought refuge after the victory of Sulla. Its present name came into general use in the eleventh century, during the contest with the Saracens. On its banks the French were completely routed by the Spaniards in 1503.

**Garland**, Augustus Hill, A. M., LL. D.: lawyer; b. in Tipton co., Tenn., June 11, 1832. He was educated at St. Mary's College, Lebanon, Ky., and St. Joseph's College, Bardstown, Ky.; removed to Arkansas, and soon rose to eminence; opposed secession as a policy until his State passed the ordinance withdrawing from the Union, then cast his fortunes with hers; was elected to the provisional Congress of the Confederate States in 1861, and to the House of the first Confederate Congress in 1862: afterward elected to the Confederate Senate, and held the office till the surrender of Gen. Lee in 1865. After the war he devoted himself to his profession; in 1867 was elected to the U. S. Senate but was not seated; in 1874 was elected Governor under the new constitution of Arkansas. U. S. Senator 1877–85; U. S. Attorney-General 1885–89; afterward resumed law practice in Washington, D. C. D. Jan. 26, 1899.

**Garland**, Hamlin: See the Appendix.

**Garland**, Landon Cabell, A. M., LL. D.: mathematician; b. in Lovingston, Va., Mar. 21, 1810. He was educated at Hampden-Sidney College, Virginia; Professor of Chemistry at Washington College, Virginia, from 1830 to 1833, and in Randolph-Macon College, Virginia, from 1833 to 1835, then its president to 1846, and at the same time Professor of Pure and Mixed Mathematics. In 1847 he became Professor of English Literature, and afterward of Mathematics in the University of Alabama, and in 1855 its president; in 1866 Professor of Physics and Astronomy in the University of Mississippi; afterward Professor of Physics in the Vanderbilt University at Nashville, Tenn. Has written on plain and spherical trigonometry, and contributed to the periodicals of the Methodist Episcopal Church South.

**Garlic** [M. Eng. *garlek*, *garleek* < O. Eng. *gārlēac*; *gār*, spear (in allusion to its pointed leaves) + *lēac*, leek : Germ. *Lauch*]: the *Allium sativum*, a cultivated plant allied to the onion (family *Liliaceæ*), and much used as a condiment in Southern Europe. The part chiefly employed is the bulb, or rather the collection of small bulbs (cloves of garlic). The wild species are numerous on both continents, especially on the Eastern. Garlic has a taste resembling that of the onion, but much stronger. It is employed in medicine as a stimulant, expectorant, diaphoretic, and revulsive. It is for the most part used externally. It abounds in the peculiar volatile oil of garlic, to which it owes most of its active properties. It is grown from the small bulbs or cloves, in the same manner as "set" onions. Revised by L. H. Bailey.

**Garlic, Oil of**: an oil obtained from garlic bulbs. Through distillation these yield about 0·2 per cent. of crude brown oil. By careful rectification about two-thirds of this is obtained as a pale-yellow oil, lighter than water. By further treatment with chloride of calcium, and distillation from a little potassium, it becomes pure and colorless. It consists of sulphide of allyl $(C_3H_5)_2S$, which was associated in the crude oil with oxide of allyl $(C_3H_5)_2O$ and another sulphur compound. This oil has the peculiar penetrating odor of garlic; it is also found in oils of onions, radishes, etc.

Oil of black mustard contains the sulphocyanide of allyl, $C_3H_5CNS$. These two oils are mutually convertible; by distillation with potassium sulphide the sulphocyanide is changed to sulphide; and by treating oil of garlic with corrosive sublimate, and distilling the precipitate with sulphocyanide of potassium, oil of mustard is produced. This oil is also found in horseradish, scurvy-grass, etc.

**Garneau**, gär'nō', Pierre: Canadian merchant; b. at Cap Sante, Province of Quebec, May 8, 1823, and educated there. He engaged in business, and is the head of the firm P. Garneau, fils et Cie., Quebec. He was a member of the canal commission in 1870; president of the Quebec board of trade in 1871; mayor of Quebec 1870–74; and has been a Government director of the North Shore Railway. He was a member of the Provincial Legislature 1873–78, and 1881–92; and during that period held the portfolios of Commissioner of Crown Lands and of Agriculture and Public Works. In 1890 he received from the King of the Belgians the cross of the order of Leopold II. in recognition of important services rendered in promoting Belgian industries in the Province of Quebec. Neil Macdonald.

**Garnet** [M. Eng. *garnet*, from O. Fr. *grenat* : Ital. *granato* < Low Lat. *grana'tus*, garnet, liter. = Lat. *grana'tus*, grained, having grains or seeds, so called either from resembling the seeds of the pomegranate (*grana'tum*) in color or shape, or from resembling the cochineal insect (*grana'ta*) in color]: a precious stone belonging to the isometric or cubic system of crystallization, its ordinary forms being the rhombic dodecahedron and trapezohedron. Specific gravity, 3·6 to 4·2; hardness, 6·5 to 7·5. The almandite variety is found in mica-slate, hornblende-slate, and gneiss; less frequently in granite: the pyrope variety in serpentine and peridotite. There are several varieties, differing in color and chemical composition, but agreeing in general properties. They are all silicates of alumina, with varying amounts of lime, magnesia, oxides of iron and manganese, etc. The precious or Oriental garnet (*almandine*) owes its fiery brightness to the presence of about 30 per cent. of the protoxide of iron. The *pyrope*, from πῦρ, fire, and ὄψις, appearance, or Bohemian garnet, differs in having less iron and more alumina, with some 15 per cent. of magnesia and traces of oxide of chromium. Both of these are much used in jewelry, together with *essonite*, or cinnamon-stone (a variety of *grossularite*, which contains no iron), *spessartite*, or manganese garnet, and *demantoid*, or Uralian emerald, a green variety of *andradite* or iron garnet, from the Ural Mountains, almost rivaling the emerald in brilliancy. Among other varieties not used in jewelry are *colophonite*, brown; *melanite*, black; *ouvarovite*, green; and *topazolite*, yellow. The Oriental garnet, or almandine (so called from the city of Alabanda, where it was anciently wrought), is found in alluvial soil, into which it has been washed out of its matrix, in Pegu, Siam, Ceylon, and India. When very large, as is frequently the case, it is cut *en cabochon*—i. e. with a flat or concave base and a convex upper surface, and is then termed *carbuncle*. The pyrope garnet, found chiefly in Bohemia, New Mexico, and South Africa, is smaller and is apparently confined to igneous rocks, or alterations thereof, while the almandine occurs in metamorphic rocks and crystalline schists. The pyrope garnet is often miscalled "Arizona ruby" and "Cape ruby." Spessartite has been found in Amelia co., Va., in large masses of great beauty, yielding fine gems up to 96 carats each, of rich wine color or hyacinth red. Rose garnet, a beautiful rose-red grossularite, has also come into notice from Xalostoc, Mexico; it is not transparent, but when cut and polished in slabs makes a fine ornamental material. Essonite, or cinnamon-stone, found chiefly in Ceylon, is also used as a gem, and frequently misnamed hyacinth by jewelers, the true hyacinth being a Zircon (*q. v.*). Notwithstanding its beauty, the commercial value even of the Oriental garnet has greatly declined in modern times, owing to the numbers brought into market. The garnet was frequently selected for engraving upon by artists of the Roman empire; one of the finest specimens of antique skill, the head of Sirius in the Marlborough collection, is upon a garnet. This stone was also a favorite gem with the engravers of the Sassanian period, but is rarely employed now, owing to its hardness and brittleness. George F. Kunz.

**Garnet**, Henry Highland, D. D.: a Negro; b. in slavery in Chestertown, Md., Dec. 23, 1815; his parents escaped with him when he was about eight years old, and in 1826 went to New York city, where he received some education; in 1835 he entered Canaan Academy, New Hampshire; returned to New York, and graduated in 1840 at Oneida Institute, Whitestown, N. Y.; spent ten years in preaching and teaching in Troy, N. Y.; was delegate to World's Peace congress in Germany in 1850; lectured three years in England and Ireland on slavery; was afterward missionary at Jamaica for the Scotch Presbyterian Church for about two years; pastor of Shiloh Presbyterian church, New York city, 1855–81, with the exception of 1865–69 when he was pastor in Washington; was appointed in 1881 by President Garfield U. S. minister resident and consul-general to Liberia, where he died Feb. 13, 1882.

**Gar'nett**: city; capital of Anderson co., Kan. (for location, see map of Kansas, ref. 6–J); on Atch., Top. and S. Fé and Mo. Pac. R. Rs.; 80 miles S. S. W. of Kansas City, near the Pottawattomie river, a small tributary of the Osage or Marais des Cygnes. It has one of the largest furniture-factories in the State, a planing-mill, and two large and very fine public-school buildings. Pop. (1880) 1,389; (1890) 2,191; (1900) 2,078. Editor of "Eagle."

**Garnett**, Alexander Yelverton Peyton, M. D.: b. in Essex co., Va., Sept. 20, 1820; graduated in the medical department of the University of Pennsylvania 1841; entered the U. S. navy same year, and rose to full surgeon in 1848. Having been elected Professor of Clinical Medicine in the National Medical College, he resigned his naval appointment

in 1850. In 1861 he left Washington and returned to Virginia; went to Richmond, where he was appointed on the examining board of surgeons, then surgeon-in-chief to the military hospitals; and being the family physician of Mr. Jefferson Davis, accompanied him on the evacuation of that city in 1865. After the downfall of the Southern Confederacy Dr. Garnett returned to Washington city, where he was re-elected professor in the National Medical College, which position he resigned in 1872; was made emeritus professor. D. at Rehoboth Beach, Del., July 11, 1888.

**Garnett**, James Mercer, M. A., LL. D.: professor of English; b. at Aldie, Va., Apr. 24, 1840; educated at the Universities of Virginia, Berlin, and Leipzig; served in the Confederate army during the civil war; held various positions in schools and colleges; became Professor of English Language and Literature in the University of Virginia in 1882. He has published *Translation of Beowulf and the Fight at Finnsburg*; *Anglo-Saxon Poems* (3d ed. 1892); *Translation of Elene, Judith, Athelstan, and Byrhtnoth: Anglo-Saxon Poems* (1889); *Selections in English Prose from Elizabeth to Victoria* (1891); and numerous essays and reviews.
C. H. T.

**Garnett**, Richard, LL. D.: philologist; b. at Litchfield, England, Feb. 27, 1835. He was appointed assistant in the printed book department of the British Museum in 1851; became also superintendent of the reading-room in 1875; and resigned both offices to give his whole time to the printing of the museum *Catalogue* (of which he had charge from its beginning) in 1884. He has published *Io in Egypt and Other Poems* (1859); *Poems from the German* (1862); *Relics of Shelley* (1862); *Idylls and Epigrams* (1869); *De Quincey's English Opium-eater* (1885); *The Twilight of the Gods and Other Tales* (1889); *Iphigenia in Delphi* (1890); and the biographies of Carlyle, Emerson, and Milton. C. H. T.

**Garnett**, Robert Selden: soldier; b. in Virginia, Dec. 16, 1819. He graduated at West Point July, 1841, and entered the army as brevet second lieutenant of artillery; served on the northern frontier and as assistant instructor of infantry tactics at West Point till 1844; was aide-de-camp to Gen. Wool in 1845. In the Mexican war he distinguished himself at the battles of Palo Alto, Resaca de la Palma, Monterey, and Buena Vista; was promoted to be first lieutenant Aug., 1846, and served as aide-de-camp to Gen. Taylor from June, 1846, till Jan., 1849; was breveted captain and major for gallant conduct at Monterey and Buena Vista; transferred to the infantry in 1848, and served against the Seminole Indians in Florida and on frontier duty in Texas 1850; captain Seventh Infantry Mar., 1851; was commandant of cadets at Military Academy 1852–54; appointed captain First Cavalry Mar. 3, 1855, and major Ninth Infantry Mar. 27, 1855; he commanded the Yakima expedition in 1856, and the operations against Puget Sound Indians in 1858. On the outbreak of the civil war in 1861 he resigned from the U. S. army and espoused the cause of the Confederates, being appointed a brigadier-general and placed in command of the department of Western Virginia. He was killed at Carrick's Ford, July 13, 1861.

**Garnier**, gäär'ni-ā', Marie Joseph François, known under the name of Francis: explorer; b. in St.-Étienne, France, July 25, 1839. He entered the French navy early in life; served through the war with China in 1860–62; was appointed to a civil office in French Cochin-China; and in 1866 was chosen as the coadjutor of Capt. Doudart de Lagrée in organizing and commanding the exploring expedition which started from the coast of Cambodia and traveled to Shanghai by way of Yunnan, the object being to open to trade a road between India, Indo-China, and Yunnan. He explored the Meikong river, and taking command of the expedition on the death of his chief brought his fellow-travelers in safety to Shanghai. The importance of this exploration is attested by the numerous honors bestowed on Lieut. Garnier by the geographical societies of France and England. He took part in the defense of Paris in 1870–71; resumed exploration in China; and was killed at Hanoi, in the Tonkin war, Dec. 2, 1873. He published *Voyage d'Exploration en Indo-Chine* (2 vols., 1873).

**Garnier**, Jean Louis Charles: French architect; b. in Paris, Nov. 6, 1825. He entered the École des Beaux-Arts 1842, and gained the grand prize in 1848; subsequently traveled in Greece and Italy, where he continued his studies. In 1861 he competed with the leading architects of Paris, and his plans were unanimously adopted for the new Paris opera-house, which was completed under his direction in 1875. He has built a number of other noted structures, and had charge of the constructions illustrating human habitations in the Paris Exposition 1889. He is officer of the Legion of Honor, member of the Academy of Fine Arts, and correspondent of the Royal Institute of British Architects.
W. R. Hutton.

**Garnier**, Jules Arsène: genre-painter: b. in Paris, Jan. 22, 1847. He was a pupil of Gérôme, and received the third-class medal at the Paris Exposition 1889. He is a skillful technician who paints scenes of life in the Middle Ages principally, and has also produced two or three large compositions of modern historical subjects. W. A. C.

**Garnier-Pagès**, gäär'ni-ā'päă-zhā', Louis Antoine: statesman; b. in Marseilles, France, July 18, 1803. He made his *début* under the patronage of his brother, who was one of the leaders of the republican party under the Restoration. During the reign of Louis Philippe he was a member of the Chamber of Deputies. In 1848 he secured the office of Minister of Finances in the provisional government of the republic, and became unpopular on account of the famous over-taxation called the "quarante-cinq centimes." When the empire was established he returned to private life until 1864, when he was elected deputy to the Corps Législatif. In 1869 he was elected again, but, though he sat on the opposition benches, he did not exercise any influence upon the events which followed the revolution of Sept. 4, 1870. He wrote an *Episode of the Revolution of 1848*; *History of the Executive Commission*; *History of the Revolution of 1848*. D. in Paris, Nov. 1, 1878.

**Garnishment** [deriv. of *garnish*, from O. Fr. *garnir* < older *guarnir*, from some form of Teuton. **warnian*, take care of, warn > Eng. *warn*]: a process of attachment by which a creditor obtains the security of property belonging to his debtor which is in the possession of third persons. It consists in a *warning* or notification given to the person holding the property, who is called a *garnishee*, commanding him not to make payment or delivery to the debtor, but to be in readiness to answer the plaintiff's claim by retaining the property in his own hands. Whenever a debtor against whom an action is instituted has himself a claim against a debtor of his own, the latter may be made a garnishee. The system of garnishment in Great Britain grew out of the custom of foreign attachment, which has existed from time immemorial in London, Bristol, and a few of the larger cities, and which permits the enforcement of a plaintiff's demand against debts due the defendant from third persons. (See Foreign Attachment.) But garnishment, as established in 1854 and at present in use, has a considerably less extensive scope of application than foreign attachment, since it only permits the seizure of a debtor's property or choses in action after the recovery of judgment against him, instead of at the time when suit is brought. In the U. S. a different rule is generally maintained, and the process of garnishment is therefore made more completely remedial, and can be adopted with much greater advantage by a creditor.

The effect of garnishment is to place the garnishee in a position resembling that of a trustee, leaving him all the defenses against the garnisher which he had against his own creditor. On this account it is known in some of the States, especially in New England, as the "trustee process." The service of a notice of attachment upon the garnishee is sufficient to effect a stay of proceedings in a suit subsequently brought against the garnishee by his creditor, and if the garnisher recovers judgment and levies execution against the money or effects in the hands of the garnishee, the latter is relieved from all obligation toward his creditor. As a general rule, any person is capable of being made garnishee, not excepting corporations and persons acting in a representative capacity as executors and administrators. A non-resident person can not be made garnishee unless he has property of the defendant in the State or is bound to pay him money within the State. But an officer of the law, as a clerk or receiver, or a trustee holding funds as agent of a court, a financial agent of the Government, a sheriff holding funds in an official capacity, or an assignee in bankruptcy, can not be a made garnishee. The same is true of an agent, unless he has an independent control of the goods, since his possession is the possession of his principal. The process of garnishment is virtually a secondary suit against some third person by a suing creditor, who claims the rights of the defendant against whom his primary action is brought. See Attachment.
Revised by F. Sturges Allen.

**Garofalo**, găă-rō-faa'lō, Benvenuto Tisi, da : Italian painter; b. in Ferrarese territory in 1481. He studied first with Domenico Panetti, then at Cremona with his uncle Soriani, who allowed him to frequent the school of Boccaccio Boccacino. In 1499 he went to Rome, afterward to Mantua as pupil of Lorenzo Costa for two years. Francesco Gonzaga had him in his service till he returned to Ferrara, where he worked four years. But it was on becoming acquainted with Raphael in Rome that he formed his style in imitation of this favorite master, and succeeded so well that his little pictures have been confounded with those of Raphael. He left a very great number of works both in Rome and his native province, and during the last twenty years he painted he used to work in monasteries on all the feast-days and Sundays. An *Enthroned Madonna*, a *Christ on the Mount of Olives*, at Ferrara; a *Descent from the Cross* at the Brera in Milan are among his important existing works. He was completely blind nine years before his death. D. in 1559.

W. J. Stillman.

**Garonne**, găă'run' [< Lat. *Garumna*, the ancient name, of Celtic origin]: a river of France; rises in the Pyrenees, within the Spanish frontier, at the foot of Mont Maledetta. It becomes navigable at Cazères, is connected at Toulouse with the Mediterranean by a canal, joins at Blaye the Dordogne, and assumes the name of Gironde, entering the Atlantic through an estuary 50 miles long. As this estuary is divided into two nearly equal branches by a long series of islands and shoals, and as the river not seldom changes its bed, the navigation is somewhat difficult. During ordinary floods the river rises about 25 feet, but this point is sometimes exceeded, and the river then causes very extensive and destructive inundations; that of 1875 was extremely so. At the mouth stands the famous tower of Cordouan, built 1584–1610.

**Garrard**, Kenner: soldier; b. in Kentucky in 1828. He graduated at the U. S. Military Academy July, 1851, and entered the army as brevet second lieutenant of artillery; transferred to the First Dragoons in 1852, and received his full commission as second lieutenant Oct., 1853; promoted first lieutenant of cavalry 1855; captain 1861; and major 1863. Served principally in garrison and on frontier duty 1851–61, being captured at San Antonio, Tex., Apr., 1861, and not exchanged as prisoner of war until Aug., 1862, serving in the meantime in commissary department and as instructor and commandant of cadets at West Point. In Sept., 1862, he was appointed colonel 146th New York Volunteers, and was engaged in the battles of Fredericksburg, Chancellorsville, and Gettysburg. Appointed brigadier-general of volunteers July, 1863, he served with the Army of the Potomac till December, when he was placed in charge of the cavalry bureau at Washington. In Feb., 1864, he commanded a cavalry division in the Army of the Cumberland, took part in the various engagements about Chattanooga and in Georgia during the Atlanta campaign, in the pursuit of Confederate army to Dalton, and with his command in the Sixteenth Army-corps at the battle of Nashville, Tenn., Dec., 1864. In the operations against Mobile, 1865, he led the party which stormed and captured Blakely. In Aug., 1865, he was mustered out of the volunteer service. For gallant services in the field during the war he was breveted colonel, brigadier-general, and major-general U. S. army. Resigned 1866. D. in Cincinnati, O., May 15, 1879.

**Garraud**, găă'rō', Gabriel Joseph: French sculptor; b. in Dijon, Mar. 23, 1807. He studied under Ramey and Rude, and made his *début* in the Salon of 1838 with a bust which attracted considerable attention. Among his later works are *La première famille* (1845), *Le secret de l'amour* (1863), and a great number of busts. His political connections made him in 1848 chief of the Département des Beaux Arts in the Ministry of the Interior, but for only a short time. D. in 1880.

**Garrett**, George Mursell: composer; b. in Winchester, England, June 8, 1834. He was educated entirely in England, and received degree Mus. Bac. 1857, and Mus. Doc. 1867, from Cambridge. In 1875 he was appointed organist to the university. His compositions include several cantatas and much excellent church music. D. Apr. 9, 1897.

**Garrett Biblical Institute**: a theological seminary of the Methodist Episcopal Church; located at Evanston, Ill.; founded through the labors of Rev. John Dempster, D. D., and the gifts of Mrs. Eliza Garrett, of Chicago, and incorporated in 1855. Its departments were organized in the summer of 1856, and opened for students in September of the same year. In the year 1891–92 it had 180 students.

**Gar'rettsville**: village; Portage co., O. (for location of county, see map of Ohio, ref. 3–I); on Erie railway; 37 miles S. E. of Cleveland. It has four churches, a literary society, library, machine-shops, and manufactories. The principal business is farming and dairying, and the place is an important center for the maple-sugar industry. Pop. (1880) 969; (1890) 1,046; (1900) 1,145. Editor of "Journal."

**Garrick**, David: actor; b. in Hereford, England, Feb. 20, 1716. He was of French extraction. His father was a captain in the British army; his mother was the daughter of a vicar of Lichfield Cathedral. He attended the grammar school at Lichfield, but at the age of twelve or thirteen his studies were interrupted, and when eighteen years old he became a pupil in Dr. Samuel Johnson's academy. His passion for the stage early showed itself in remarkable gifts for mimicry and recitation, and in a desire to frequent theaters. When but eleven years old he performed Sergeant Kite in *The Recruiting Officer* before a select company, being even then a juvenile manager. In 1735 he went to London with Dr. Johnson, proposing to study law, but gave it up, lacking the means of support. A short experience as a wine-merchant satisfied him that trade was not his calling, and he adopted the theatrical profession, making his first appearance at Ipswich, under the assumed name of Lyddal, in the tragedy of *Oroonoko*. The effort was applauded, but not as rapturously as his subsequent appearance in comedy. On the strength of his provincial reputation he resolved to try his fortune in London, and, finding the popular theaters closed to him, made his first appearance on Oct. 19, 1741, at the obscure theater in Goodman's Fields in *Richard III.* The success was wonderful. In a few weeks the house was crowded, people deserting Drury Lane and Covent Garden to see the man who so attractively introduced a natural school of acting in place of the artificial tradition of the English stage. At the close of the season of 1742 he played three nights at Drury Lane, and made an engagement there on a salary of £500 a year. In 1745 he joined Mr. Sheridan in the management of the Royal theater in Dublin. Two years later he opened the Covent Garden theater, London, and spoke the prologue written for him by Dr. Johnson. In June, 1749, Mr. Garrick married the Viennese dancer, Eva Maria Violetta, who brought him a moderate fortune. At this time Garrick was the greatest figure on the English stage. The public opinion of the Continent, which he visited in 1763, ratified the judgment of his countrymen. The Shakspeare jubilee at Stratford-on-Avon, which continued three days and was represented ninety-two successive times at Drury Lane, was arranged by him in 1769. Four years after this the death of his partner threw on him the whole management of the theater; his health failed: he played less and less frequently, and in 1776, after acting through his favorite characters—the last performance being for the benefit of the Decayed Actors' Fund, established by himself—he retired from the stage. Garrick was a man of varied talents; as an actor he excelled in the most opposite styles, in high tragedy, and in broad farce; he was in his profession an author, too; he wrote verses, prologues, epilogues, farces, and adapted many plays for the stage. Though self-conscious and vain, he was popular for his friendly, generous, and charitable qualities, and respected for his solid virtues. In person he was of middle height, slight of figure, animated in countenance, quick and expressive in action, effective though not imposing in presence. His voice was musical, and his sensitive temperament made amends for the absence of great physical advantages. D. in London, Jan. 20, 1779, and was buried in Westminster Abbey. Mrs. Garrick survived many years, dying at the age of ninety-eight in 1822. Revised by B. B. Vallentine.

**Garrison**, James Harney: clergyman and editor; b. in Ozark, Mo., Feb. 2, 1842. He received a common school education; entered the Twenty-fourth Missouri Infantry at the beginning of the civil war; was wounded in the battle of Pea Ridge in Mar., 1862; commissioned captain in the Eighth Missouri Cavalry Sept. 15, 1862; and was mustered out of the service in 1865. In 1868 he graduated at Abingdon College, Illinois; the same year began preaching in Macomb, Ill.; 1869 became an editor of *The Gospel Echo* in that city; 1871 removed to Quincy, Ill., and became editor-in-chief of the consolidated *Gospel Echo* and *The Christian*, formerly of Kansas City, Mo.; and subsequently, on the consolidation of *The Christian* and *The Evangelist*, of Chi-

cago, he became associated with B. W. Johnson in the editorship of *The Christian-Evangelist*, an office he still holds (1893). He was pastor of the Church of Christ in Southport, England, in 1881–82, and of the Church of Christ in Boston, Mass., in 1885–86, and has published *Heavenward Way* (1880); *Alone with God* (1891); and several other smaller works.

**Garrison**, William Lloyd: pioneer and leader of the modern anti-slavery movement in the U. S.; b. in Newburyport, Mass., Dec. 12, 1804. He served an apprenticeship to the printing business in the office of *The Herald* in his native place, and while doing so wrote extensively for that and other journals, mainly upon political topics, carefully preserving his incognito. His anti-slavery utterances attracted the attention of Benjamin Lundy, a Quaker, who was engaged in the publication of *The Genius of Universal Emancipation* in Baltimore, and he induced Mr. Garrison to join him in the editorship of that paper. In the very first number of *The Genius of Universal Emancipation* which appeared under his and Mr. Lundy's joint editorship was developed a radical difference in their opinions, Mr. Lundy advocating gradual and Mr. Garrison immediate emancipation as the inalienable right of the slave and the duty of the master. Subsequently another difference appeared, Mr. Lundy favoring and Mr. Garrison opposing the scheme for colonizing the slaves as a condition of emancipation. They were one, however, in a common hatred of slavery, and as each appended his own initials to whatever he wrote in the paper, the partnership was agreeable to both parties. In May, 1830, Mr. Garrison was convicted, by a court and jury of slaveholders, of a libel upon Capt. Francis Todd, in denouncing Capt. Todd as guilty of "domestic piracy" in conveying a cargo of slaves from Baltimore to New Orleans. For this he was sentenced to pay a fine of $50 and costs of court. Being unable to pay this money, he was committed to jail. His writings while in prison, especially several sonnets which he inscribed with a pencil on the wall of his cell, were widely copied and admired as expressions of the true spirit of liberty. At the end of seven weeks he was set at liberty, his fine being paid by Mr. Arthur Tappan, a merchant of New York. He then turned his steps toward the Northern States, delivering lectures in Philadelphia, New York, New Haven, Hartford, and Boston, in which he depicted the sinfulness and the cruelties of slavery, and sought to enlist the people in the work of promoting emancipation. Others had denounced slavery as an evil, but Mr. Garrison was the first to declare it a sin, and demand its immediate abolition in the name of God and of humanity. He thus became the leader of an anti-slavery movement founded upon the principle of immediate in distinction from gradual emancipation. On Jan. 1, 1831, he commenced, in partnership with Isaac Knapp, the publication, in Boston, of *The Liberator*, a weekly journal, the motto of which was "My country is the world—my countrymen are all mankind." The voice of this paper was soon "heard round the world"; the North was deeply moved, while the South was filled with excitement and alarm. The dead calm that had followed the enactment of the "Missouri Compromise" of 1820 was completely broken up, and the discussion of slavery in all its relations to civil and religious institutions went on with constantly augmenting force, in spite of every effort to arrest it, from that time until the war of 1861–65. In Dec., 1831, the Legislature of Georgia offered a reward of $5,000 to any person who should arrest, bring to trial, and prosecute to conviction, under the laws of that State, the editor or the publisher. On Jan. 1, 1832, under Mr. Garrison's direct inspiration, was organized the New England Anti-Slavery Society, the first association ever formed in the U. S. on the principle of immediate emancipation. He soon afterward published his work, *Thoughts on African Colonization*, in which he contended that the colonization scheme was an ally of slavery, and went to England as an agent of the society, and was warmly received by Wilberforce, Clarkson, Brougham, and the great body of English abolitionists. In Oct., 1835, a pro-slavery mob of "gentlemen of property and standing" broke into the anti-slavery office in Boston, dispersing a meeting of women, seized Mr. Garrison and dragged him through the streets with a rope around his body. His life was saved with great difficulty, and only by the city authorities taking him to jail for protection. He was released the next day, but was compelled to go into the country for safety. In 1846 he went to England upon an anti-slavery mission for the third time. In 1843 he was chosen president of the American Anti-Slavery Society, and held the office until the close of the civil war in 1865, when, slavery having been abolished and its rehabilitation made impossible by an alteration of the U. S. Constitution, he resigned, announcing that his career as an abolitionist was ended, and that in his judgment the society ought to be dissolved. He continued the publication of *The Liberator*, however, until the close of that year, and in the last issue had the satisfaction of putting on record the official proclamation of the adoption of the amendment to the Constitution forever prohibiting slavery in the U. S. His paper thus covered the whole period from the beginning of the agitation for the abolition of slavery in 1831 until the final and complete triumph of the cause in 1865. In 1843 appeared a volume of his *Sonnets and other Poems*, and in 1852 a volume of selections from his writings and speeches. D. in New York city, May 24, 1879. See *William Lloyd Garrison and his Times*, by Oliver Johnson; and *William Lloyd Garrison: the Story of his Life told by his Children* (1885). Revised by C. K. Adams.

**Gar'rod**, Sir Alfred Baring, M. D.: physician and author; b. in Ipswich, England, May 13, 1819. He graduated at the University of London in 1842; became assistant physician to the University College Hospital in 1847; physician and Professor of Therapeutics and Chinical Medicine there in 1851; physician to King's College Hospital and professor in the college in 1863; and consulting physician in the hospital in 1874. He was elected a member of the Royal College of Physicians of London in 1851; fellow in 1856; senior censor in 1887; and vice-president in 1888. In 1847 he discovered the presence of uric acid in the blood of gouty subjects. Dr. Garrod has published many works in medical science, including *On the Conversion of Benzoic into Hippuric Acid in the Animal Economy* (1843); *Researches on the Pathological Condition of the Blood in Cholera* (1849); *The Essentials of Materia Medica and Therapeutics* (1855); *On the Nature and Treatment of Gout and Rheumatic Gout* (1860); and the results of his inquiries of the value of small but long-continued doses of sulphur in the treatment of diseases of the skin, liver, and joints, in *The Lancet* (1889).

**Gar'rod**, Alfred Henry, M. A., F. R. S.: anatomist; b. in London, England, May 18, 1846. He studied at King's College, London, taking the first, second, and third years' scholarship for medical students, and graduated at St. John's College, Cambridge. In 1871 he was appointed prosector to the Zoölogical Society of London; in 1874 Professor of Comparative Anatomy at King's College; and in 1878 Fullerian Professor of Physiology of the Royal Institution. Although he was the author of a number of papers on various anatomical and physiological subjects, those on the anatomy and classification of birds are by far the most important, and will ever remain of vast service to ornithologists. He was the first to draw attention to the value, for purposes of classification, of the ambiens, semitendinosus, and other muscles of the thigh, and to distinguish between and make use of the holorhinal and schizorhinal types of the narial opening of birds. He also demonstrated the importance of the single or double condition of the carotid arteries, and made valuable contributions to our knowledge of the deep plantar tendons and structure of the trachea in birds. D. Oct. 17, 1879. F. A. Lucas.

**Garrot**: a European name for the golden-eye duck (*Glaucionetta clangula*), used to some extent in the U. S., principally as a "book name." See Golden-eye. F. A. L.

**Garrote**, găr-rōt', or găr-rot' [from Span. *garrote*, stick, hence compression or strangling produced by twisting a stick inserted in a bandage, this being the most primitive form of the garrote; the word is of Celtic origin]: a form of capital punishment employed in Spain and Spanish America. A metallic collar is put around the neck of the victim, and a screw at the back of the collar is turned in such a way that its point touches the spinal cord, causing instant death. Originally a stout cord was tied about the neck, and the culprit was strangled by twisting the cord with a stick (*garrote*). Robbery, accompanied by choking of the person robbed, is often called *garroting*.

**Garter, Order of the**: the most illustrious British order of knighthood, founded, according to Selden, who follows Froissart, on Apr. 23, 1344, by King Edward III. The exact date is much disputed, some making it Jan. 18, 1344, and some tracing it back even to 1192, when on St. George's Day Richard I. made twenty-six of his best knights wear a thong of blue leather on the leg in a fight with the infidels.

But the common tradition is that King Edward was dancing with the Countess of Salisbury at a ball, when she let fall her garter, which the king at first tied about his own leg; but observing that the act excited much attention, he restored it to the fair owner, exclaiming, *Honi soit qui mal y pense*—"Evil be to him who evil thinks"—words which are still the motto of the order: and the king said further, "that shortly they should see that garter advanced to so high an honor and renown as to account themselves happy to wear it." The order was founded in honor of the Holy Trinity, the Blessed Virgin, St. Edward the Confessor, and St. George, but the last named was its chief patron. Ladies were admitted as late as the reign of Edward IV., since which time no ladies but the sovereign are received into it. At present there are, besides the sovereign, the Prince of Wales and such other princes of the blood as may be chosen, and twenty-five regular knights of the Garter, while extra knights are admitted by special statute; vacancies occurring in the regular knighthood of the Garter being filled from the extra knights, many of whom are foreign reigning princes. In 1893 there were, besides the Queen, forty-nine knights, none of a rank below that of earl. In 1873 the Shah of Persia received the garter. Anciently, gentlemen not of the titled nobility were admitted. The Bishop of Winchester is prelate of the order, the Bishop of Oxford is chancellor, the Dean of Windsor is registrar, and there is a king of arms and an usher of the black rod; but none of these officials are knights of the Garter. The knights of the order write K. G. after their names. The distinguishing badges are the collar, badge, star, garter, George, and lesser George; there are also a mantle, surcoat, hood, hat, and plume appropriate to the order. In strict language the knights are termed "knights of the Golden Garter," or "knights of the most noble order of St. George and the Garter."

**Garter Principal King of Arms**: the chief herald of England and of the order of the Garter. As principal king of arms he is the head of the college of heralds, subject to the earl marshal. As garter king of arms he is independent of that officer. He takes precedence not only of Bath, Clarenceux, and Norroy kings of arms, but of Lyon and Ulster, the heraldic kings in Scotland and Ireland. According to most authorities, Henry V. first instituted this office, but others say that Henry VIII. first gave the title to Guienne king of arms, his first herald for the French possessions.

**Garth**, Sir SAMUEL: poet and physician; b. at Bolam, Durham, England, in 1660. He studied at Peterhouse, Cambridge; took his medical degree 1691; removed to London 1693; was physician to George I. and physician-general of the army; became a Whig leader; joined the Kit-Cat Club; and was knighted 1714. He is chiefly remembered for his satirical poem, *The Dispensary* (1699), directed against the selfishness of the apothecaries who opposed the gratuitous distribution of medicines to the poor. He translated a part of Ovid's *Metamorphoses*, and wrote *Claremont*, a poem, etc., and delivered the Harveian oration for 1697. D. in London, Jan. 18, 1719.

**Gas** [a word invented by the Belgian chemist Van Helmont (d. in 1644), which has since passed practically unchanged into all European languages]: according to the usual definition, *a permanently elastic fluid*—permanently elastic, that is, under the usual atmospheric conditions, and thus distinguished from a *vapor*, which is the aëriform condition of a substance normally existing in the liquid or solid state. By a *fluid* in this definition is designated a condition of matter in which the particles have great freedom of motion—a condition common both to gases and liquids. By *elastic* is meant a condition in which the material particles are in a state of tension, and in consequence of this tension exert pressure against every surface with which the body comes in contact. By virtue of its inherent elasticity a gas tends to expand indefinitely; and this tendency can only be restrained by inclosing it in some containing vessel whose form the aëriform mass assumes. By virtue of its fluid condition a gas transmits the pressure it exerts equally in all directions, and when at rest and under uniform conditions throughout its whole extent, a mass of gas presses against different surfaces with forces which are proportional to the area of those surfaces, and independent of their form or position. A liquid also, when rendered elastic by stress of any kind, transmits pressure equally in all directions, but this elasticity is dependent on the external force; it is not inherent in the liquid; and a liquid mass comes to rest in an open vessel, forming a definite surface of its own. The tension of an aëriform mass is measured by the pressure which this tension produces on the unit of area, and which may be estimated as so many pounds on a square inch, or so many grammes on a square centimeter, according as we use the British or the metric system of measures and weights. It may also be measured by the height at which it sustains a column of mercury in the tube of a barometer; and since, according to the laws of mechanics, this height is directly proportional to the pressure, so dissimilar a value as the height of a mercury column becomes a legitimate measure of the tension of a gas. We speak therefore of the tension of a gas as so many inches or so many centimeters of mercury, and in mathematical expressions we represent the tension of a gas by H, which stands for a certain number of inches or centimeters, the height of the mercury column which the tension supports. The normal tension of the atmosphere at the level of the sea supports a column of mercury 30 inches (or about 76 cm.) high, but, as is well known, the tension lessens as we rise in the atmosphere, and at the same place it varies, within somewhat narrow limits, with meteorological changes. A tension of 30 inches in the British and of 76 cm. in the metric system is called *one atmosphere*, and high tensions are usually estimated in *atmospheres*. The British standard temperature is 62° F., and the tension measured by a mercury column 30 inches high at this temperature corresponds to a pressure of $14\frac{68}{100}$ lb. on a square inch. The French standard temperature is that of melting ice, or 0° C., and a mercury column at this temperature 76 cm. high corresponds to a pressure of 1,033·3 grammes of a square centimeter. Remembering also that 30 inches equal 76·2 cm. (very nearly), it is easy, by means of these standard values, to compare the various measures of tension.

The common mercurial barometer is simply a glass tube open at one end, which, having been filled with mercury and the open end temporarily closed, has been inverted and the aperture opened under a basin of mercury. The column of mercury falls in the tube until it balances the tension of the air, and slowly oscillates as this pressure varies. As in filling the tube great care is taken to drive out all the air, there is no atmosphere above the mercury, and therefore no pressure exerted upon the upper surface of the column. If, however, a small amount of gas or vapor be introduced into such a tube, a pressure will be at once exerted upon the upper surface which will depress the mercury column, and the vertical height through which the column is depressed is obviously the measure of the tension of the confined aëriform body. The value is easily ascertained by comparing the depressed column with a perfect barometer at its side; and this method of measuring tensions is capable of very wide application, but is necessarily limited to cases in which the tension is less than one atmosphere. The barometer itself, although exceedingly valuable for observing the varying tensions of the atmosphere, is not, on account of its size and shape, a convenient instrument for measuring the tension of a confined and limited volume of gas. Moreover, although theoretically a barometer might be of any length, yet the difficulties connected with filling the tube increase so rapidly with the length that one is practically limited to something less than a meter, and therefore the ordinary forms of the instrument could not, in any case, be used if the tension were much greater than one atmosphere. However, a mercury column can be used for measuring tension up to several atmospheres by so arranging the apparatus that the pressure of the confined gas acting on the surface of the mercury shall force the liquid up a vertical glass tube open at the top, so that the column shall be lifted against the pressure of the atmosphere. Evidently, under such circumstances the height of the column measures the difference between the tension of the gas and the tension of the air; and to find the value of the first this height must be added to the height of the barometer at the time. Such an instrument is called a manometer; but, although susceptible of great accuracy, the mercurial manometer is difficult of application when the tension exceeds two or three atmospheres. The manometer which is usually used in the arts for measuring approximately the tension of steam consists of a spiral flattened metallic tube. The pressure of the steam on the interior of this tube tends to uncoil the spiral, and the motion, multiplied by a system of levers, appears in the movement of an index over a dial. The figures on the manometer usually used in the U. S. indicate the number of pounds. pressure per square inch above the atmospheric

pressure; and a boiler is said to carry 25 lb. of steam, for example, when the pressure of the steam on the interior surface exceeds that of the air on the outer surface by 25 lb. per square inch. A metallic barometer is made on the same principle; and in another form of metallic barometer, called an aneroid, a tight metallic box, having a corrugated top, which rises and falls with the varying pressure, takes the place of the spiral tube.

Gases differ from liquids in their compressibility even more markedly than in their elasticity. Liquids are frequently called *incompressible fluids*; for even when exposed to the greatest attainable pressure, their volume alters so slightly that the shrinkage can be detected only by delicate experiments. Gases, on the other hand, are very *compressible fluids*; and the simple law which obtains between the volume and tension of a mass of gas is the most characteristic feature of the aëriform state. When a mass of gas is exposed to pressure the volume diminishes until the increased tension balances the pressure; and, if the temperature does not change, it is found, in general, that the tension is inversely proportional to the volume—the less the volume the greater the tension; and, on the other hand, when the gas is allowed to expand, the larger the volume the less the tension. $V$ and $V'$ represent two different volumes of the same mass of gas, $H$ and $H'$ the corresponding tensions, measured by columns of mercury, $H : H' = V : V'$. Hence $HV = HV'$; that is, for every mass of gas at an invariable temperature the product of the tension and the volume is a constant quantity. This law was discovered by the chemist Boyle in England in 1662, and verified by the Abbé Mariotte somewhat later; and it is by some called the law of Mariotte, and by others the law of Boyle. This law, however, is to be regarded as a typical condition of aëriform bodies, rather than a state which is ordinarily realized. There is no gas known which at the ordinary temperature absolutely obeys Mariotte's law. Except in the case of hydrogen, the tension increases as the volume diminishes less rapidly than the law requires, while that of hydrogen increases more rapidly. It is true that with oxygen, hydrogen, nitrogen, and a few other gases the deviations from the law are so small that in almost all cases the differences may be neglected without appreciable error; but with most gases the differences are very marked, and rapidly augment as the pressure increases. As the temperature increases these differences lessen; and there is probably for every gas a temperature at which it exactly obeys the law. When this point is passed differences again appear, but in the opposite direction; and the ordinary temperature is beyond the typical point for hydrogen.

All gases, by the combined action of pressure and cold, may be condensed to liquids (see LIQUEFACTION OF GASES), and the deviations from Mariotte's law just noticed are closely connected with the transition from the lighter to the more dense state of aggregation. When by pressing a piston into a cylinder the volume of a mass of sulphurous oxide gas, for example, is reduced, the tension increases, but in an ever-lessening ratio, up to a certain value. As soon, however, as this value is reached, a further reduction of volume causes no increase of tension, but a portion of the gas becomes a liquid, and afterward the piston descends under a constant pressure until the whole mass is liquefied. It then occupies only a small portion of its original volume, and yields scarcely perceptibly to any further attempts to compress it. This greatest value which the tension reaches is called the *maximum tension* of the gas; and although it varies with the temperature, yet for a given temperature it has a definite value for each gas that can be liquefied by pressure alone. Those gases, however, which closely conform to Mariotte's law can not be condensed by pressure alone; and there appears to be for each gas a temperature which has been called the *critical temperature*, below which the gas presents phenomena similar to those obtained with sulphurous oxide, as just described, and above which it is in a condition in which its tension increases indefinitely, however great the pressure to which it is exposed. If a perfect gas be defined as one which conforms to Mariotte's law, such a gas, of course, could not be condensed to a liquid by pressure alone; and, as has been said, it is probable that every aëriform body can be brought into this condition by heat—at least when not chemically changed in the process. The *critical temperature*, therefore, must be passed before the body reaches the condition of a perfect gas; and this temperature seems to mark the transition from the state of vapor to the state of gas, and points out a more philosophical distinction between these two phases of aëriform matter than the popular definitions imply.

Another characteristic feature of gases appears in the fact that the same change of temperature causes in all of them the same change of tension or volume. When a gas is confined, the effect of heat is to increase its tension; when free to expand under a constant pressure, the effect is to increase its volume; and, as Mariotte's law requires, these two effects would be strictly proportional in every perfect gas. Since, under ordinary circumstances, the gases with which one has to deal are not perfect, this result, although very closely approached, is not absolutely realized, and in general the effects of heat on masses of different gases are not strictly identical, the slight differences observed being of the same order of magnitude as the deviations from Mariotte's law above referred to, and resulting doubtless from the same cause. Disregarding these slight differences, the effect of heat on all aëriform matter is correctly represented in the following illustration: Conceive of a vessel of invariable size containing air which at the temperature of melting ice has a tension of 273 mm., as shown by a barometer. If, now, this vessel is heated to the temperature of water when boiling under the normal atmospheric pressure, the tension of the confined air will become 373 mm.—that is, between these two standard temperatures the tension increases 100 mm. Evidently such an apparatus would serve as a measure of temperature. The 273d division on the millimeter scale of the barometer would indicate the freezing-point, the 373d division the boiling-point of water, and the intermediate divisions would divide the difference between these two fixed points into 100 degrees. Such an instrument would serve as an air-thermometer, and the degrees of temperature thus marked would closely correspond to those of the ordinary mercury thermometer, graduated on the centigrade system. The degrees of such a thermometer, however, are merely arbitrary points in the scale of temperature until the relation between the change of tension and the amount of heat which enters or leaves the confined air is determined. But if it can be shown that equal accessions of heat produce equal increments of tension, then it would follow that the air-thermometer is an accurate measure of thermal values. Unfortunately, experimental evidence on this point is not as direct as could be wished. The only safe standard to which measures of heat can be referred is what may be called the fuel standard—that is, the weight of some combustible, like hydrogen, by whose burning the heat is generated; and could it be shown experimentally, for example, that the heat from a gramme of hydrogen increased the tension of the confined air exactly 100 times as much as that from a centigramme of the same fuel, and this, too, from whatever point on the scale of temperature one might start, then there could be no question that the increments of tension were the legitimate measures of the heat which entered the air, and therefore of the differences of temperature thus produced. Such direct observations, however, are impracticable; and it would not be possible with a few words to make clear to the reader how far the conclusion just stated is justified by such indirect experimental evidence as it has been possible to obtain. It must be sufficient to say, first, that within moderate limits of temperature the experiments prove the increase of tension to be very nearly, if not exactly, proportional to the amount of heat which enters such a confined mass of air as is described above; and, secondly, that the accepted theory of heat leads to the belief not only that the increase of tension is proportional to the accession of heat within the latitude and limits of error of the experiments, but also that in a perfect gas this law would hold without variation throughout the whole range of temperature.

Accepting, then, the law provisionally, it is found that it leads to a most remarkable conclusion. Starting with the apparatus assumed above at the temperature of melting ice, and the barometer indicating a tension of 273 mm., impart to the air successive increments of heat, and raise the temperature degree by degree, and the tension millimeter by millimeter, until the barometer marks 546 mm. Knowing the weight of the air, it can easily be determined how much heat, estimated on the fuel standard, is required to produce this result; and it will be found that it is represented by a very small weight of hydrogen gas. If the theory advanced is correct, $\frac{1}{273}$ of this amount would correspond exactly to 1 mm. of tension, the same for the last degree as for the first. Returning now to the freezing-point, what must be the result if the heat be withdrawn in similar successive

portions? Evidently the temperature will fall degree by degree, as the tension is reduced millimeter by millimeter; and if the law holds to the last, when there is removed the quantity of heat represented by the same amount of hydrogen as before—that is, at 273 degrees below the freezing-point—the tension must fall to zero, and the absolute zero of the thermal scale is reached. If, then, the law deduced from the experiments on the thermal relations of gases is well established and holds to the end, the absolute zero of temperature is at 273 degrees below the melting-point of ice on the scale of the air-thermometer; and, moreover, the amount of heat which natural bodies contain is very limited, and is equivalent to an amount of fuel which in many cases can be definitely stated. Of course, until the validity and scope of the law can be placed beyond doubt, this remarkable result must be regarded as only ideal. It should be added, however, that there are several natural phenomena which point to a definite lower limit of temperature, and, in one or two instances, which indicate the same limit as that just assigned. But even if the absolute zero is merely a fancy, the point assigned to it is the natural zero of the scale of the air-thermometer, graduated as described above; and there is one great advantage in counting the degrees of temperature from this point, for the tensions of gases under constant volumes, or their volumes under constant tensions, are directly proportional to the temperatures thus expressed —at least within the limits of ordinary observations. Between the freezing and boiling points of water the degrees of a common mercury thermometer graduated on the centigrade system are essentially the same as those of the air-thermometer, and hence by adding 273 to temperatures expressed in centigrade degrees we obtain the values referred to the absolute zero, which may be called the absolute temperatures; and, as just said, the volume or tension of any mass of gas under otherwise constant conditions is proportional to the absolute temperature. Suppose we have measured 250 cubic cm. of gas at 20° C., and wish to know how much it would measure under the same circumstances at 4° C. We first add 273 both to the 20° and to the 4°, and then make the proportion, $293 : 277 = 250 : x = 236{\cdot}3 +$. Thus all observations on the volume or tension of aëriform bodies are reduced from one temperature to another, and the law that has been discussed on which the method is based is called the law of Charles. Charles was a French physicist who near the close of the eighteenth century discovered the equality of the dilatation of the principal gases when heated from the freezing to the boiling point. However, knowledge of the limitations of this general truth, as well as the exact measurement of the amount of expansion, is due to modern investigators, and especially to Regnault.

A third characteristic quality of aëriform matter is the power of motion inherent in its parts. The parts of a solid or a liquid show no disposition to leave the mass. Dissolve in a vacuous space, so far as possible, a solid or liquid body, no separation from the mass takes place, except in so far as by evaporation from the surface the material changes into the aëriform condition, and thus acquires power of motion. But open to a mass of gas an aperture into a vacuum, and the material rushes through the door with an enormous velocity. The rate of motion varies for different gases very greatly. Thomas Graham named this motion *effusion*, and showed experimentally that when other conditions were the same the rates of effusion of any two gases are inversely proportional to the square roots of their densities. In Graham's experiments the gases entered the vacuum through a pin-hole in a thin metallic plate, and he observed the number of seconds occupied by a given volume in passing through this narrow opening. He found slight deviations from the law in the times both of the very light and of the very heavy gases, but these he traced to the tubularity of the aperture, arising from the unavoidable thickness of the metallic plate. When a gas flows through a capillary tube into a vacuum, a wholly new class of phenomena appear, which entirely mask the law of effusion. The motion of a gas through a capillary tube Graham called *transpiration*, and he carefully observed the velocity of the flow of different gases under the same conditions. The effects thus obtained seem to depend not simply on the friction of the gas against the surface of the tube, but much more on the friction of the gas particles against each other, and the transfer of momentum which thus results; and a comparison of the velocity of transpiration with that of effusion has led to important conclusions in regard to moleeular magnitudes. The inherent power of motion in a mass of gas is manifested not only by its *effusion* into a vacuum, but also by what is called its *diffusion* into the space already occupied by another aëriform body. If a jar of chlorine is opened on the table of a lecture-room, the presence of this suffocating gas will be perceived before long at the farther end even of a large hall, because this material, although two and a half times as heavy as air, slowly spreads through the whole space. Graham discovered that the relative rates of diffusion of different gases are precisely the same as their relative rates of effusion; or, in other words, that a gas diffuses through the space filled by another gas according to the same law which governs its effusion into a vacuum. As before, the relative rates of diffusion are inversely proportional to the square roots of the densities. Thus oxygen, which is *sixteen* times *heavier* than hydrogen, diffuses *four* times *less* rapidly. But although an aëriform body offers no *permanent* resistance to the expansion of a gas, and the final result is the same as if it expanded into a vacuum, yet the velocity of the diffusion is vastly less than that of the effusion; and, to use an illustration of Dalton, one gas offers to another the same kind of resistance which stones in the channel of a stream oppose to the flow of running water. Loschmidt, of Vienna, supplemented the experiments of Graham by measuring in a number of cases the absolute, as well as the relative, velocity with which diffusion proceeds. The phenomena of effusion and diffusion are obviously manifestations of the same mechanical condition that determines the pressure exerted by aëriform matter upon all surfaces against which it rests. Pressure implies the possibility of motion, for the same force which produces pressure will cause motion when the support is removed. And we have finally to consider a theory which attempts to explain what the mechanical condition thus indicated is.

The modern theory of chemistry regards every mass of matter as an aggregate of small isolated particles which can not be further subdivided without destroying the identity of the substance, and these particles it calls molecules. The molecules of the same material are supposed to be alike in every respect, and those of different materials to differ in all those qualities which distinguish substances. Thus a lump of sugar is an aggregate of very small isolated masses of sugar, each of the same weight and pattern. These molecules are not metaphysical abstractions, but, to use the words of Sir William Thomson, they are "pieces of matter of measurable dimensions, with shape, motion, and laws of action, intelligible subjects of scientific investigation." The lump of sugar is an aggregate of such pieces in the same sense that a stellar cluster is an aggregate of suns. So long as the sugar remains sugar, the integrity of the molecules is preserved, but when in a chemical process the sugar disappears and new products result, the sugar molecules are broken up and new molecules are formed from the fragments. In every chemical process the change takes place between molecules, and in these changes definite proportions by weight are preserved, because the different molecules have definite weights. When, for example, hydrochloric acid gas combines with ammonia gas, $36\frac{1}{2}$ parts of the first substance unite with 17 parts of the second, simply because these numbers represent the relative weights of their respective molecules, which in the chemical process pair with each other, and form the molecules of the resulting product. This product is called sal ammoniac, and each of the molecules of this compound weighs $43\frac{1}{2}$, the combined weight of its constituents. The modern theory of heat assumes that all thermal phenomena are the manifestations of molecular motions, and that molecular activity is the measure of that condition of matter which we call temperature. In a solid or liquid the molecules are crowded together, and, although in motion, their path is exceedingly circumscribed; but in a gas the molecules are widely separated, and their free path, although not larger than the waves of light, is still large as compared with their own dimensions. This path is limited by the frequency of their collisions; not only with each other, but also against the walls of the containing vessel. As the molecules are perfectly elastic, there is no loss of moving power in these collisions, and if the surrounding temperature is constant and the walls immovable, the total moving power of the molecules in a mass of gas remains invariable. There may result from the collision an accumulation of moving power in some molecules, and a corresponding loss to others, but the mean value will remain unchanged; and this mean value is the measure of the temperature of the aëriform mass. If the

surrounding temperature is different from that of the gas, there will be a transfer of moving power through the walls of the vessel until a condition is reached where the transfer of moving power through the walls in one direction exactly balances the corresponding transfer simultaneously taking place in the opposite direction; and any two bodies are at the same temperature when thus related. Moreover, as material walls must consist of molecules, power can readily pass through such barriers, as it passes along a line of ivory balls in a familiar experiment of mechanics. If a portion of the walls is movable, the impact may impart motion to the mass, as to the piston of a steam-engine or to a cannon-ball; if, however, the walls are fixed, the only effect is the production of pressure.

The pressure exerted by a gas being the effect of molecular impacts, the law of Mariotte is a necessary consequence of this mechanical condition. For if the temperature is constant, the molecules of the gas have a definite mean velocity and a definite mean momentum; and since, if we consider an interval sufficiently long, each molecule must on an average strike the sides of the vessel the same number of times and with the same average impulse, it follows that each molecule must contribute an equal share to the whole pressure. This pressure, therefore, other things being equal, must be proportional to the number of molecules in the vessel, or, what amounts to the same thing, to the quantity (or weight) of the given gas which the vessel contains; and this is a form of statement of Mariotte's law. According to this law the pressure of a gas is inversely proportional to the volume, or, what comes to the same thing, directly proportional to its density; and our theory not only explains this general principle, but further shows that if different portions of gas are forced into the same vessel, each must exert its own pressure independently of the rest; and this, too, whether these portions be of the same gas or not. Assume next that while the number of molecules (that is, the quantity of gas) in the vessel remains the same, their mean velocity increases; it is evident that each molecule will now strike the sides of the vessel a greater number of times in a second, and also that the momentum of each impact will increase in the same proportion. Hence the part of the pressure due to each molecule will increase not simply as the velocity, but as the square of the velocity; and if we represent by $m$ the common weight of the molecules of a given mass of gas confined to a constant volume, and by $V$ their mean velocity, then the pressure exerted by the gas on the unit-area, or the height of the mercury column which measures that pressure, will be proportional to the product $mV^2$, or to $\frac{1}{2}mV^2$, which represents the moving power of the molecules. But the height of a mercury column so related (in the form of the air-thermometer described above) is the actual measure of what has been called the absolute temperature; and thus is reached not only a perfect dynamical explanation of that feature of gases on which the air-thermometer is based, but also a remarkable confirmation of the generalization drawn from these phenomena. Moreover, as the same general result must follow, whatever be the nature of the gas ($m$ in the formula representing the molecule of any gas), there is also found in the theory a simple explanation of the fact discovered by Charles, that all gases undergo equal changes of volume or tension when heated or cooled through the same number of degrees. Again, Prof. Maxwell has proved that if "molecules of different masses (that is, of different gases) knock about together," the exchange of velocities which results from the collision will tend to bring the whole mass to a condition in which on an average every molecule, great or small, has the same moving power, the lighter molecules acquiring a sufficiently greater velocity to compensate for their smaller mass. This principle must be equally true when the molecules of the different gases are separated by any partition through which velocity may be transferred; and hence when masses of two different gases are at the same temperature $\frac{1}{2}mV^2 = \frac{1}{2}m'V'^2$. From this theorem of molecular mechanics several important consequences follow. In the first place, equal volumes of different gases at the same temperature and pressure must contain an equal number of molecules. For consider two similar vessels filled with different gases under these conditions. As has been seen, the part of the pressure due to a single molecule in either vessel is proportional to its moving power; and if the average value of the moving power of the molecules in the two vessels is the same, it is evident that the total pressure must depend in each case on the number of molecules, and, these pressures being equal, the number of molecules must be the same. This important truth which is thus shown to be a necessary consequence of the dynamical theory, is known as the law of Avogadro or Ampère. It was first stated by Amedeo Avogadro, an Italian physicist, in 1811, and was reproduced by Ampère, a French physicist, in 1814. In the second place, the molecular weights of different substances must be proportional to their densities in the state of gas. For if the unit-volumes of two gases contain, under like conditions, the same number of molecules, it is evident that the weights of these equal volumes must be as the weights of the molecules. Hence molecules may be weighed against each other simply by determining gas or vapor densities; and since the results thus obtained closely correspond with the combining proportions of chemistry, the facts of this science furnish still further confirmations of the molecular theory. In the third place, if $\frac{1}{2}mV^2 = \frac{1}{2}m'V'^2$, then $V : V' = \sqrt{m'} : \sqrt{m} = \sqrt{\delta'} : \sqrt{\delta}$; and it follows that under like conditions the velocities of different molecules are inversely as the square roots of the densities of the aëriform masses of which they are parts: and here is seen the simple mechanical principle underlying the laws of effusion and diffusion discovered by Graham. Moreover, the molecular theory explains the peculiar relations of these two classes of phenomena. When the molecules of any gas rush into a vacuum, they hurry through the aperture with a rapidity which is commensurate with their great velocity; but when they rush into the equally empty space between the molecules of another gas, they are so jostled about by the collisions which ensue that they make but very slow progress. Still, as the molecules of all gases are retarded in the same proportion, their relative rate of progress is not altered.

The dynamical theory makes it possible to calculate not only the relative but also the absolute velocity of the molecules of different gases. A cubic centimeter of hydrogen gas, at the normal temperature and pressure, weighs $\frac{89.5}{10000000}$ of a gramme, and exerts a pressure of 1,033 grammes on each face of the cube; and it is easy to calculate the velocity with which the parts of this small mass must move in order that the component in the direction of either face of the cube should produce such a pressure. The result is 1,843 meters in a second; and although the velocity of the molecules of other gases must be less in proportion as their mass is greater, according to the law already stated, the velocity is in all cases very large as compared with that of a rifle-ball. The velocity of the molecules of gases and their relative masses are values accurately known, because they are direct deductions from observations which can be made with great precision; and even if the theory is false and there are no such things as molecules, these values are quantitative relations which any new theory must equally explain. The scope of the dynamical theory, however, is far wider than could possibly be exhibited in a brief popular article. It embraces molecular magnitudes of which knowledge is far less accurate and certain than in regard to those described, both because the relations involved are more doubtful and because the values depend on measurements which are not susceptible of the same accuracy. Among these may be mentioned the length of mean path, the number of collisions in a second, and finally the number of molecules in a cubic centimeter of any gas under normal conditions, and the absolute diameter and mass of molecules of different kinds. The following table is taken from an article* on molecules by Prof. Clerk Maxwell:

MOLECULAR MAGNITUDES.

| RANK. | Hydrogen. | Oxygen. | Carbonic oxide. | Carbonic dioxide. |
|---|---|---|---|---|
| RANK I. | | | | |
| Mass of molecules when that of hydrogen is 1 | 1 | 16 | 14 | 22 |
| Velocity (of mean square) meters per second at 0° C. | 1,859 | 465 | 497 | 396 |
| RANK II. | | | | |
| Length of mean path in ten billionths ($10^{-10}$) of a meter | 965 | 560 | 482 | 379 |
| Collisions in a second, number of millions | 17,750 | 7,646 | 9,489 | 9,720 |
| RANK III. | | | | |
| Diameter in hundred billionths ($10^{-11}$) of a meter | †58 | 76 | 83 | 93 |
| Mass in ten million million million millionths ($10^{-25}$) of a gramme | 46 | 736 | 644 | 1,012 |

* *Nature*, Sept. 25, 1873.

† Two million hydrogen molecules in a row would occupy a little over a millimeter.

In a cubic centimeter of any gas at the standard temperature and pressure there are nineteen million million million ($19 \times 10^{18}$) molecules. J. P. Cooke.

**Gas-burners**: See Gas-lighting.

**Gas'ca**, Pedro, de la: Spanish lawyer, ecclesiastic, and administrator; b. at Barco de Avila, Castile, 1485. He was doctor of theology and canon law, member of the council of the Inquisition, and had charge of some notable heresy trials. After Gonzalo Pizarro had rebelled in Peru, Gasca was sent in 1546 to regulate the affairs of that country; he took only the title of president of the royal council, but had practically unlimited powers. On reaching Santa Marta (July, 1546) he heard that the viceroy, Nuñez Vela, had been defeated and killed, and that Pizarro had possession of all Peru and of the Isthmus of Panama. Gasca had no military force, but he managed to win over the commandant at Nombre de Dios. Hinojosa finally submitted to him at Panama, giving up the whole of Pizarro's fleet (Nov. 19, 1546); Centeno, Valdivia and Benalcazar sent messages promising support; and when Gasca landed at Truxillo, Feb., 1547, hundreds flocked to his standard. Pizarro defeated Centeno in the south, but when he met Gasca at Saesahuana, near Cuzco, his soldiers deserted, and he was captured almost without a blow (Apr. 9, 1548). Pizarro, Carvajal, and others were executed, and Gasca showed great cruelty in his treatment of the rebels. He finally slipped away from Peru in Jan., 1550, leaving the government in the hands of the audience, though affairs were still in great confusion. Charles V. received Gasca with great honor; he was made Bishop of Palencia and afterward of Siguenza, and was influential in colonial matters. D. at Valladolid, Nov., 1561. See Prescott's *Conquest of Peru*; Markham's *Peru*. Herbert H. Smith.

**Gascoigne**, găs-koin', George: English poet; b. probably in Westmoreland in 1525; studied at Cambridge, and in 1555 was admitted to Gray's Inn; became distinguished as a dramatist, but being disinherited by his father, Sir J. Gascoigne, in consequence of his excessive expenses at court, he took ship for Holland in 1572, where he served with distinction, but was made prisoner by the Spaniards, who sent him back to England, where he resumed his occupations as dramatist, courtier, and poet. He was "the first English satirist" and "the first English critic in poesy"; now chiefly remembered for *The Steele Glas* (1576), a blank-verse satire, and *The Complaynt of Philomene*, a rhyming elegy (1576). D. in Stamford, Lincolnshire, Oct. 7, 1577. There is an excellent edition of his principal poems, with full bibliographical details, by E. Arber (1868).

**Gascoigne**, Sir William: chief justice of England in the reign of Henry IV.; b. about the middle of the fourteenth century, at what date is uncertain; appears to have practiced as an advocate in the reigns of Edward III. and Richard II.; was attorney to the exiled Henry of Lancaster, who soon after his accession to the throne as Henry IV. appointed Gascoigne his chief justice. The latter won for himself the reputation of an able and fearless judge, who did not hesitate to oppose the wishes of the king and to assert the principle that the crown itself is subject to the law. When the revolt of the Percys was put down, Gascoigne was commanded to pronounce sentence of death on Archbishop Scrope and Mowbray, the earl marshal, both implicated in the rebellion, but he refused to obey, maintaining in the case of the former that there was no civil tribunal in the land with authority to condemn a bishop to death, and in the case of Mowbray that he had a right to a trial by his peers. The famous story of Gascoigne's arrest and punishment of the young Prince Henry, who had violated the dignity of the court, has been discredited by modern critics, but appears in several of the chronicles, although they generally fail to give the name of the judge. The story, though inaccurate, is characteristic of Gascoigne, and it is probable that Shakspeare's version in *Henry IV.* is not without some historical foundation, though Henry V.'s magnanimous retention of the judge in his position appears to have been a mere poetic invention. D. in 1419. F. M. Colby.

**Gasconade**, găs-cō-nād': a river rising by several headstreams in Wright co., Mo., and flowing nearly N. N. E. through a broken and densely wooded region, which affords much timber. It is navigable at high water by small steamboats for 66 miles. It flows into the Missouri river 40 miles below Jefferson City.

**Gas'cony** [from Fr. *Gascogne*, deriv. of *Gascon* < *Vasco*, the Lat. form of the name *Basque*]: an old province of France, between the Pyrenees, the Garonne, and the Atlantic, comprising parts of the present departments of Landes, Gers, Hautes-Pyrénées, Haute-Garonne, Tarn-et-Garonne, and Lot-et-Garonne. In the sixth century it received its name from the Basques (*Vascones*, *Vasques*), who were driven by the Visigoths across the Pyrenees and settled here. Half a century later it became a part of Aquitania, and in 1152, when Eleanor married Henry Plantagenet, it became an English possession, and remained so until 1453, when the French reconquered it. Its capital was Auch. Its inhabitants—whose Basque descent is very apparent, but who also show unmistakable vestiges of Gothic blood—were noted for their strength, connected with a certain phlegmatic slowness, their indomitable courage, and an irrepressible passion for boasting.

**Gas-engine**: a name given to certain prime movers in which the motive-power is derived from the expansive or explosive energy of a mixture of inflammable gas with atmospheric air behind a driven piston. These engines were originally operated by means of the gas in ordinary use for artificial illumination; but it has been found that the vapor of any volatile hydrocarbon will serve equally well, and this fact has contributed to the availability, if not also to the economy, of this source of motive-power, as applied in portable or locomobile motors. The earliest attempts to direct the energy of powerful explosives to the uses of the industrial arts were made with gunpowder. By exploding a moderate charge in a close chamber having valves opening freely outward, the air will be expelled from the chamber and a vacuum, or a near approach to one, will be produced. The apparatus employed, however, by the early experimenters (among whom was the illustrious Huyghens) were exceedingly rude, and no economically useful results were reached in this direction (1680). The possibility of securing a better success by the use of inflammable gas subsequently occurred to more than one inventor. In Great Britain credit is claimed for John Barber, 1791, and for Mead and Street, 1794. In 1799 the first French engine was devised and patented by an ingenious artisan named Le Bon, but it was not an industrial success, attracting little notice in the scientific world of the period and inspiring no practical confidence. The engine of Le Bon had the general form of a reciprocating steam-engine, and operated as follows: From a reservoir containing a sufficient supply of inflammable gas a certain measured charge was drawn and introduced, in mixture with a similarly measured charge of atmospheric air, into the cylinder, on alternate sides of the piston successively; and this mixture was then fired by means of the electric spark. The inventor seems to have overlooked no provision necessary to secure the success of his design. His engine was entirely self-regulating, and mechanically as well as theoretically it was a success. But economically it failed: for at that time inflammable gas had not been introduced for the general purposes of illumination, and its preparation for the engine involved a disproportionate expense; static electricity, so dependent on atmospheric conditions for its regularity of action, was the only known source of the electric spark; and finally the mechanic arts were yet unequal to the requisitions of a problem involving the peculiar difficulties which the construction of this engine presented.

A reproduction to all intents and purposes of the engine here described was patented in France in 1860 by an inventor named Lenoir. A description of it in detail may be found in the *Annales du Conservatoire des Arts et Métiers*, of Paris, for the year 1866, and in the report by Dr. F. A. P. Barnard made to the Government of the U. S. on the Machinery and Processes of the Industrial Arts and the Apparatus of the Exact Sciences in the Universal Exposition of 1867, which forms the third volume of the reports of the U. S. commissioners on that exposition. Such a detailed description is unnecessary here, since the particulars which it embraces, which relate to the mechanical expedients employed for introducing and firing the charge, and for maintaining the action when the motive force is zero or negative, do not in any manner concern the principle. In its general appearance this engine very much resembles an ordinary reciprocating steam-engine; but there is a very important difference between the two, in the respect that, in the steam-engine, the pressure on the piston is maximum when the induction-valve is open; while in the gas-engine, on the contrary, in which the charge does not force its own way into the cylinder but is drawn in by the movement of the

piston, the pressure during this period, as shown by the indicator card, is negative, and uniformity of movement can only be maintained by means of a heavy fly-wheel. The inequality of pressure at different periods of the effective stroke is also very great, the maximum being between five and six atmospheres, and the mean not more than half an atmosphere. The engine of Lenoir found its way somewhat extensively into use, having been employed not only in Paris and most of the provinces in France, but also in other European countries, including Russia, and in Cuba, Peru, and Chili. It was not called an economical source of power, since from the test experiments made on it by Prof. Tresca, assistant director of the Conservatoire, its consumption of gas under the most favorable circumstances amounted to $2\frac{1}{10}$ cubic meters (about 100 cubic feet) of gas per horse-power per hour. Six pounds of coal employed in raising steam would perform the same work, and at $6 a ton would cost but 2 cents, while 100 cubic feet of illuminating gas would then cost in Paris about a franc, and in the cities of the U. S. from 25 to 35 cents.

Another engine belonging to this class, and in many respects resembling the one just described, was that of Mr. Hugon, also of Paris. Hugon's engine employs two little constantly burning gas-jets placed just outside the valve-box, instead of the electric spark, to fire the successive charges in the cylinder. Two little movable jets in recesses constructed in a slider operated by the engine are alternately lighted at the external burners, and then drawn inward by the slider, so as to inflame the charges at the proper moment. The movable jets are of course extinguished by the explosion, but on the reversal of the movement of the slider they are relighted again at the external burners. Another peculiarity of this engine is that, along with the explosive charge, there is introduced a small amount of water, which, being converted into steam by the heat generated in the explosion, moderates the violence of the action, and sustains better the pressure during the stroke. At the Universal Exposition of 1862 in London a gas-engine was exhibited by the well-known engineers W. and C. F. Siemens in which this peculiarity—viz., the introduction of water into the cylinder—was carried much further than is done by Mr. Hugon, the object being to generate as much steam as the heat furnished by the combustion of the gas would allow. A regenerator was also employed to receive the heat of the exhaust gases, and to transfer it to the entering charge. Though no exact statements of the economy of working this engine appear to have been published, it would seem in theory to be preferable to either of those described above, both as regards steadiness of action and cost of maintenance. It appears, nevertheless, to have been abandoned. The consumption of gas in the Hugon engine, including that employed in maintaining the permanent lights, amounted to 2·6 cubic meters per horse-power per hour. There is also in this engine the same inequality of pressure at different periods during the stroke that has been remarked in the Lenoir engine.

In all engines of this class it is necessary that a current of cold water should be kept constantly circulating around the cylinder, to prevent its becoming overheated; and in order to facilitate this object the cylinder is surrounded by a jacket, leaving a free interval for such circulation.

A gas-engine quite different in principle from either of the foregoing was exhibited at the Paris Exposition of 1867 by its inventors, Messrs. Otto and Langen, of Cologne in Rhenish Prussia. Externally, this engine presented the appearance of a Doric column, somewhat more than a meter in height, upon the enlarged capital of which is fixed a horizontal plate which supports the arbor of the fly-wheel and other parts of the machinery. This column is the working cylinder. The mixed gases—common coal-gas and air—are introduced at its base, and fired by an ingenious mode of communication with a gas-jet which is constantly burning. The base is surrounded by a jacket between which and the cylinder itself there is maintained a refrigerating current. By the explosion of the gas, the piston, which is rather heavily weighted, is driven to the top of the cylinder. The collapse which immediately follows produces a partial vacuum beneath the piston; and this now descends, urged by the pressure of the atmosphere with its own weight superadded. In order to transfer this force to the working arbor of the machine, the piston-rod is on one side provided with a rack which acts on a spur-wheel on the arbor. This wheel is loose on the arbor, but is free to turn in one direction only—that is, the direction which corresponds to the rising of the piston. Two tall uprights serve as guides to the piston and give stability to the machine. When the piston descends, its energy is transferred through the spur-wheel above mentioned to the arbor. A fly-wheel maintains the movement during the intervals in which the piston is ineffective. From experiments made upon this engine with a Prony dynamometer before a jury of the exposition, it appeared that its consumption of gas amounted, on an average, to a very little over a cubic meter (say 38 cubic feet) per horse-power per hour. It exhibits, therefore, a large economy over the engines of Lenoir and Hugon; but it is very noisy in its operation, and the violence of its action, during the first part of each pulsation, is such as to limit its employment to comparatively low powers.

It has been already stated that the vapor of the more volatile hydrocarbons may be substituted in all of these motors for the permanent inflammable gases, without prejudice to their mechanical efficiency; but in point of economy it is probable that coal-gas will generally be found to be the cheaper fuel of the two. (See FUEL.) Some inventions of this class have nevertheless been devised with special reference to the use of such vapors. One of these, by Mr. Julius Hock, of Vienna, presented at the International Exposition in that city in 1873, and put forward with a good deal of pretension as "differing completely from anything which had ever been done before," was nevertheless in every essential respect a Lenoir engine burning vapor instead of gas, and is therefore entitled to no further mention here.

The next type of engine to be developed was the expansive type known as the Brayton engine, patented by George B. Brayton, Apr. 2, 1872. This engine, while using a mixture of gas or vapor with atmospheric air, compresses it into a reservoir, from which it flows through a gauze or grating into the working cylinder. It is there inflamed and expands, doing work against the piston, while the wire gauze prevents the rush of flame backward into the reservoir. Some accidents have been known, due, however, to defect in the separating material.

The efficiency of this engine is due to the expansion of the air introduced, and of the products of combustion (carbonic acid and steam) by the heat generated in the same combustion. The pressure in the cylinder is no greater than that in the reservoir. The opposing pressure is at first only that of the atmosphere, but rises toward the end of the stroke to be equal also to that in the reservoir. The action of the engine therefore in every respect resembles that of a hot-air engine; and it is to this class, rather than to the class of gas-engines, that it properly belongs. Though hot-air engines are in theory the most economical of engines driven by heat, the economy of theory has never been realized from them in practice, in consequence of the extreme difficulty of imparting heat to air. Radiant heat in this case produces but little effect; and to heat air thoroughly by contact requires a complicated construction which seriously impedes circulation and increases the resistance of friction. The Brayton motor has practically solved this difficulty by mingling the fuel with the air itself, so that the whole heat of combustion is imparted to the air directly. It is therefore a hot-air engine without a furnace, or one in which the furnace is the cylinder.

When the economical performance of this engine was tested it was found that the consumption of gas amounted to $32\frac{96}{100}$ cubic feet per horse-power per hour, being less than that of the Otto and Langen engine by about 18 per cent. But the steadiness of action of this engine adapts it to high as well as to low powers; and it works silently, while the one just mentioned creates an intolerable din. It is obvious that the Brayton engine might be made double-acting by employing separate pumps for the reservoir.

The modern gas-engine in its successful and more economical form dates from the introduction in 1876 of the form of Otto engine to which the trade name of "Silent" was given, by virtue of its practical abandonment of the explosive idea. The success of this form of motor has given rise to a great development and to a more detailed study, whereby the motors of this class have been divided into two great groups.

The first group includes those types of motor in which the explosive mixture enters the cylinder at atmospheric pressure or without compression. The second great group includes those in which the mixture of air and gas is compressed before it enters the cylinder for ignition. The first group presents two types, the first being that in which the explosive force is directly used to do work upon the motor

piston, and of this the Lenoir is the standard type. The second type uses the explosive force indirectly, the actual motor energy being the pressure of the atmosphere upon the piston, behind which is a vacuum. The Otto and Langen engine is the standard of this second type, as are also those of Barsanti and Matteucci (1854), Robson, and other British designs. The second great group, or compression class of motors, are much the most frequently used, are more powerful for small bulk, and more economically efficient. It appears in two forms, first where the ignition of the combustible mixture is followed by a sudden rise of pressure in a volume sensibly constant, and the second type where the gas mixture is gradually ignited as it enters, expanding at constant pressure in a varying volume. Of the first type, the new Lenoir, the Clerk, Griffin, Fielding, and Day motors all follow the Otto principle, which was first proposed by Barnett in 1838, but was not successfully applied until the design of 1876 of Otto.

Of the second great type, the Brayton, Siemens, Foulis, and Simon are English examples. The Otto cycle consists of four steps: The first is inspiration of a mixture of gas and air at atmospheric pressure. Second, a compression of the charge thus drawn in upon the return of the piston. Third, a combustion and expansion of this compressed charge, whereby the piston is driven forward and the industrial resistance overcome. Fourth, the discharge of the products of the combustion by the opening of an exhaust valve at atmospheric pressure. The Otto and Clerk engines differ mainly in that the Otto has the compression and driving functions both done in the working cylinder, so that a working stroke occurs once in every two revolutions, while the Clerk engine uses an auxiliary cylinder for inspiration and compression, and gets, in this way, a working stroke for each outward motion of the working piston. In the second type of engine the separate compressor is a necessity, or else the working cylinder must be closed at its outboard end, so that it shall be competent to inspire and compress on one side of the piston, while the other is the distinctly motor side. In this type of engine the cycle has four periods, as before: First, compression of the mixed gas and air inspired by previous stroke; this compression will be most likely adiabatic. Second, slow combustion of the mixture at constant pressure, while the working piston moves outward. Third, expansion after the admission valve closes, the curve of such expansion being adiabatic. Fourth, exhaust of the products of combustion at atmospheric pressure, which is synchronous with the stroke of inspiration. Of course, single-acting engines of all these types, involving the Otto or the other cycle, can be made double acting by the use of two working cylinders.

Gas-engines may be again classified according to the method used for igniting the charge of mixed gas and air. Three methods are usual: First, by means of the direct contact between the combustible working fluid and a naked gas-flame. The flame may either be uncovered to the mixture in the cylinder or may be introduced into it. The second principle is by the passage of an electric spark between suitable electrodes within the cylinder and surrounded by the mixture. The objection to this method is the annoyance from the deposit of lampblack which coats the terminals and stops their sparking. The third plan is to cause the combustible gas to ignite by contact with an incandescent surface, the surface being maintained at the necessary temperature either by an external flame or by the heat of the products of combustion themselves.

The oil-engine differs only from the gas-engine by reason of the necessity for making an inflammable vapor by mechanical means instead of by distillation. This is usually done by forcing air through the liquid fuel, finely dividing it, and the finely divided spray is then made into a gas by further heat. Recent British types of such motors show that this object has been sought in three general ways: The first type converts the vapor into gas in the working chamber upon its ignition; the second type converts the spray into gas in an extension of the working cylinder, either open to it or closed by an admission valve; the third class converts the oil to a gas in a separate vaporizer, heated by a lamp using oil as fuel under a forced combustion.

Recent improvements in the economy of the gas-engine have brought the consumption of gas per indicated horse-power down to a figure within 19 to 24 cubic feet of gas per hour. This would make, with gas at $1.25 per thousand cubic feet, the hourly cost for fuel 2½ cents per horse-power. A steam-engine of small size using 4 lb. of coal per horse-power per hour in cities where coal is $5 per ton will cost for fuel one cent per horse-power per hour. The advantage of the gas-engine must therefore be sought in directions other than its absolute economy for fuel, if run continuously. Such advantages are its compactness, because it requires no boiler; it is instantaneously made ready to run, and expense ceases when it stops; it requires no skilled engineer or licensed artisan to run it; it is clean, without ashes or defiling products of combustion. Its disadvantages arise from the noise of its exhaust or working stroke, from the waste of heat from a high temperature of such exhaust, from the necessity of water-jacketing its cylinder and the loss thus entailed, and from the difficulty of absolutely avoiding an odor in its use. Absolute regularity of speed of rotation is also difficult to attain in many types, by reason of the irregularity of the effort. But for domestic and smaller industrial uses the gas-engine has a particular field of its own, and it is being built on an ever increasing scale, in Great Britain especially.

F. R. Hutton.

**Gas'kell**, Elizabeth Cleghorn (*Stevenson*): author; b. in Chelsea, England, Sept. 29, 1810; married William Gaskell (1805–84), Unitarian minister of Manchester; author of *Mary Barton* (1848); *Moorland Cottage* (1850); *Ruth* (1853); Cranford (1853); *North and South* (1855); *Round the Sofa* (1859); *Sylvia's Lovers* (1863); *Wives and Daughters* (1866), and other novels, all of high moral purpose; also of the *Life of Charlotte Brontë* (1857). D. at Holybourne, Alton, Hampshire, Nov. 12, 1865.

**Gaskell**, Walter Holbrook, M. D.: physiologist; b. in Naples, Nov. 1, 1847. He was educated at Trinity College, Cambridge; entered University Hospital in 1872; studied the circulation of blood through muscle with Prof. Ludwig, at Leipzig in 1874; and, after working in the physiological laboratory and teaching in the physiological department in Cambridge, took his degree in University Hospital in 1878. His paper *On the Rhythm of the Heart of the Frog, and the Action of the Vagus Nerve*, was chosen for the Croonian lecture in 1881. He was elected a fellow of the Royal Society in 1882; made a university lecturer on Physiology in 1883; awarded the Marshall Hall prize of the Royal Medical and Chirurgical Society for his investigations on the sympathetic nervous system in 1888; and in 1889 received the gold medal of the Royal Society for his researches into the innervation of the heart and the nature of the sympathetic nervous system.

**Gas-lighting**: illumination by means of gas, especially of streets and buildings.

*Early History.*—About the beginning of the seventeenth century Van Helmont noticed that when animal or vegetable substances were heated in close vessels, vapors or spirits were obtained which burned with a bright flame. Some time previous to 1691 Dr. John Clayton prepared gas from the bituminous coal of Wigan, collected it in bladders, and burned it for the amusement of his friends. In 1726 Dr. Stephen Hales made similar experiments with Newcastle coal. The Bishop of Llandaff showed in 1767 how gas evolved from coal might be conveyed in tubes, and in 1786 Dr. Pickel, Professor of Chemistry at Würzburg, lighted his laboratory with the gas obtained by the dry distillation of bones. In 1787 Lord Dundonald, of Culross Abbey in Scotland, took out a patent for making coal-tar, and erected ovens for the purpose. The coal-gas produced was burned at the abbey as a curiosity. The real inventor of practical gas-lighting was William Murdoch, who in 1792 lighted his house and office at Redruth, in Cornwall, with gas made from coal, and astonished his neighbors still more by adapting the new light to a small steam-carriage in which he rode to and from the mines. He soon removed to Scotland, and in 1797 lighted his premises at Old Cumnock, in Ayrshire, with coal-gas. In 1798 he constructed gas-works at the shops of Boulton, Watt & Co., in Soho, and first publicly exhibited the gas in 1802 at the Peace of Amiens, when he showed two enormous flames of coal-gas burning from two copper vases at these works. In 1805 the cotton-mills of Phillips & Lee, at Salford, were lighted with gas by Boulton, Watt & Co., under the direction of Murdoch; and at about the same time the mills at Sowerby Bridge were lighted by the same firm, under the direction of Mr. Clegg. In 1799 the French engineer Le Bon took out a patent in France for making gas from wood, with which he proposed to light Paris. In 1804 Winsor lectured on gas at the Lyceum theater in London, exhibiting the gas, but making a great mystery of the process. He finally

obtained permission to light a few street lamps with gas in Pall Mall, which he did in 1809. On Dec. 31, 1813, Westminster bridge was lighted, and soon after the oil-lights in the streets of St. Margaret's, Westminster, were replaced by gas-lights, and about a year later (1815) Guildhall also was lighted.

The manufacture of gas was first attempted in the U. S. at Baltimore, without success till 1821. It was introduced in Boston in 1822, and in 1823 the New York Gas-light Company was started, though it was not in successful operation till 1827.

*Materials used for Making Gas.*—All vegetable and animal substances when exposed in close vessels to a red heat undergo destructive distillation, yielding gas, water, and tar, and leaving a residue of charcoal or coke. A few only are adapted for the economical production of illuminating gas. Bituminous coal is the material generally selected, though under certain circumstances several other substances have been, and are even now, employed. The most important of these are petroleum or some of its less valuable products (as naphtha or residuum), rosin, wood, peat, cheap oils, and fats.

*Coal-gas* is made from bituminous coal. (See COAL.) Of true coals, the cannels yield the richest gas, and in the United Kingdom they are sometimes used exclusively. The caking coal is, however, the chief material employed. The advantage of this variety of coal is due to its abundance and consequent cheapness, and to the fact that when heated it undergoes a kind of fusion, and furnishes a compact porous coke of great value as fuel. The gas from caking coal is inferior in illuminating power, but this deficiency is supplied by the use of a certain proportion of richer cannels and other enriching materials. The accompanying table illustrates the character of a few of the more important gas-coals and enrichers.

*The manufacture of coal-gas* includes three distinct operations: (1) the distillation of the coal; (2) the separation of the water, tar, and other condensable matters—*condensation*; (3) the removal of sulphur compounds and carbonic acid—*purification*.

| GAS-COALS, ETC. | Volatile matter. | Fixed carbon. | Ash. | Gas, per ton of 2,240 lb. in cubic feet. | Candle-power of gas. | Coke, per ton of 2,240 lb. | | Gas purified by 1 bush. of lime, in cubic feet. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Pounds. | Bushels. | |
| I. CAKING COALS. | | | | | | | | |
| Newcastle, England | 32·70 | 65·55 | 1·75 | 10,057 | 10·11 | 1,536 | 49 | 3,500 |
| Glace Bay, Cape Breton | ..... | ..... | ..... | 9,560 | 12·50 | 1,484 | 38 | 1,945 |
| Lingan, Cape Breton | 35·20 | 60·80 | 4·00 | 9,520 | 12·92 | 1,450 | 42 | 2,200 |
| Block House, Cape Breton | 40·80 | 57·70 | 1·50 | 10,217 | 17·32 | 1,460 | 40 | 2,304 |
| Pittsburg, Pa. | 36·76 | 51·93 | 7·07 | ..... | ..... | ..... | .. | ..... |
| Westmoreland, Pa. | 36·00 | 58·00 | 6·00 | 10,642 | 16·62 | 1,544 | 40 | 6,420 |
| Sterling, O. | 37·50 | 56·90 | 5·60 | 10,528 | 18·81 | 1,480 | 36 | 3,993 |
| Despard, W. Va. | 40·00 | 53·30 | 6·70 | 10,765 | 20·41 | 1,540 | 36 | 2,494 |
| II. CANNEL COALS. | | | | | | | | |
| Kirkless Hall, England | 40·30 | 56·40 | 3·30 | 10,012 | 21·47 | 1,410 | 36 | 2,000 |
| Darlington, O. | 43·00 | 40·00 | 17·00 | 9,800 | 34·98 | 1,320 | 32 | 2,806 |
| Petonia, W. Va. | 46·00 | 41·00 | 13·00 | 13,200 | 42·79 | 1,380 | 32 | 4,510 |
| III. ENRICHING MATERIALS. | | | | | | | | |
| Boghead mineral, Scotland | 51·60 | 15·70 | 32·70 | 13,619 | 26·45 | 1,378 | 35 | 3,400 |
| Grahamite, W. Va. | 53·50 | 44·50 | 2·00 | 15,000 | 28·70 | 1,056 | 44 | ..... |
| Albertite, Nova Scotia | 57·70 | 41·90 | 0·40 | 14,784 | 49·55 | 806 | 16·8 | ..... |
| Wollongongite, Australia | 82·50 | 6·50 | 11·00 | 13,716 | 131·00 | 424 | .... | 5,686 |

*Retorts.*—The distillation is effected in long horizontal, semi-cylindrical, D-shaped retorts of cast iron, or more generally of clay, which consist of two parts—the body and the mouthpiece. They are closed when in use by a lid, properly luted and held in place by a screw. The retorts are set in groups or *benches* of three, five, six, or seven, heated by one fire of coke. The coal is charged in at the front of the retort through the mouthpiece, generally in an iron scoop, which is inverted before it is withdrawn, leaving the coal evenly distributed on the bottom of the retort. When the distillation is completed, the lid is removed and the red-hot coke is drawn out into an iron wheelbarrow, spread out in the yard, and quenched with water. About one-third of the coke obtained is required for heating the retorts; the rest is sold. When the charge of 160 or 200 lb. of coal is first introduced into the hot retort, the outer layers only of the coal undergo distillation, yielding condensable vapors very rich in carbon; these, passing through the red-hot retort on their way out, are decomposed into fixed gases of high illuminating power. As the heat continues these outer layers of coal become converted into coke, which is soon raised to a red heat. In the meantime the heat reaches the interior of the charge, and the vapors produced, passing through the red-hot layers of coke, are in turn converted into fixed gas. As each successive portion of vapor has to pass over a larger surface of red-hot coke, it is more and more completely decomposed, and its percentage of carbon, and consequently its illuminating power, reduced. For this reason the quality of the gas deteriorates as the process of distillation continues, till finally little besides hydrogen is evolved. At the last stages of the process the sulphur contained in the coke is said to form bisulphide of carbon, which is a most objectionable impurity. It is considered better, therefore, to interrupt the process at the end of four hours than by continuing it to impair the quality of the whole product by the poor gases of the later stages of the distillation. To prevent the reduction of the illuminating power of the gas by too high a temperature, it is also necessary to remove the gas from the retort as soon as possible, and not to permit its pressure to be increased by obstacles to its ready escape. For the accomplishment of this object an exhauster, or gas-pump, is employed.

*The Standpipe.*—From the retorts the gas and vapors pass up to the *hydraulic main* through the ascension or *standpipe*, which at its lower end is attached to the mouthpiece of the retort.

*The Hydraulic Main.*—This is a large horizontal tube half filled with tar which condenses from the gas, the constant level of which is maintained by an overflow to the tar-well. To prevent the escape of gas from the hydraulic main when the retorts are opened, the standpipe makes a double turn and enters the hydraulic main from above, its end dipping 3 or 4 inches into the tar, which makes an effective seal. The hydraulic main is really the first element of the condensing apparatus, for here the condensable vapors begin to separate, as tar and ammonia-water.

*The Exhauster.*—From this main the gas passes to the *exhauster*, or gas-pump, which pushes it forward to the *condenser*, or refrigerator. The exhauster is provided with a special device to prevent the drawing in of air.

*The condenser* consists of a series of iron tubes placed in the open air, or more commonly in cisterns of cold water. By a simple contrivance the tar and ammonia-water which separate from the gas as it traverses the condenser readily flow off into their respective wells. From 50 to 100 sq. feet of tube-surface is allowed for every 1,000 feet of gas to be cooled per hour. The action of this condenser is more than its name implies. While the warm gas contains steam and various condensable vapors, which are liquefied and separated here, it also bears along a considerable quantity of tar, in the form of globules, spray, or fog, too minute to be deposited by gravity. This tar is already condensed to liquid, and it requires for its separation actual contact with a bath of tar, as in the hydraulic main, or with surfaces wet with tar, as in the tubes of the condenser.

*The Washer.*—The gas next enters the *washer*, and then at many works a scrubber, both designed to render more complete the separation of the tar and ammonia, and also to separate some of the sulphur compounds. The washer consists of a series of compartments, through which the gas passes, and where it is exposed to jets of water.

*The scrubber* is a large chamber partially filled with coke, fragments of fire-brick or paving-stones, which are kept constantly wet by a spray of water. It serves to remove the last portions of tar, etc.

*Products of the Distillation of Coal.*—These may be divided, first, into *gas*, *ammonia-water*, *tar*, and *coke*. The proportion of these products attained varies according to

the quality of the coal used and the temperature of distillation. A fair average is given in the table below:

| | Per cent. |
|---|---|
| Coke | 64 –65 |
| Tar | 6·5– 7·5 |
| Liquid | 10 –12 |
| Gas purified | 15 –12 |
| Impurities and loss | 4·5– 3·5 |
| Totals | 100·0 100·0 |

The composition of each of the principal products is approximately given in the following table:

I. Coke.

| | Per cent. |
|---|---|
| 1. Carbon | 90–95 |
| 2. Iron sulphide | 3–10 |
| 3. Ash | 3–15 |

II. Ammonia-water.

| | |
|---|---|
| 1. Acid ammonium carbonate | $HNH_4CO_3$ |
| 2. Ammonium hydrosulphide | $HNH_4S$ |
| 3. Ammonium sulphocyanide | $NH_4CNS$ |
| 4. Ammonium cyanide | $NH_4CN$ |
| 5. Ammonium chloride | $NH_4Cl$ |

III. Tar.

1. Oils lighter than water, or crude naphtha, containing: *a*, benzene; *b*, toluene; *c*, xylene; *d*, cumene; *e*, pyridine; *f*, carbolic acid; *g*, cresylic acid.

2. Oils heavier than water, otherwise dead oil or tar, commonly called creosote: *a*, carbolic acid; *b*, cresylic acid; *c*, other tar acids; *d*, naphthalene; *e*, quinoline series; *f*, phenanthrene; *g*, carbazol; *h*, anthracene; *i*, acridine; *j*, pyrene; *k*, chrysene; *l*, benzerythrene.

IV. Gas.

| | Per cent. |
|---|---|
| Hydrogen | 38 –48 |
| Carbonic oxide | 9 –14 |
| Methane (marsh-gas) $CH_4$ | 43 –31 |
| Hydrocarbons, $C_nH_{2n}$ | 7·5– 4·5 |
| Nitrogen | 3 – 3 |

The constituents of coal-gas may be divided into three classes:

1. *The Luminants.*—These when burned deposit free carbon in the flame and cause it to give light. All the hydrocarbons fall in this class.

2. *Diluents.*—These give heat, but no light. They are hydrogen and carbonic oxide.

3. *Impurities.*—These are mainly nitrogen and carbon dioxide, which diminish the luminous effect of the gas. But besides these there are other impurities present in coal-gas in small quantities, especially ammonia and compounds containing sulphur.

*Purification.*—The impurities, which are not separated from the crude gas either in the condenser, washer, or scrubber, are all more or less objectionable. All the sulphur compounds produce sulphurous acid, and probably some sulphuric acid, when the gas is burned, which vitiate the atmosphere, and may even cause serious damage to books and silks and other textile fabrics. Ammonia is objectionable, because it attacks the fittings, corrodes the meters, and fixes the stopcocks. Nitrogen diminishes slightly the illuminating power of the gas, as it absorbs a portion of the heat of combustion, without contributing either heat or light. It may also form nitrous or nitric acid, and thus vitiate the atmosphere. Oxygen is more objectionable than nitrogen; it diminishes the illuminating power of the gas very materially. Carbonic acid also occasions a considerable loss of light; 1 per cent. of this gas is said to diminish the illuminating power of coal-gas 5 per cent.

The principal methods of purifying gas are:

1. *The Dry-lime Process.*—In this process dry or slightly moist hydrate of lime is placed on trays in iron boxes, through which the gas is made to pass. This process is very effective, and has very generally superseded the wet-lime process. It removes the sulphur compounds and the carbonic acid equally well. When the foul lime is removed, however, it evolves the same odor which caused the wet-lime process to be abandoned. When exposed to the air it rapidly undergoes oxidation, becoming heated in consequence. During this process it evolves sulphide of ammonium, and some other compounds whose exact nature is not known, but whose odor is extremely offensive. After the oxidation of the foul lime is completed, it ceases to be specially offensive, the peculiar stench being evolved during the first hour or two of exposure.

2. *The Laming Process.*—In 1849 Mr. Laming introduced the hydrated sesquioxide of iron as a substitute for lime for purifying gas, preparing it of a suitable quality by mixing copperas (sulphate of iron) with slaked lime and sawdust, and exposing the mixture to the air to oxidize the protoxide of iron to the sesquioxide. The resulting mixture contains hydrated sesquioxide of iron, sulphate of lime, and sawdust. When an excess of hydrate of lime is employed, the resulting mixture contains this substance also. This material is very effective in removing the sulphur compounds from the gas. Two important advantages attend the use of this mixture: first, when fouled it does not evolve offensive odors on exposure to the air; second, by exposure to air the sesquioxide of iron, which has been changed to sulphide of iron in the purifier, is regenerated, the sulphur being liberated and sesquioxide of iron again formed.

3. *The Iron-ore Process.*—A few months after Laming introduced the artificial hydrated sesquioxide of iron in France, J. M. Hills applied the natural hydrated sesquioxide of iron, or "bog-iron ore," in England. This material, as well as the Laming mixture, may be used again and again, and does not evolve offensive odors when exposed to the air. As the bog-iron ores of this neighborhood are not sufficiently pulverulent to act promptly on the gas, Messrs. St. John and Cartwright add to the ore a quantity of iron borings or turnings, which they then convert into an artificial hydrated sesquioxide of iron by moistening the whole with ammoniacal liquor and exposing it to the air. The resulting mixture of natural and artificial oxide receives an addition of coarsely pulverized charcoal. This mixture is always sprinkled with ammoniacal water before it is placed in the purifier.

*Extent to which the Different Methods of Purification are Employed.*—The dry-lime process, though still in general use in the U. S., has been almost universally abandoned in Europe, first, because the foul lime was an intolerable nuisance; second, because the process is too expensive, as the lime can be used but once, and when exhausted has but a trifling value as a fertilizer. The iron-ore method is now most generally used in Europe, and has obtained a foothold in the U. S.

*Composition of the Purified Gas.*—The following table shows the percentage composition of the purified coal-gas as it is delivered to consumers:

| ELEMENTS. | Heidelberg. | Bonn. | Chemnitz. | London common. | London cannel. |
|---|---|---|---|---|---|
| Hydrogen | 44·00 | 39·80 | 51·29 | 46·00 | 27·70 |
| Marsh-gas | 38·40 | 43·12 | 36·45 | 39·50 | 50·00 |
| Carbonic oxide | 5·73 | 4·66 | 4·45 | 7·50 | 6·80 |
| Olefiant gas and other hydrocarbons | 7·27 | 4·75 | 4·91 | 3·80 | 13·00 |
| Nitrogen | 4·23 | 4·65 | 1·41 | 0·50 | 0·40 |
| Oxygen | not det. | not det. | 0·41 | not det. | not det. |
| Carbonic acid | 0·37 | 3·02 | 1·08 | 0·70 | 0·10 |
| Aqueous vapor | not det. | not det. | not det. | 2·00 | 2·00 |

*The station-meter* is the apparatus through which the purified gas next passes on its way to the holder. This is constructed on the same principle as the wet meter, described further on; it measures the gas produced and registers the quantity in cubic feet.

*The holder or gasometer* is the vessel in which the gas is stored. It consists of an enormous bell, or a cylinder with a conical top, constructed of iron plates, and floating in a cistern of water. The bell is supported by chains led over pulleys fastened to iron columns, and provided with weights to counterbalance the greater part of the weight of the holder, which is not allowed to exert a pressure on the gas more than equivalent to a column of water 6 inches high, this pressure being sufficient to force the gas through the mains to the consumers. In order to economize depth in the cisterns the holders are often telescopic.

*The governor or pressure-regulator* is an automatic valve through which the gas passes from the holder to the consumers. It serves to regulate the pressure of the gas in the mains.

*The mains* distribute the gas throughout the city, being laid about 3 feet under ground. They are generally made of cast iron, and are from 24 inches down to 3 inches in diameter. They are cast in convenient lengths, one end being enlarged into a socket, which receives the small end of

the next length. The joint is made tight with hempen rope and lead. A certain percentage of leakage is unavoidable, but this can be reduced to a minimum by the exercise of a little care. Immersing the pipes in hot coal-tar is a very effective preventive of leakage. Leakage is said to often amount to 16 per cent. of all the gas produced, or even more; by the above-mentioned precaution it may be reduced to 2 per cent.

*Service-pipes* of wrought iron convey the gas from the mains to the buildings of the consumers. They should be protected when crossing sunken areas, as otherwise they are liable in cold weather to be entirely closed by the hoar-frost formed in them by the freezing of the aqueous vapor always present in gas.

*The house-meter* receives the gas when it enters the premises of the consumer, measures the quantity which passes through it, and records it in cubic feet on a series of dials.

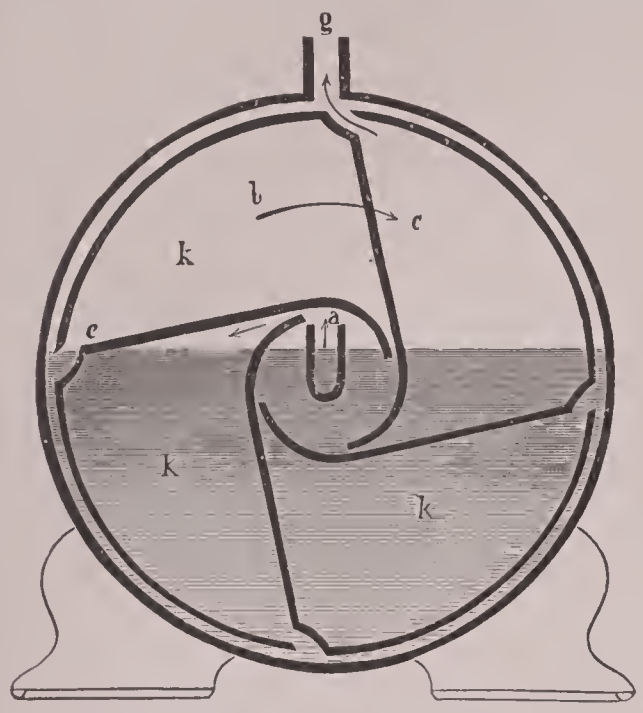



FIG. 1.—Vertical section of the early wet meter. The gas enters the chambers $k$ at the center through the tube $a$, and passes out through the slits $e$ on the periphery of the drum, escaping at the outlet $g$.

Samuel Clegg in 1815 constructed the first meter, consisting of two gas-holders working alternately, which was a failure. In 1816 he invented a rotating meter, applying the principle on which all wet meters are now constructed.

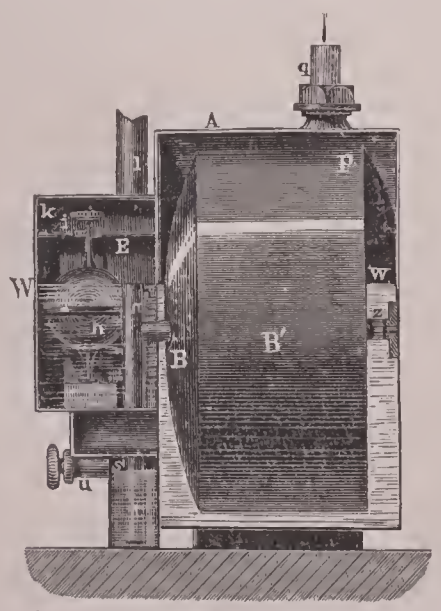



FIG. 2.—Section of the modern wet meter, shown also in Figs. 3 and 4. The gas enters by the inlet-pipe $l$ to the space $k$, passes through the valve $i$ to the space E, through the tube $n$ to the space B of the drum, through the inlet slits to the measuring chambers, thence through the outlet slits to the space above the water-line W, and through the outlet pipe $q$ to the burners. The tube $n$ serves also as an overflow, and carries the excess of water to the waste-water cistern $m$ (Fig. 3). W is the water-level, regulated by the overflow-tube $n$. If the level falls, the float $h$ drops and closes the valve $i$, preventing the passage of gas through the meter.

This meter was still very imperfect. In 1819 John Malam invented the four-chambered drum meter, which was improved by Crosley, Wright, and others, and is now in use. Malam also invented a dry meter in 1820, consisting of six bellows radiating from a shaft. In 1833 Bogardus, an American (Bojardin, a Frenchman, some say), invented a dry meter, which consisted of a vessel divided by a flexible diaphragm, which was the parent of all subsequent dry meters. Defries invented the three-chamber dry meter now in use, and Croll and Richards invented the two-chamber or double-bellows meter now very generally used. Two kinds of meters are now employed: (1) the "wet meter," which must be partially filled with water to be effective; (2) the "dry meter," which requires no liquid. *The wet meter* consists of a hollow metal case containing the measuring drum, and a box front containing the regulating valves and the gearing which connects the measuring drum with the index dials. The measuring drum is divided into four compartments or chambers by oblique partitions. This drum revolves upon a horizontal axis. It is immersed about three-fifths in water, receives the gas through inlet slits on one side and discharges it through outlet slits on the opposite side. The compartments are occupied successively by gas and water. The position of the slits of each compartment is such that one or the other is always below the water-line; thus the gas can never enter the chamber and escape from it at the same time. The surface of the water forms the bottom of the measuring chamber, and the water-level determines the capacity of the gas-space in each chamber. As the drum revolves, the inlet slit emerges above the water-line, when gas enters, imparting an impetus to the drum, which continues to revolve, the space in the chamber above the water-line receiving gas till the chamber is full. Although there are four chambers in the drum, the obliquity of the dividing partitions makes nearly a half revolution necessary to bring the outlet slit above the water-line; this occurs an instant after the inlet slit on the opposite side has passed below the water-line. As the chamber now passes below the water-level, the gas escapes, and the chamber is finally filled with water, the drum operating on the principle of a turnstile. It is the pressure of

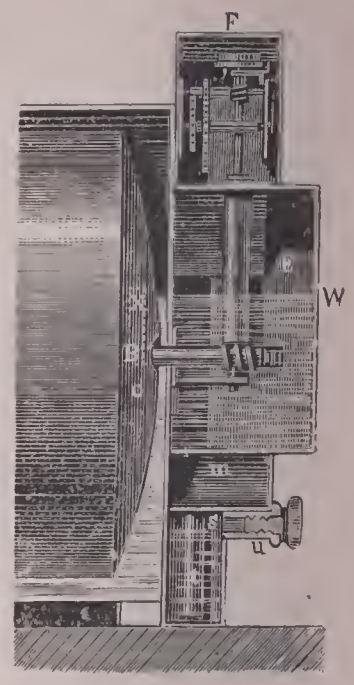



FIG. 3.—Section of the modern wet meter, shown also in Figs. 2 and 4, described under Fig. 2.

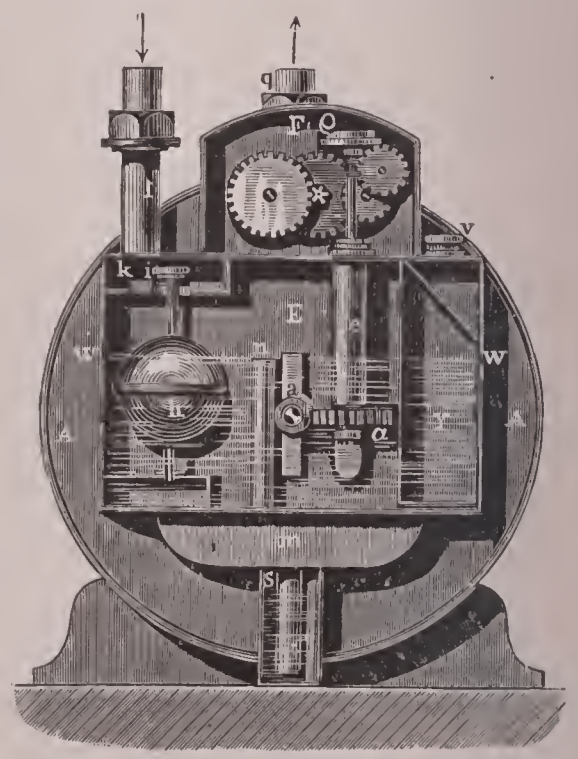



FIG. 4.—Front section of the modern wet meter, shown also in Figs. 2 and 3. $a$ is the screw on the axis of the drum which turns the toothed wheel $\alpha$, the axis of which passes through the tube $e$ to the system of wheels in the space F which move the hands on the index-dials shown in Fig 7.

the gas acting on the compartments of the drum in succession that causes it to revolve. Unless there is a free escape for the gas from the meter through the burners, the rotation of the measuring drum ceases, as the pressure on the outlet side of the drum becomes equal to that on the inlet side, and there is no pressure against the compartments. The revolutions of the drum are registered by the action of an endless screw on its axis, which moves a train of toothed wheels bearing hands on dials, which indicate cubic feet. As the position of the water-line regulates the capacity of the measuring chambers, it is carefully protected by very simple devices. To prevent its falling by evaporation of water into the gas, and thus causing the meter to pass more gas than it registers, a float-valve is provided (*h i*, Figs. 2 and 4), which shuts off the gas as soon as it registers 2 or 3 per cent. against the company. To prevent its rising by the return of condensed water from the house-pipes into the meter, and thus registering against the consumer, the tube (*n*, Figs. 2 and 4) which admits gas to the drum is set in such a position that it serves as an overflow, conveying superfluous water to a waste-water cistern below. When this cistern is filled, the water rises and prevents the flow of the gas to the drum. Thus if the meter *tends* to become inaccurate, it refuses to deliver gas, and demands either a further supply of water or to be relieved of an excess, either of which forms of relief can be readily applied by any intelligent person who understands the construction of the meter.

Meters are liable to freeze; the drum then becomes fixed and the flow of gas is prevented. A frozen meter may be readily thawed out by covering it with a cloth and pouring boiling water over it. In exposed positions the meter should always be protected by some non-conducting material, such as woolen cloths, felt, straw, tan-bark, sawdust, or sand, or the water in the meter may be replaced by glycerin or a solution of chloride of calcium in water, containing 4 lb. in each gallon. These liquids neither freeze nor evaporate.

*When the gas goes out* in a house supplied through a wet meter it may be due to (1) a deficiency of water, (2) exeess of water, (3) freezing of the meter, (4) freezing of the service-pipe, and (5) condensation of water in the house-pipes. The best and safest plan is to send for a gas-fitter or to the office of the company; but as the difficulty is most likely to occur during the evening, when help can rarely be obtained, it is well to know how to meet the emergency. (1) The cocks of all the burners which are open save one should be closed; (2) if the meter is approached with a candle, the latter must be held at a distance to avoid explosion; (3) the gas should be turned off at the main cock between the street service-pipe and the meter; (4) the plug *u* (Figs. 2 and 3) of the waste-water system should be unscrewed to let out any excess of water present; (5) the supply-plug *v* (Fig. 4) and the overflow plug (not shown in the figures, the tube *n* serving as an overflow in this meter), should be unscrewed, and a small quantity of water should be poured in gently till it issues from the overflow or at *u*. When it ceases to flow, all the plugs must be replaced carefully and the gas turned on, when the meter will be in working order. (6) If the meter is frozen, boiling water must be poured over it, and a little hot water run through the orifice *v* and allowed to escape at *u*, or at the overflow. (7) A frozen service-pipe generally necessitates an excavation and the application of heat outside the house. (8) Condensation in the pipes is first indicated by a flickering or jumping of the lights, due to the partial obstruction of the gas by the accumulation of water in the depressions in the line of pipe, which breaks it into bubbles. Removing a burner and blowing violently into the pipe will sometimes force the water beyond the hollow. The aid of the gas-fitter will generally be necessary to remedy this difficulty, by placing the meter in a cool situation or inclining the pipes so that condensed water will all trickle back to the meter.

*The dry meter* consists of two or three chambers, each divided by a flexible partition or diaphragm, by the motion of which the capacity on one side is diminished, while that on the other is increased. By means of slide-valves like those of a steam-engine, worked by the movement of the diaphragms, the gas to be measured passes alternately in and out of each space. The movements of the partitions are recorded by clockwork on dials which indicate cubic feet. The diaphragms in all the chambers are so connected that they move in concert. The two-diaphragm meter of Croll and Richards (Figs. 5 and 6) is most used. Defries's three-diaphragm meter is also extensively employed. If a dry meter has been standing for some time, it sometimes fails to move, from the adhesion of the surfaces of the slide-

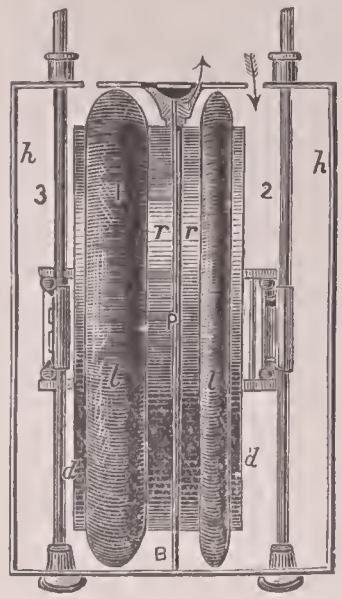



Fig. 5.—Side view of the measuring chambers of a dry meter. The case is divided by the partition P into two independent compartments; in each of these is a flexible chamber, formed by the rings *r r*, the disks *d d*, and the leather belts *l l*. Each disk is supported and kept in the same plane in its motion by means of the horizontal arm *s* (Fig. 6), and the guides *g g*. The rods *h h*, bearing the arms *s s*, pass through a stuffing-box into the upper chamber C, and bear horizontal jointed levers, giving motion to the slide-valves which regulate the flow of gas into the various compartments, and also working the system of toothed wheels which record the quantity of gas passing through the meter on the index-dials.

valves. It can often be started by turning off the gas at the meter, opening all the burners in the house, and then turning the gas on at the meter again suddenly and fully. This treatment is specially effective just at dark, when the pressure in the mains is greatest. If the lights be unsteady with a dry meter, it is due to a stiffness of the working parts, and the meter should be repaired.

*Comparative Advantages of Wet and Dry Meters.*—Wet meters being simpler in construction, composed entirely of metal, and having no valves except the float, are most

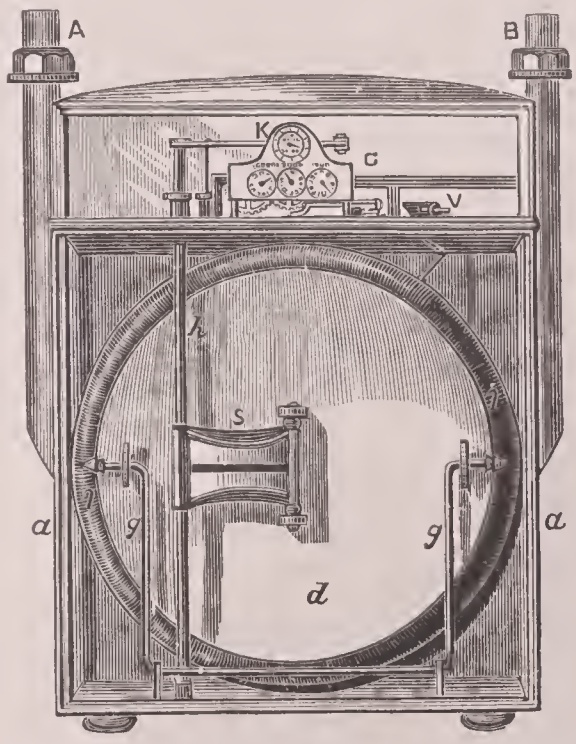



Fig. 6.—Front view of the dry meter. A is the inlet, B the outlet. The gas enters at A, passes to the valve-box V, enters the space 2 (Fig. 5), and the left-hand chamber *l r*, while its pressure forces the gas out of the space 3 and the right-hand chamber *r l*. When the left-hand chamber is full and its companion empty, the slide-valves reverse the flow of gas, and the empty chamber and the space 3 receive, while the full chamber and the space 2 deliver gas.

durable and less liable to get out of order. They are, however, liable to stop from freezing, from too much or too little water, and from sending moisture into the pipes. They also register vapor of water as gas, though the quantity is too small to be of any consequence. The dry meter is not

liable to any of these objections, but, being more complicated and more delicate, it is more liable to wear and to get out of order.

*The index* of the meter is very simple. It consists of a number of dials like that of a watch, except that while the

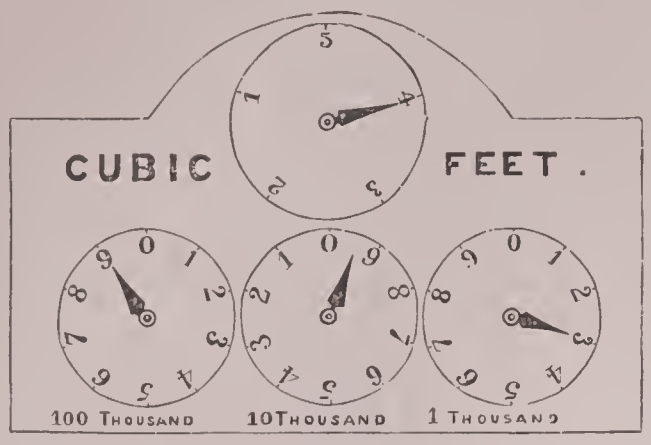



FIG. 7.—The index of a dry meter.

hour and minute hands of a watch traverse the same dial, the different hands of the meter have each a separate dial. Fig. 7 is a dry-meter dial. The dial at the top, which indicates units of feet, is only used in testing the meter. The other dials show 89,300 feet to have passed through the meter; if a month hence the hands indicate 93,400, then 4,100 feet will have passed the meter during the month.

*The accuracy of the meters* is very often questioned by consumers. The clock-like appearance of the dials leads them to infer that the meters may run fast or slow. But the case is not parallel; the meter is an engine in which the gas is the motive-power, and unless the gas passes through the meter, it can not move. On its dials are faithfully recorded the number of its revolutions in cubic feet. All waste and leakage are recorded as well as the useful consumption. Some think that the increased pressure makes the meter spin round faster and record against the consumer; but if he regulate the burners so as to prevent "blowing," he at once neutralizes the effect of the increased pressure. From the nature of things, the injury which the meter suffers in use must generally be against the company. If a valve leaks or a rust hole occurs in the measuring drum, or a crack in the leather, gas gets through without being recorded. Sometimes the valves of a dry meter become fixed in such a position as to let the gas through without moving. The meters are all tested by inspectors by passing a certain number of cubic feet through each, and noting whether it is properly recorded on the dials.

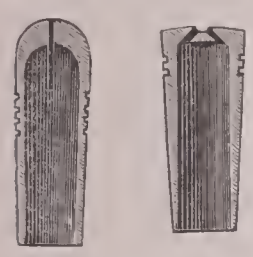


FIG. 8.



FIG. 9.

Fig. 8, 4-foot bat-wing, lava tip. Fig. 9, 2-foot fish-tail, lava tip.

*Gas-burners* now in use are of three kinds: (1) the *bat-wing*, a burner with a slit (Figs. 8, 10, 13); (2) the *fish-tail*,

FIG. 10.

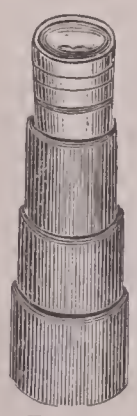


FIG. 11.

FIG. 12.

FIG. 13.

Fig. 10, 7-foot bat-wing, lava tip, mounted in pillar. Fig. 11, 6-foot fish-tail, lava tip, mounted in pillar. Fig. 12, brass pillar for lava tips. Fig. 13, 7-foot bat-wing, lava tip.

with two oblique holes in the end facing each other (Figs. 9, 11, 14, 17, 18); (3) the *argand*, a circular burner with a ring of thirty-five to fifty small holes, a glass chimney and

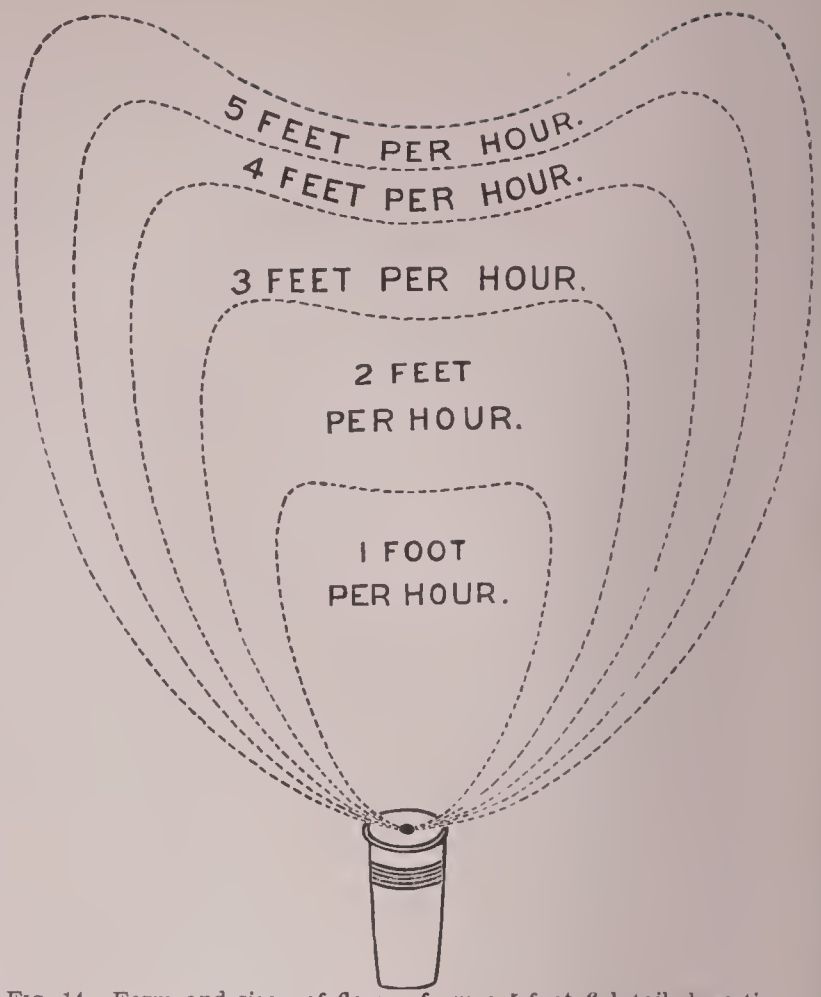



FIG. 14.—Form and sizes of flames from a 5-foot fish-tail, lava-tip burner.

an interior supply of air (Figs. 15, 16). Burners are made of iron, brass, or soapstone ("lava"); the last is preferable, as the holes are not liable to be stopped by rust. The amount of light produced by a given gas varies enormously with the conditions under which it is burned. The maximum amount of light is obtained by burning it on the verge of smoking, while in the Bunsen burner, used for heating purposes in chemical laboratories, the flame is blue and non-luminous. The loss of light is due to a too rapid mixing or contact of the gas with the air. This is controlled by the size and shape of the holes in the burner, the height of the chimney, and the distribution of the air (in the argand), and in all cases by the pressure. The holes and slits for rich gas should be small, as such gas requires more air than poor gas. Under the same pressure a burn-

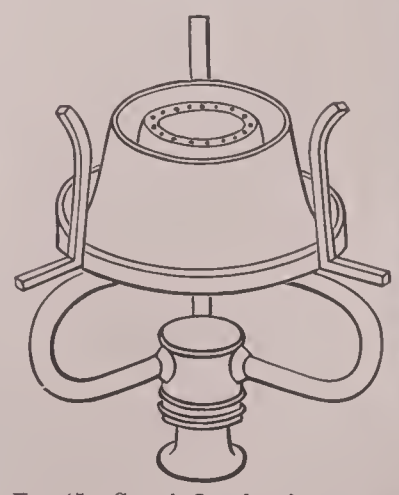


FIG. 15.—Sugg's London burner, lava.

FIG. 16.—Gleason's noiseless argand burner, of brass, with valve.

er which consumes 4 feet of gas per hour gives more light than two burners consuming each 2 feet. There is no economy of light in small burners. The pressure of the gas is a most important consideration. Argands give most light under a pressure of $\frac{1}{10}$ inch, bat-wings and fish-tails under a pressure of $\frac{3}{10}$ to $\frac{4}{10}$ inch. As gas is supplied to consumers under pressures varying from 3 or 4 inches down to $\frac{1}{10}$, it is very desirable to check the flow of gas when it is excessive. This can be done by the use of regulators, by turning the gas off at the meter, by partly closing the cocks on the fixtures, or by introducing a check into the burner. Check-burners should always be used; they are constructed in various ways —always by placing some obstruction in the way of the gas to retard its escape. A very simple plan is to screw a 5 or 6 foot burner over a 3 or 4 foot burner. With regard to a choice of form, the *argand* is best for ordinary gas; it gives

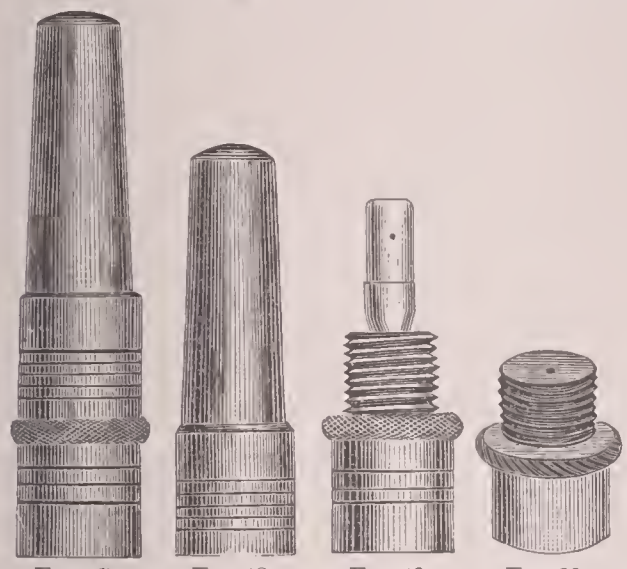


Fig. 17. Fig. 18. Fig. 19. Fig. 20.

Fig. 17, check burner, a 5-foot burner screwed upon a 3-foot burner. Fig. 18, 5-foot brass fish-tail burner. Fig. 19, 3-foot base for a check burner. Fig. 20, another base for a check burner.

a very steady flame and consumes the gas to the best advantage. The best form of argand made in the U. S. is shown in Fig. 16. It is provided with a cut-off or check of very simple construction. The best burner yet constructed is Sugg's London burner, shown in Fig. 15 without its chimney. *Bat-wing* burners can not be used in globes or shades, as the flame is so broad as to crack the glass; *fish-tails* must then be employed. Five or six foot lava-tipped check bat-wings are the most economical burners for general use.

*The loss of light by the use of shades, chimneys*, etc., is very considerable, largely due to the conversion of light into heat. The following numbers, selected from the results of William King, of Liverpool, and Prof. F. H. Storer, of Boston, are a sufficient illustration:

| DESCRIPTION OF GLASS. | Thickness of glass. | Loss of light. |
|---|---|---|
| Clear glass (King) | ..... | 10·57 |
| Ground glass " | ..... | 29·48 |
| Smooth opal " | ..... | 52·83 |
| Ground opal " | ..... | 55·85 |
| Thick English plate (Storer) | $\frac{1}{8}$ inch | 6·15 |
| Crystal plate " | $\frac{1}{8}$ " | 8·61 |
| English crown " | $\frac{1}{8}$ " | 13·08 |
| Double English window (Storer) | $\frac{1}{8}$ " | 9·39 |
| Double German (Belgian) " | $\frac{1}{4}$ " | 13·00 |
| Single German (Belgian) " | $\frac{1}{16}$ " | 4·27 |
| Double German (Belgian) ground (Storer) | $\frac{1}{4}$ " | 62·34 |
| Single German (Belgian) ground " | $\frac{1}{16}$ " | 65·75 |
| Berkshire, Mass., ground (Storer) | $\frac{1}{16}$ " | 62·74 |
| Orange-colored window-glass (Storer) | $\frac{1}{16}$ " | 34·48 |
| Purple " " " | $\frac{1}{4}$ " | 85·11 |
| Ruby " " " | $\frac{1}{16}$ " | 89·62 |
| Green " " " | $\frac{1}{16}$ " | 81·97 |
| A porcelain transparency " | $\frac{1}{16}$ " | 97·68 |

*Pressure.*—A certain amount of pressure is required to force the gas through the street-mains, house-meters, pipes, and burners. The pressure is measured by the height of a column of water supported by the gas in a U-shaped tube, one end of which is open to the air, while the other is connected with the gas-supply. It is exerted by the weight of the great gas-holders at the works. Were the consumption of gas uniform during the entire twenty-four hours, the holder could be properly balanced once for all, and a uniform pressure would be exerted at all times; but when no gas is burned, no pressure is required, and when little gas is burned, 4 or 5 inches would be excessive. Consequently the pressure must be graduated according to the hourly consumption. For this purpose the *governor* is employed at the works to regulate the flow, and consequently the pressure, of the gas from the holder to the street-mains.

*Regulators* are constructed on the same principle as the governor at the works. They contain automatic valves which partially close when the pressure increases, and open when it diminishes. They may be applied to the entire supply of gas at the meter or to each burner.

*The illuminating power of gas* is dependent upon several conditions (see Flame): (1) Liberation of solid particles of carbon from the olefiant gas and rich hydrocarbon vapors by the heat of the flame, or the oxidation of the hydrogen at points in the flame when the supply of oxygen is not sufficient for both hydrogen and carbon; (2) to the temperature of the flame, which renders the carbon particles luminous; (3) to the density of the materials burned; (4) to the density of the products. These conditions depend upon the chemical composition of the gas and the manner of its combustion. Gases rich in olefiant gas and heavy hydrocarbons furnish the most luminous flames. The character of the burner, the dimensions of the chimney with argands, and the pressure determine the manner of combustion by regulating the supply and admixture of air. A low pressure with a burner which secures a supply of air just sufficient to prevent smoking—i. e. the escape of unconsumed carbon—secures the maximum amount of light. The pressure and quality of the gas being fixed, it was formerly supposed that the light produced was directly as the rate of combustion, and that consequently two like burners consuming each 3 feet of gas per hour would give the same amount of light as one similar burner consuming 6 feet. Recent investigations make it extremely probable that the amount of light increases as the square of the consumption. (*Farmer's Theorem.*) Consequently the light from the two burners would be $3 \times 3 + 3 \times 3 = 18$, while that from the one 6-foot burner would be $6 \times 6 = 36$. Thus the large burner gives twice as much light for the same consumption as the two small burners; hence the economy of a few large burners over many small ones.

*Carbureting or Carbonizing Gas.*—It having been established that the illuminating power of gas depends upon the presence of heavy hydrocarbon vapors, numerous means have been contrived and patented for adding such vapors to the gas. The materials available are the naphtha of coal-tar and the naphtha of petroleum or coal-oil. Coal-tar naphtha is by far the most effective, though most expensive. It consists of benzene, $C_6H_6$, and its homologues, which are very dense and very rich in carbon. Petroleum and coal-oil naphtha consists of hydrocarbons of the marsh-gas series (see Petroleum), such as pentane, $C_5H_{12}$; hexane, $C_6H_{14}$; heptane, $C_7H_{16}$, etc., in which the ratio of carbon to that of hydrogen is less than half what it is in benzene, etc.

*Testing Gas.*—In order to determine the value of gas for illuminating purposes, several modes of testing have been suggested: (1) Photometrical tests, by which the amount of light actually produced by a given quantity of gas is determined (see Photometer); (2) specific-gravity test; (3) tests for special objectionable impurities, particularly sulphur compounds and ammonia; (4) special tests intended to determine the comparative illuminating power of the gas: *a*, percentage of rich hydrocarbons condensed by chlorine, bromine, or fuming sulphuric acid; *b*, Henry's explosion test, showing the quantity of oxygen necessary to burn the gas and the quantity of carbonic acid produced; *c*, Fyfe's durability test, by which he determines the time required to burn a given volume of the gas through a jet $\frac{1}{33}$ inch in diameter with a flame 4 inches high; *d*, Erdmann's test, which determines the amount of air necessary to deprive the flame of the burning gas of a given size of all illuminating power; (5) gas analysis, by which the different constituents are accurately determined. The practical examination of gas is generally limited to the photometric test, the specific-gravity test, and the determination of ammonia and sulphur.

*Impurities.*—Ammonia is detected by moistened turmeric paper; 2 grains in 100 cubic feet quickly redden it. It is determined by passing a measured quantity of gas through a glass tube filled with glass beads, moistened with a known quantity of a standard solution of oxalic acid. (See *Am. Chemist*, ii., p. 247.) Sulphur in the form of sulphuretted hydrogen is rarely found in purified gas, as it is all removed by the purifiers; but sulphur in other forms, bisulphide of carbon and sulphur compounds of unknown composition, is always present. Lime purification reduces the sulphur in

these forms to 7 or 8 grains per 100 cubic feet. Iron purification is not so effective, as it leaves from 12 to 40 grains of sulphur per 100 cubic feet. The total sulphur is determined by burning a certain quantity of the gas through a Leslie burner, and collecting the sulphurous and sulphuric acids produced by ammonia, oxidizing all to sulphuric acid by bromine, and weighing as sulphate of baryta. (See *Am. Chemist*, ii., 247.) *Special tests* by chlorine, etc., are fully described in the works on gas mentioned at the close of this article.

*The waste products* of the manufacture of coal-gas consist of (1) coke, (2) ammoniacal liquor, (3) tar, (4) the spent lime or oxide of iron used in purification. (See lecture by Dr. Letheby on the waste products of coal-gas, *Chem. News*, xvi., 31, 44, 55, 68, 91, 95, 106.) *Coke*, the fixed residuum which remains in the retorts, and which amounts in quantity to about 66·66 per cent. of the coal, is a very valuable fuel and finds a ready sale. (See Coke.) *The ammoniacal liquor* is the source of nearly all the ammonia salts of commerce. By far the larger part of the nitrogen of the coal, which varies from less than 1 per cent. to nearly 2 per cent., is not converted into ammonia; it forms cyanides, sulphocyanides, bases, etc. The ammoniacal liquor contains the ammonia in the form of hydrosulphide, acid carbonate, cyanide, sulphocyanide, chloride, and benzoate. By mixing it with lime and blowing steam through it the ammonia is expelled, and conducted to vats containing sulphuric acid, where it is absorbed and combined as sulphate, which is obtained in crystals on evaporation. This salt is used as a fertilizer, in the manufacture of alum, and for the preparation of other ammoniacal compounds. The tar is a very complex body. It was formerly thrown away, but is now the source of a great variety of useful products. See Coal-tar.

*Gas from Coal-tar.*—Ever since the manufacture of coal-gas became an established industry the importance of converting the tar into gas, or of so conducting the destructive distillation as to prevent its formation, has been fully recognized, and the greatest variety of processes has been patented, all of which claim to make *more gas and better gas* from a ton of coal. The actual possibilities are estimated by comparing the weight of tar with the weight of gas from the same coal. Twenty-two hundred and forty lb. of average caking coal yield from 9,000 to 10,000 cubic feet of gas of a specific gravity of, say, 0·430, equivalent to 296·86 or 329·84 lb. of gas. The same coal yields, say, 12 U. S. gal. of tar, the specific gravity of which is from 1·12 to 1·15, or 9·33 to 9·58 lb. per gallon, equal to 112 to 115 lb. If this tar could be entirely converted into gas of ·430 specific gravity, it would add 3,394 to 3,488 cubic feet to the yield of gas. The proportion of carbon in coal-tar is so great, however, that under no system can it be converted into gas without the formation of a considerable proportion of fixed coke, probably from 25 to 40 per cent. of its entire weight. This fact reduces very considerably the possible gain of gas from the tar; in the case of caking coal, the usual material, from the 3,394 to 3,488 cubic feet of gas to not much above 2,000 feet. To secure this gain the tar, which has a market-value of from 33 to 50 cents per ton of coal, must be sacrificed, and more complicated apparatus and a larger consumption of fuel and labor must be resorted to. It is for these reasons that none of the methods suggested for producing gas from the tar have as yet been successful. In 1827 Bernard Chaussenot patented in France the use of one vessel or retort heated to a low temperature for distilling "resin and all hydrogenous matters liquid and solid" into rich vapors, and a second retort heated to a high temperature for converting these vapors into permanent gas. This principle has been the basis of numerous patents, and while it has not been successful if applied to coal alone, it is probably essential to the production of gas from petroleum or any of its products, and is in successful operation in several works where petroleum naphtha is used as an enricher for coal-gas.

*Oil-gas.*—As a matter of fact, whenever oil is burned in lamps it is first converted into gas at the wick. This is by far the most economical method of making oil-gas. Nevertheless, when gas-lights were first introduced coal was quickly replaced by oil. Cheap refuse oils and fats were employed, kitchen grease, and whale oil. The gas was obtained by allowing a stream of the oil or melted fat to trickle into a red-hot tube or a retort filled with coke or similar porous solid. The oil was at once converted into a permanent gas, which, owing to the freedom of the oil from nitrogen and sulphur, contained no ammonia or sulphur compounds, and consequently required no purification, merely washing with water to condense the liquid products. A considerable residue of charcoal is always left in the retort. Oil-gas possesses a very high illuminating power, several times that of ordinary coal-gas, and must be burned through very small burners to prevent smoking. The yield of oil-gas depends upon the temperature at which the oil and its vapors are decomposed; a low temperature gives a smaller quantity of very rich gas, with the minimum deposit of carbon. A high temperature yields more hydrogen and marsh-gas, and a larger deposit of carbon. A gallon (U. S.) of oil weighs about 8 lb.; 1,000 cubic feet ·900 gas weighs 69 lb. Were there no waste, and were it possible to obtain 8 lb. ·900 gas from 1 gal. of oil, 8·63 gal. of oil would make 1,000 cubic feet of gas. Oil-gas has come into extensive use on railways and for the illumination of buoys and lighthouses. Its use began in 1871 in Germany, and it was later adopted by the Metropolitan Railway in London (1876). It is said that the cost of oil-gas is not much more than half that of coal-gas. It is usually compressed to 10 atmospheres in large vessels, from which small reservoirs, attached to railroad cars, buoys, etc., are filled under a pressure of from 6 to 8 atmospheres.

*Petroleum and Naphtha-gas.* See Petroleum. *Air-gas.* See Petroleum. *Water-gas.* See Water-gas. *Oxy-hydrogen Gas-lighting.* See Oxygen.

For further details with regard to gas-lighting, the following works may be consulted: Muspratt's *Chemistry*: Muspratt's *Handbuch der Technischen Chemie* (3d. ed. 1875); Wurtz's *Dictionnaire de Chimie*; *Neues Handwörterbuch der Chemie*; *Le Gaz*; Wagner's *Jahresbericht der Chemischen Technologie*; Matthews's *History of Gas-lighting* (2d ed. 1832); Blochmann's *Beiträge zur Geschichte der Gasbeleuchtung* (1871); *Abridgments of Specifications of Patents Relating to the Production and Applications of Gas* (1860); Accum's *Practical Treatise on Gas-light* (4th ed. 1818); Accum's *Description of the Process of Manufacturing Coal-gas* (1819); Bowditch, *The Analysis, Technical Valuation, Purification, and Use of Coal-gas*; *The Gas-manager's Handbook*, Thomas Newbigging; Bower, *Gas-engineer's Book of Reference*; Clegg, *On the Manufacture of Coal-gas*; Colburn, *The Gasworks of London*; *Gas-consumer's Guide*; Hughes, *Gasworks and Manufacturing Coal-gas*; Mason, *The Gasfitter's Guide*; d'Hurcourt, *De l'éclairage du gaz*; Richard, *Gas-consumer's Guide*; Sugg, *Gas Manipulation, with a Description of the various Instruments and Apparatus Employed in the Analysis of Coal and Coal-gas*; Wilkins, *How to Manage Gas*; Schilling, *Handbuch für Steinkohlengasbeleuchtung* (2 Bde., 3te Auf., 1879); E. J. Mills, *Destructive Distillation* (3d ed. 1886); W. Richards, *A Practical Treatise on the Manufacture of Coal-gas* (1890); *Dictionary of Applied Chemistry*, article *Coal-gas*, by Lewis Wright (1891); G. Thenius, *Fabrikation der Leuchtgase* (1891); Knapp's *Lehrbuch der Chem. Technologie* (3te Auf., 1865); Bolley's *Handbuch der Chem. Technologie* (1862); and the authorities previously cited in this article. See the article Natural Gas.

Revised by Ira Remsen.

**Gasparin**, gäas'paă'răn', Agénor Étienne, Count de: author; b. in Orange, France, July 10, 1810; the son of Count Adrien Étienne Pierre de Gasparin (1783–1862), an Orleanist statesman of liberal views. The son was much in public life until 1846; disapproved of the revolution of 1848, and after Napoleon III. came into power retired to Switzerland, where he engaged in literary pursuits. De Gasparin was a Protestant, a friend of safe reform measures, a pronounced enemy of slavery, and was the author of several volumes, chiefly upon religious and social questions, two of which, *Un grand peuple qui se relève* (The Uprising of a Great People, 1861) and *L'Amérique devant l'Europe* (America before Europe, 1862), maintaining the justice of the Federal cause in the U. S. during the civil war, were translated into English and widely read in the U. S. D. near Geneva, May 14, 1871. See his *Life* by Th. Borel (English trans., New York, 1879).—Mme. Valérie Bossier de Gasparin, his wife (b. in Geneva, Sept. 13, 1813), also wrote on topics kindred to those discussed by her husband, and made numerous translations from the English. D. near Geneva, June 19, 1894. S. M. Jackson.

**Gas'pé** (Indian, *Gasépion*): a district, cape, and town in Quebec province, Canada; on the end of the peninsula which extends into the Gulf of St. Lawrence; between the St. Lawrence river and Chaleur Bay. The name is often applied to the peninsula itself (see map of Quebec, ref. 1–I). The cape is a towering rampart of sandstone 690 feet high.

Gaspé town is the headquarters of immense cod and mackerel fisheries, and has about 850 inhabitants. Its attractive scenery, cool summer climate, and the excellent trout and salmon fishing in neighboring streams, make the town a favorite resort for sportsmen. M. W. H.

**Gass**, gäas, Friedrich Wilhelm Johann Heinrich, D. D.: German theologian; b. in Breslau, Nov. 28, 1813; studied theology in his native city, Halle, and Berlin, and was appointed professor extraordinary at Breslau in 1846, same at Greifswald in 1847, ordinary 1855, at Giesen in 1861, and at Heidelberg in 1868. His chief works are his *Geschichte der protestantische Dogmatik* (4 vols., Berlin, 1854–67) and *Geschichte der christlichen Ethik* (2 vols., 1881–87). He also wrote much on the Greek Church—*Gennadius und Pletho* (Breslau, 1844); *Die Mystik des Nikotaus Kabasilas* (Greifswald, 1849); *Symbotik des Griechischen Kirche* (Berlin, 1872)—besides a number of minor essays and treatises, *Optimismus und Pessimismus* (Berlin, 1876), etc. D. in Heidelberg, Feb. 21, 1889.

**Gassendi**, gäas-sen'dĕe, Pierre: philosopher; b. at Champtercier, Provence, Jan. 22, 1592. He was a poor peasant's son and had remarkable precocity of intellect. When ten years old he delivered a Latin address before the Bishop of Digne, and when nineteen took for a time the professorship of Theology at Digne. He became Professor of Philosophy in the university at Aix 1616; took priest's orders 1617; became canon and then provost in the diocese of Digne 1623; and Professor of Mathematics in Paris in 1645. Galileo, Hobbes, Kepler, and Descartes were his friends and correspondents. Gassendi was an able opponent of the Aristotelian scholastic philosophy, and by his championship of Epicureanism drew upon himself the charge of infidelity; but he was a devout churchman and a conscientious conservative who espoused the cause of physical science from a conviction of its truth. Molière was his pupil. His best works are *De vita moribus et placitis Epicuri* (1647), *Syntagma Phitosophiæ Epicuri* (1649), and the *Lives* of Tycho, Copernicus, Regiomontanus, and Purbach. He published in 1630 a severe attack upon Robert Fludd. His *Institutio Astronomica* (1645), an able work, has a value now chiefly historical. His *Syntagma Philosophicum* (1658), a work of great erudition, sets forth his own eclecticism. His philosophy in some parts remarkably resembles that of Locke. His cautious spirit led him to oppose the important physiological discoveries of Harvey and Pecquet. D. in Paris, Oct. 24, 1655. His *Life* was written by Bougerel (1637), by Sorbière (1658), by Camburat (1770), and by A. Martin (1853).

**Gasse'rian Ganglion** [named from Giulio Casserio (Latinized *Gasserius*), 1556–1616, its discoverer]: a large semilunar ganglion upon the large or sensory root of the fifth cranial nerve, near the apex of the petrous portion of the temporal bone. It is found in man and many of the lower animals, and at once recalls the ganglia upon the posterior roots of the spinal nerves, of which it is the analogue.

**Gast**, Frederick Augustus, D. D.: theologian; b. in Lancaster, Pa., Oct. 17, 1835. He was educated at Franklin and Marshall College and Mercersburg Theological Seminary. After a pastorate of seven and a half years and several years of educational work, he became in 1874 Professor of Hebrew and Old Testament Theology in the Theological Seminary of the Reformed Church in the U. S. at Lancaster. He has published no volumes, but many separate papers, including lines of important theological articles in *The Mercersburg Review* and *The Reformed Quarterly Review*, among others the following: *Religion of Israel* (1874); *Origin of Otd Testament Religion* (1876); *The Peshitto Version of the Otd Testament* (1880); *Claims of the Semitic Languages* (1881); *Assyrian Research and the Old Testament* (1884); *The Presemitic Babytonians* (1885); *The Mystery Language* (1888).
Willis J. Beecher.

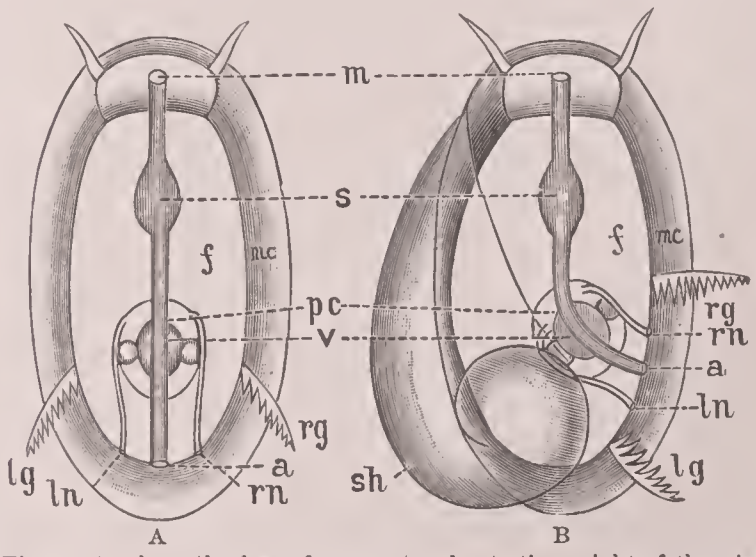
**Gas'tein**: a beautiful valley, some 30 miles long; in Austria, to the S. of Salzburg. It is traversed by the Ache, and has on either hand steep mountains with some glaciers, and containing mines of gold and silver. Here are three villages, Hofgastein, Dorfgastein, and Wildbadgastein, the last one of the most fashionable watering-places in Europe. It has thermal springs, renowned for their efficacy in the treatment of many chronic diseases.

**Gastein, The Convention of**: a convention concluded at Wildbadgastein (Aug. 14, 1865) between Austria and Prussia, and intended to regulate the relations of these two powers with respect to the duchies, Schleswig, Holstein, and Lauenburg, which they had taken from Denmark, and then occupied in common. By the convention they agreed that Schleswig should be placed entirely under Prussian, Holstein entirely under Austrian administration, while Lauenburg should be annexed to Prussia, Austria ceding its part of it for 2,000,000 thalers. On Aug. 20 this convention was signed at Salzburg by Emperor Francis Joseph and King William.

**Gasteromyce'teæ**: an order of the higher fungi containing the Puff-balls (*q. v.*).

**Gasterop'oda**, or **Gastropoda** [Mod. Lat. from Gr. γαστήρ, γαστρός, belly, stomach + πούς, ποδός, foot]: one of the great divisions or classes of the Mollusca (*q. v.*, for anatomical details, etc.). They are distinguished from the other classes (*Amphineura*, *Scaphopoda*, *Lamellibranchiata*, and *Cephalopoda*) by the development of a distinct head, bearing tentacles and eyes; a broad creeping foot arising from the lower surface of the body (whence the name), a lingual ribbon or odontophore armed with horny teeth and usually a shell, which is always in a single piece (univalve), and which is usually coiled in a spiral. Many forms appear externally to have the two sides alike, but anatomical investigation shows that all are more or less asymmetrical. The explanation of this lack of symmetry is interesting. There is a marked tendency in all forms to produce a well-marked hump upon the back, into which many of the viscera extend and on the outside of which the shell (primitively a regular cone) is developed. This cone, on account of its weight, tends to topple over (usually on the left side), and as a result the corresponding mantle cavity (see Mollusca) is obliterated, and the organs which it should contain and the ducts which should empty into it are either forced to the right side of the body or they may entirely disappear, those of the other side, in the latter case, taking their functions. This torsion of the body may be carried so far that the vent is situated in front, just above the head, while the various organs which primitively belong to the right side of the body are transferred to the left, and *vice versa*. The shell at first grows in a regular cone, but as the tipping continues the result is that it eventually takes a spiral form.

Gasteropod: *Helix desertorum*.




Figures to show the loss of symmetry due to the weight of the visceral mass and shell. In both the animal is regarded as transparent. In A no shell is developed; in B there is a shell (*sh*), which has tipped toward the left, crowding the gills (*g*), vent (*a*), excretory openings (*n*), to the right side of the body; *m*, mouth; *s*, stomach; *f*, foot; *mc*, mantle cavity; *v*, ventricle of heart; *pc*, pericardium.

This destruction of the primitive symmetry may become marked by the development of a secondary symmetry by which the right and left sides are externally alike. This is especially marked in the limpets, naked molluscs (Nudibranchs), and the Heteropods. In numerous instances the shell—present in the young of every Gasteropod—more or less completely disappears in the adult. Thus in the slugs (*Limacidæ*) it has degenerated to a small internal scale-like plate, while in the adult Nudibranchs and in certain Pteropods it is entirely absent. In the cases of those symmetrical Heteropods like *Atlanta* the adult shell is perfectly

symmetrical, but in the young the shell is asymmetrical just as in the common snail.

The class of Gasteropods is divided into the following orders: Order I. PROSOBRANCHIATA, which derive their name from the fact that the gill or gills are in front of the heart, and correspondingly have the auricles in front of the ventricle of the central circulatory organ. The pleurovisceral nerves (see article MOLLUSCA) are involved in the torsion of the body, and as a result are crossed, bringing the right visceral ganglion upon the left side, and *vice versa*. The sexes are separate and the foot usually bears an operculum for closing the shell when the animal is retracted. A shell is lacking in the single genus *Titiscania*. Most of the species are marine. The order *Prosobranchiata* is subdivided into two divisions or sub-orders—*Diotocardia* and *Monotocardia*.

Sub-order I. DIOTOCARDIA, characterized by the usual presence of two auricles and two kidneys (nephridia). According to the character of the gills the *Diotocardia* are arranged as follows: (α) ZYGOBRANCHIA, marine forms with two gills and with the intestine passing through the ventricle of the heart. Here belong the Abalones or ear-shells (*Haliotidæ*), in which the iridescent shell (largely used in inlaid work) is perforated by a series of holes through which the gills project freely into the surrounding water; the keyhole limpets (*Fissurellidæ*), with flattened conical shells, perforated at the apex; the *Pleurotomaridæ*, with spiral shells, deeply slit at the edge of the aperture, etc. (β) AZYGOBRANCHIA, with only the left gill persisting, and with the intestine passing through the heart as in the Zygobranchs. To this division belong the TOP-SHELLS (*q. v.*) or *Turbinidæ*, the closely allied *Trochidæ*, the NERITIDÆ (*q. v.*), and the *Helicinidæ*. These latter are terrestrial, and like the *Pulmonata* (*infra*) have developed a "lung" for breathing air, but in their structure they are in all other respects allied to the Nerites and Top-shells. (γ) DOCOGLOSSA, with but a single auricle, no operculum, and with the intestine distinct from the heart. The *Docoglossa* contains the true limpets (*Patellidæ*). In the common European limpet (*Patella*) the true gills (ctenidia, see MOLLUSCA) have been lost and a secondary gill developed, but in the common limpets (*Acmæa*) of the U. S. Atlantic coast the true left gill occurs in conjunction with numerous other secondary gills.

Sub-order II. MONOTOCARDIA (*q. v.*), with a single auricle, a single true gill (ctenidium) and a single kidney (nephridium). This sub-order, formerly called *Pectinibranchia*, contains the great majority of the sea-snails. Among these the HETEROPODA (*q. v.*), formerly regarded as a distinct order of Gasteropods, are now known to belong here and to be specially modified (by compression of the foot to a keel-like structure, etc., for a free swimming or pelagic life).

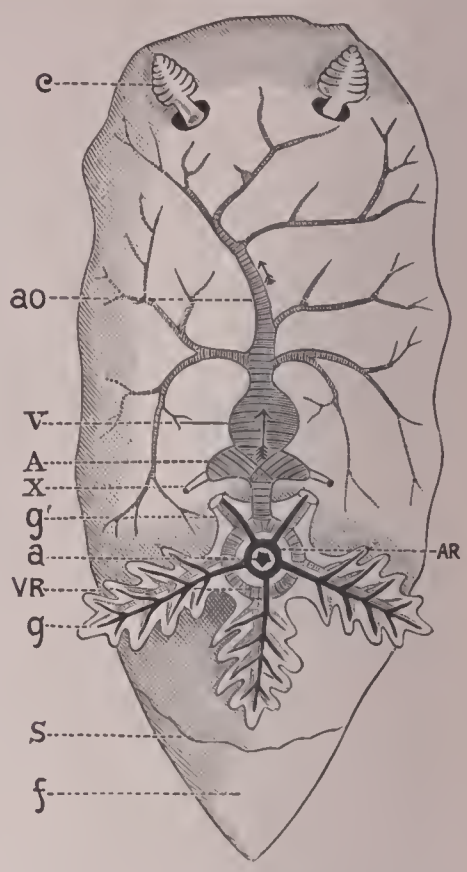
Order II. PULMONATA (*q. v.*).—These have the pleurovisceral nerves uncrossed, and derive their name from the fact that the gills have disappeared, while the respiratory function is taken by the walls of the mantle cavity, which have developed into an air-breathing organ or lung. Most of the Pulmonates live in fresh water or on the land, and among the terrestrial forms there is a marked tendency toward loss of the shell, as seen in the common garden slugs. Most of the species are vegetarians, both slugs and snails eating fresh plants as well as decaying vegetation. The aquatic forms feed largely upon the lower plants occurring in the water, while they respire by occasionally coming to the surface, expelling a bubble of used air and filling the lung with a fresh supply.

Order III. OPISTHOBRANCHIATA.—These are marine snails, which like the Pulmonates have the nerves uncrossed and lack the operculum. They have a single auricle placed behind the ventricle, and gills (either ctenidia or adaptive gills) may be present or absent. When present they are usually behind the heart, whence the name of the order. A shell may be either present or absent, and the visceral hump is more or less reduced. All are marine, and some present beautiful instances of protective resemblance, being so modified and colored as to resemble the plants or hydroids upon which they commonly occur.

Sub-order I. TECTIBRANCHIATA.—In these the mantle cavity is well developed upon the right side of the body, and contains a single (primitively left) true gill (ctenidium), which is more or less completely covered by the mantle. A shell may be well developed or it may be more or less rudimentary, and not infrequently it is internal. Two divisions of the sub-order may be recognized—(α) *Reptantia*, embracing the creeping forms, and (β) PTEROPODA (*q. v.*), Tectibranchs which have been modified for a free-swimming life on the high seas. The *Pteropoda* were formerly regarded as a distinct class of the *Mollusca*, but more detailed studies of their structure and especially of their development have shown that they belong here.

Sub-order II. NUDIBRANCHIATA.—Opisthobranchiate molluses in which there are no true gills, no shell, and no mantle fold in the adult. On the other hand, adaptive gills are frequently present, and may form either lobes variously arranged along the back or arranged in a circle around the vent (see figure of *Doris*). Owing to the failure to develop a mantle fold, the gills when present project freely into the water, whence the name of the group, which means naked gills.

J. S. KINGSLEY.




Respiratory and circulatory organs of an Opisthobranch (*Doris*) after Leuckart, to show the position of the gills behind the heart. A, auricle; *a*, vent; *ao*, aorta; *c*, tentacle; *g*, gill; *v*, ventricle.

**Gas'ton**, WILLIAM, LL. D.: jurist; b. at New Berne, N. C., Sept. 19, 1778; studied at Georgetown College, Md.; graduated in 1796 at Princeton with first honors; admitted to the bar in 1798; was in Congress from North Carolina 1813–17, where he opposed the "loan" bill and was one of the ablest of the Federalists; judge of the State Supreme Court 1835–44, although a Roman Catholic, and as such incapable of holding office by the constitution of North Carolina; opposed in 1835 the disfranchisement of free colored voters, which was provided for by the constitution of that year; declined the U. S. Senatorship 1840. D. at Raleigh, Jan. 23, 1844.

**Gaston de Foix**, găăs'tōn'de-fwăă': a nephew of Louis XII. of France; b. 1489; became Duke of Nemours 1505; led the army of Louis XII. in Italy; vanquished the besiegers of Bologna; defeated the army of Venice near Brescia, and took the city by storm; won the great battle of Ravenna (Apr. 11, 1512), and by rash exposure after the victory was killed on the same day.

**Gastral'gia**: See CARDIALGIA.

**Gastric Juice** [*gastric* is from Gr. γαστήρ, stomach]: See DIGESTION.

**Gastritis**: See STOMACH.

**Gastrotricha** [Mod. Lat. from Gr. γαστήρ, stomach + θρίξ, τριχός, hair]: a group of simple fresh-water worms of microscopic size and uncertain affinities. They are elongate, unsegmented animals with ciliated ventral surface, whence the name. *Chætonotus* is the principal genus.

J. S. K.

**Gastrula** [Mod. Lat. dimin. of Gr. γαστήρ, stomach]: an embryonic stage in the history of all many-celled animals, characterized by the presence of two body layers: an outer ectoderm or external skin, an inner entoderm or stomach lining, and a single opening connecting the stomach or archenteron with the external world. The gastrula may arise in two ways: (1) invagination; (2) delamination. In the first the egg produces a hollow globe of cells, one side of which becomes inpushed, much as one would push in one side of a rubber ball, thus producing the two body layers, while the hole through which the inpushing takes place is the opening mentioned above. In delamination the same globe of cells occurs, but the inner ends of all the cells are cut off from the outer ends, and the two body layers are produced in this way, while the mouth or opening breaks through both layers at a later date. For modifications of the above-described typical conditions, see EMBRYOLOGY.

From the almost universal occurrence of the gastrula in all many-celled animals, Häckel claims that all have descended from a gastrula-like creature to which he has given the name *Gastræa*. J. S. Kingsley.

**Gas-wells**: See Petroleum and Natural Gas.

**Gatchina**, or **Gatschina**: town of Russia; 30 miles S. W. of St. Petersburg (see map of Russia, ref. 5–C); has an imperial palace surrounded by one of the most beautiful parks in Europe. Pop. 11,557.

**Gates**, Horatio: soldier; b. in Malden, Essex, England, in 1728; in early life entered the British army; attained the rank of major without purchase, and laid the foundation for his future military success. At the capture of Martinico he was aide to Gen. Monkton, and after the peace of Aix-la-Chapelle was among the first troops to land at Halifax under Lord Cornwallis. He was with Braddock at his defeat in 1755, where he was shot through the body. At the conclusion of war he purchased an estate in Virginia, on which he resided till the commencement of war with Great Britain in 1775, when he was appointed by Congress adjutant-general, with the rank of brigadier-general. He accompanied Gen. Washington when he went to take command at Cambridge, and in June, 1776, was appointed to the command of the army in Canada; in May, 1777, he was superseded by Gen. Schuyler, but in August following in turn superseded that officer in the northern department. The success which attended his arms in the capture of Burgoyne and surrender of the British army at Saratoga in October gave to him a brilliant reputation. After the capture of Gen. Lincoln he was appointed, June 13, 1780, to command the southern department; on Aug. 16 following he was defeated at Camden by Cornwallis, and in December was superseded by Gen. Greene, but restored in 1782, after the surrender of Cornwallis. After the peace he retired to his farm in Berkeley co., Va., where he remained till 1790, whence he went to reside in New York, having first emancipated his slaves. D. in New York, Apr. 10, 1806.

**Gates**, Merrill Edwards, LL. D., L. H. D.: educator; b. in Warsaw, N. Y., Apr. 6, 1848; son of Seth Merrill Gates, lawyer and Congressman; A. B. Rochester University 1870; principal of Albany Academy, Albany, N. Y., 1870–82; president of Rutgers College, New Brunswick, N. J., 1882–90; president of Amherst College 1890–99; chairman U. S. board of Indian commissioners: author of numerous addresses and articles upon educational, social, and religious themes, some of the most important being *Athens and the Greeks of To-day*; *Sidney Lanier*; *The Debt the School Owes the State*; *Land and Law as Agents in Educating Indians*. C. H. T.

**Gateshead**: town of England; on the Tyne, opposite Newcastle, with which it is connected by two bridges (see map of England, ref. 3–H). It is chiefly inhabited by workingmen from the neighboring collieries and quarries (the famous "Newcastle grindstones"), and from the extensive iron-manufactories of the town itself. Pop. (1901) 109,891.

**Gatesville**: city; capital of Coryell co., Tex. (for location of county, see map of Texas, ref. 3–H); on the Leon river and the St. Louis Southwestern Railway system; 40 miles W. by S. of Waco, 80 miles N. of Austin. It is in the heart of a rich valley, is principally engaged in agriculture and stock-raising, and has churches, schools, county buildings, and three weekly newspapers. Pop. (1880) 434; (1890) 1,375; (1900) 1,865.

**Gath** [Heb., wine-press]: one of the five cities of Philistia (1 Sam. vi. 7), in Palestine (see map of Palestine, ref. 10–C). Gath, as it stood on the frontiers of Judah, played a conspicuous part in the wars between those two peoples. The ethnic form was *Gitté*, so its people were called Gittites (Josh. xiii. 3). Goliath was born there (1 Sam. xvii. 4) and David captured it (1 Chr. xviii. 1). Rehoboam fortified it (2 Chr. xi. 8), Uzziah dismantled it (2 Chr. xxvi. 6). As the later prophets do not mention it among Philistine cities, it is probable that it was destroyed during the Babylonian invasions. Its site is now commonly said to be occupied by the modern village of Tell-es-Safi, 10 miles E. of Ashdod. Samuel Macauley Jackson.

**Gati** [Sanskr., path, way, or course]: in Buddhism the six ways or forms of sentient existence through which living beings pass in the round of transmigration: (1) *gods*; (2) *men*; (3) *asuras*, or demons, whose abode is beneath Mt. Meru; (4) *animals*; (5) *prêtas*, or hungry ghosts, tall, attenuated beings whose mouth is no bigger than the eye of a needle, and who are afflicted with an unquenchable thirst. They wander about incessantly and weep without intermission for a whole kalpa. (6) Beings who suffer in hell for periods proportioned to their demerits. See Naraka. R. L.

**Gatien-Arnoult**, gā'ti-ăn'ăr'nō, Adolphe Félix: teacher and author; b. at Vendôme, Loir-et-Cher, France, Oct. 30, 1800; was educated in his native city and in Orleans; taught philosophy at Nevers, Bourges, Reims, and Nancy; published in 1830 *Programme d'un cours complet de philosophie* (9th ed. 1864), and was in the same year appointed Professor of Philosophy at Toulouse, from which position he retired into private life in 1873. After the revolution of Feb., 1848, he was elected mayor of Toulouse and a member of the Constituent Assembly; but after 1852 he abandoned politics. He wrote a *Life* of Victor Cousin (1867); *Histoire de la philosophie en France* (1859); and a number of essays on the *langue d'oc* and its literature, from which he also made several translations. D. at Mont-de-Marsan, Jan. 18, 1886.

**Gatling**, Richard Jordan: inventor; b. in Hertford co., N. C., Sept. 12, 1818; became a resident of Hartford, Conn. His first invention was a screw for the propulsion of watercraft, in which he found, upon application for letters patent, that he had been anticipated a short time by Ericsson. He subsequently devised a machine for sowing wheat in drills, which found a ready sale in the Western States; and then studied medicine, attending lectures in 1847–48 at the Indiana Medical College (then settled in Laporte, Ind.), and in 1848–49 at the Ohio Medical College at Cincinnati, O. He also discovered a method of transmitting power through the medium of compressed air, and invented a double-acting hemp-break, still in use in some parts of the West for breaking hemp. Dr. Gatling's greatest invention (1861–62) is the mitrailleuse, a repeating machine-gun, universally known as the Gatling gun. At the first trial of this gun, in the spring of 1862, it fired 200 shots per minute. After making some improvement in its mechanism, the arm was submitted to trial by the U. S. Government at the Frankford, Washington, and Fort Monroe arsenals, and at other places, and was adopted into the service for use with troops and for the flank defense of fortifications. It has also been adopted by Russia, Great Britain, and other nations. He has also patented a gun metal composed of steel and aluminium.

**Gatling Gun**: a repeating machine-gun or mitrailleuse, the invention of Richard Jordan Gatling (*q. v.*). See Machine-guns.

**Gatschet**, Albert Samuel: linguist; b. in St. Beatenberg, in the Bernese Oberland, Switzerland, Oct. 3, 1832; educated in the lyceums of Neuchâtel 1843–45 and of Berne 1846–52, and in the universities of Berne and Berlin 1852–58. In 1865 he began the publication of a series of brief monographs on the local etymology of his country, entitled *Ortsetymologische Forschungen aus der Schweiz* (1865–67). In 1868 he settled in New York, and became a contributor to various domestic and foreign periodicals, mainly on scientific subjects, and having devoted himself to a more attentive study of the American Indians he published several compositions upon their languages, the most important of which is *Zwölf Sprachen aus dem Südwesten Nordamerikas* (Weimar, 1876). This led to his being appointed to the position of ethnologist in the U. S. Geological Survey in Mar., 1877, when he removed to Washington. Mr. Gatschet has ever since been actively connected with that bureau. To increase its linguistic collections, and to extend and intensify his own studies of the Indian languages, he has made extensive trips of linguistic and ethnologic explorations among the Indians of North America. He was the first to discover the affinity of the Biloxi language with the Siouan family. He also committed to writing the Tunika or Tonica langnage of Louisiana, never before investigated, which forms a linguistic family of itself. Mr. Gatschet's report on *The Klamath Indians of Southwestern Oregon* was published in 1890 by the Government as volume ii., in two parts, of *Contributions to North American Ethnology*. This embodies his researches among the Klamath Lake and Modoc Indians of Oregon, and consists of an ethnographic sketch, texts, grammar, and dictionary (Klamath-English and English-Klamath). J. W. Powell.

**Gauchos**, gow'chōz: a name given in the Platine states of South America, especially Uruguay, to peasantry of mixed Indian and white race, who form a large portion of the

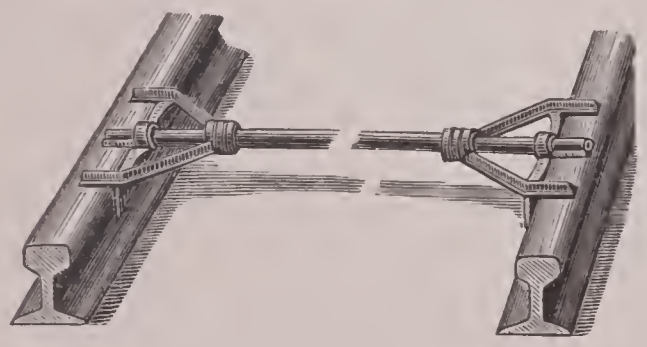
country population. They are generally employed as herdsmen, and are accustomed to roam for weeks over the pampas, sleeping in miserable huts or in the open air, and subsisting on the meat of cattle which they kill. They always go mounted, and, being accustomed to horses from their infancy, are splendid riders. In the numerous civil wars of their countries the Gauchos have taken a prominent part. They care little for political questions, but are ready to follow any leader who gives them a roving life and plunder; and as they carry all their possessions on their horses and know all the roads, they readily avoid regular soldiers. Even in periods of comparative peace they form bands of cattle-thieves and highwaymen, and these lawless companies may at any time develop into insurgent armies. One of their favorite weapons is the *bolas* or weighted lasso, which they also use in catching cattle. HERBERT H. SMITH.

**Gauden**, JOHN: English bishop; the reputed author of EIKON BASILIKE (*q. v.*).

**Gaudentius** [Lat., liter., joyful, rejoicing, deriv. of *gaudens*, pres. partic. of *gaude're*, rejoice]: the name of nearly thirty ancient Christian bishops, two of whom were especially noted. GAUDENTIUS, Bishop of Brescia, in Northern Italy, a friend of Ambrose and Chrysostom, was born about 360 A. D., but it is uncertain whether he lived till about 427 A. D. or died shortly after 410 A. D. Before becoming a bishop (about 387 A. D.) he had traveled in the East, whence he brought back the relics of nearly forty saints. Twenty-one of his sermons are extant, the best edition of which is by Galeardus (1738); reprinted in Migne's *Pat. Lat.*, vol. XX. GAUDENTIUS, Donatist Bishop of Thamugada, in Northern Africa, of whose personal history very little is known, first came into notice at the famous conference in Carthage in 411. It was against him that Augustine wrote his last works in the Donatistic controversy, about the year 420 A. D.

**Gaugame'la** (in Gr. *τὰ Γαυγάμηλα*): a village in the province of Aturia in Assyria, at which Alexander the Great routed the army of Darius. By some it is placed nearly midway between the mouth of the upper Zab and Eski-Kelek, the ferry of the modern caravan road between Mosul and Erbil. By others it is placed at Kermelis, nearly midway between Mosul and Eski-Kelek. For a discussion of the question, see Droysen, *Geschichte des Hellenismus*, i., pp. 329–330, footnotes. J. R. S. S.

**Gauge of Railways**: the distance between the inner sides of the rails of a track, which is usually 4 ft. 8½ in. The illustration shows one form of the implement, also called a gauge, by which the rails are set to the proper dis-



tance apart. On curves the gauge of the track is often made slightly wider than on the straight portions, and hence the ends of the implement are adjustable, and they are sometimes made with segments of a circle corresponding in curvature to that required for the rails. See RAILWAYS concerning the narrow gauge, standard gauge, and broad gauge. MANSFIELD MERRIMAN.

**Gaul**: See GALLIA.

**Gaul**, ALFRED ROBERT: composer; b. at Norwich, England, in 1837; studied under local teachers, gained the degree Mus. Bac. from Cambridge, and has made a favorable reputation as a composer of cantatas and songs. His *Ruth*, *Holy City* (Birmingham, 1882), *Passion Service*, *Joan of Arc*, *The Ten Virgins*, *Israel in the Wilderness*, *Song of Life*, and *Una* are written for ordinary choral societies and good church choirs, and have been highly successful. He has for many years resided at Birmingham, England. D. E. H.

**Gaul**, GILBERT WILLIAM: genre-painter; b. in Jersey City, N. J., Mar. 31, 1855. Pupil of J. G. Brown, New York; National Academician 1882; member of Society of American Artists 1882; third-class medal, Paris Exposition, 1889. His pictures of episodes in the civil war are spirited and cleverly painted; well known as an illustrator, in which field he is especially notable as a delineator of character. Studio in New York. W. A. C.

**Gauley** (gaw'lĕe) **Mountains**: a mountain-range in West Virginia, forming a part of the ridge known farther S. W. as the Cumberland Mountains. The name is sometimes given to the Little Gauley Mountains in Nicholas County, and is sometimes extended indefinitely to the same range farther to the N. E. The mountains contain much wild and sublime scenery.

**Gauley River**: a river of West Virginia; rises in Pocahontas County, drains a valley having the Gauley and Birch Mountains on the N. W. and the Greenbrier Mountains on the S. and S. E. It falls into the Great Kanawha.

**Gauls**: See CELTS.

**Gault**, gawlt [from provinc. Eng. *gault*, clay, brick-earth; cf. Norweg. *gald*, hard earth]: originally a provincial name for a stratum of stiff blue calcareous clay or marl occurring in several localities in the south and east of England, but now accepted as a geological term to designate a stratigraphical horizon in the Cretaceous formation of Europe. When represented in the series (and it is often wanting), this stratum of clay, varying in thickness from 80 to 200 feet, is regarded as the commencement of the Upper Cretaceous. It intervenes between the Lower and the Upper Greensands, and lithologically is very distinct from either; paleontologically, its fossils, abundant and often beautifully preserved, represent a fauna marked by a strong preponderance of forms identical with or closely related to those of the Upper Greensand or of the chloritic marl above.

**Gaultheria**, gawl-thee'ri-a [Mod. Lat., named in honor of Dr. Gaultier, of Quebec, a physician of the eighteenth century]: a genus of shrubs mostly very small, found in North and South America, Asia, Australia, etc. Many of them produce edible fruits. The typical species is the *Gaultheria procumbens*, the wintergreen or checkerberry of the U. S. and Canada. Its fruit and young leaves are edible, and abound in the oil of wintergreen, a fragrant volatile oil used in pharmacy and confectionery. Oil of gaultheria is used as a source of salicylic acid, as it contains over 90 per cent. of salicylate of methyl. For this reason it is often used in the treatment of rheumatism. The *Gaultheria* (now *Chiogenes*) *hispidula*, the sweet birch (*Betula lenta*), and several other plants yield the same oil. The *Gaultheria shallon* of the Pacific coast (the *Salal* of the Indians) is sometimes 3 feet high, and produces very pleasant edible berries, which, when ripe, are picked, pressed into cakes, and largely used for food. See WINTERGREEN, etc. Revised by H. A. HARE.

**Gaunt, JOHN OF**: See JOHN OF GAUNT.

**Gaur**: See GOUR.

**Gaur**, gawr, or gowr [the native name < Sanskr. *gaura-*, gaur, substantive use of adjec. *gaura-*, white]: a wild ox (*Bibos gaurus*) found in Assam, the Madras Presidency, and other parts of India. It is a powerful animal, a full-grown bull standing 5 ft. 6 in. high at the shoulders. The forehead is wide and concave, the horns strong, much curved, and from 2 feet to 2 ft. 6 in. long. The dewlap is small. The color is deep brown or blackish, legs white below the knees. The gaur is found in small herds, and is partial to forest uplands. It is believed by many naturalists to be the wild stock of the gayal, an ox domesticated in the eastern portions of India. The gayal is somewhat smaller in size than the gaur, with smaller horns, shorter tail, and more white on the legs. F. A. LUCAS.

**Gauss**, gows, KARL FRIEDRICH: mathematician; b. in Brunswick, Germany, Apr. 30, 1777; was educated at the expense of the Duke of Brunswick, who had heard of his precocious mathematical talents; solved when eighteen years old the problem of the division of the circle into seventeen equal parts, and afterward became famous for skill in the indeterminate analysis and in curious numerical questions; demonstrated Fermat's theorem; became in 1807 Professor of Astronomy at Göttingen and director of the observatory; received in 1810 the Lalande medal for calculating by a new method the orbits of Ceres and Pallas; was made in 1816 a court councilor, and in 1845 a privy councilor of Hanover; made after 1821 important improvements in geodetic methods and instruments; after 1831 devoted much attention to terrestrial magnetism. Gauss is

regarded as one of the first mathematicians of the nineteenth century. His principal works are *Disquisitiones Arithmeticæ* (1801); *Theoria motus corporum cœlestium* (1809); *Theoria combinationis observationum* (1823); *Intensitas Vis Magneticæ* (1833); reports of the *Magnetischer Verein* (1836, with Weber, and 1837–40); *Atlas der Erdmagnetismus* (1840); *Dioptrische Untersuchungen* (1841); and collections of papers on geodesy and related subjects. D. at Göttingen, Feb. 23, 1855.

**Gaussen**, François Samuel Robert Louis: French reformer and theologian; b. in Geneva, Switzerland, Aug. 25, 1790. He was Professor of Theology in the Evangelical Society's seminary in Geneva from 1836 till his death, and is best known as the advocate of the extremest views of verbal inspiration in the books once widely read—*Theopneustia, or the Plenary Inspiration of the Holy Scripture* (Paris, 1840; 14th ed. 1850; Eng. trans. London, 1841; 4th ed. 1856); and *Canon of the Holy Scriptures from the Double Point of View of Science and Faith* (Lausanne, 1860; Eng. trans. 1862). D. in Geneva, June 18, 1863.

Samuel Macauley Jackson.

**Gautama**, gow'ta-ma, or **Gotama**, gō'ta-ma: the personal name of the historical Buddha, son of Suddhódhana, a Sákya chieftain whose seat was at Kapilavastu in Northern India, about 100 miles N. W. of Benares. His mother was Máyá (Illusion), daughter of Suprabuddha, the chieftain of a neighboring clan, the Koli, whose territories were separated from those of the Sákyas by the river Rohini. Just when Gautama was born is not certainly known. A statement made by Fa-hien, a Chinese Bûddhist pilgrim, who visited India about the beginning of the fifth century of our era, and who studied Buddhism in its original home, points to the eleventh century B. C., and 1027 is the accepted date in China. Other dates mentioned by Northern Buddhists are 753, 687, and 537 B. C. Among Southern Buddhists the date is usually fixed at 622 B. C.; but there is no agreement, and at least one European scholar makes it as late as 492 B. C. This was not Gautama's first birth, or his first appearance on the earth. Five hundred and fifty forms of pre-existence are recorded, in which he made his way through the six Gati, until at last he reached the heaven called Tushita. (See Devaloka.) From Tushita he descended in the fullness of time in the form of a white elephant, and entered the womb of Máyá. On the eighth day of the second month of the following year she was painlessly delivered of a son, on whose body were found the thirty-two marks and eighty forms of beauty whose presence betokened a Buddha. He was accordingly named Siddhártha, "He who has accomplished his object." Seven days later his mother died, and his aunt Prajápatí became his nurse. His mother is said to have been reborn in Tushita. At seven he began his studies, and soon surpassed all other boys in learning and accomplishments and in bodily strength, and at ten he is said to have tossed an elephant over the city walls. Another legend, however, discredits this, and says that his kinsmen complained in a body that as a member of the Kshatriya, or warrior caste, he was deficient in those martial and athletic exercises which alone would fit him for the profession of a soldier and the leadership of the clan. At seventeen he married his cousin Yasodharâ. In the following year began those visions (see Buddhism) which first directed his attention to the problem of life, with its sorrow and death, and led ultimately to his renunciation of family and home, that he might solve the problem and procure deliverance for himself and the world. This occurred when he was twenty-nine, the birth of a son—Ráhula—being the determining circumstance. At midnight he stole away with only one attendant, and rode far into the forest toward Rájagriha, the capital of Magadha, where he dismissed his servant with a message to his father and his wife that he would not return until he could bring them tidings of deliverance. Cutting off his hair he assumed the garb of a beggar and entered upon his task, attaching himself first to one Brahmanical teacher and then to another. Dissatisfied with their teaching he withdrew into the forests, where, in company with five other ascetics, he subjected himself for six years to the severest self-mortification and fasting, earning for himself the epithet Sákyamuni (the Sákya saint). At last convinced of the uselessness of those methods, he refreshed himself with food, and removed to another part of the forest, where under the shelter of a pipal-tree he remained for forty days and nights in fixed contemplation, subjected the while to innumerable temptations by Mára, the destroyer. Enlightenment and deliverance at last came to him, he attained to Buddhahood, and propounded the Four Noble Truths which have ever since formed the basis of Buddhism (*q. v.*). After some weeks spent in meditative review of the struggle and its results, he set out to proclaim his tidings of deliverance, first seeking out the two Brahmanical teachers. Finding that they were dead, he bethought him of the five ascetics with whom he had been associated in the forest, and who had forsaken him when he abandoned asceticism, and converted them. These, with a young man whom he met and converted, formed the nucleus of the Sangha (*q. v.*), or assembly of believers who were later formally organized into a brotherhood or community of monks, bound to celibacy and simplicity of life, living entirely on unsolicited alms. The remainder of his life (forty-five years) was spent in wandering all over India, expounding his doctrine and making converts. His father and wife heard his gospel with gladness and became disciples, and his aunt Prajápatí became the first "mother superior" of the community of nuns which he was persuaded to establish. He died at Kushinagara, and was cremated, in the eightieth year of his age, 543 B. C., or, as some modern European scholars now say, 412 B. C. No trustworthy biography of Gautama is found in the Southern Canon. The *Lalitavistara*, one of the nine dharmas of the Nepaulese, is very ancient, but is overlain with much that is legendary and fanciful. It was written in pure Sanskrit, and was translated into Chinese about the year 68. A popular version of it forms the basis of the *Romantic Legend of Sakya Buddha*, by Beal (London, 1882). Besides this, see Bishop Bigandet's *Life or Legend of Gaudama, the Buddha of the Burmese* (London, 1880); W. W. Rockhill's *The Life of the Buddha*, etc. (London, 1884), and the works mentioned under the article Buddhism.

R. Lilley.

**Gautier**, gō'ti-ā', Théophile: author; b. at Tarbes, France, Aug. 31, 1811; studied at the College of Charlemagne, and tried, without success, to become an artist. In 1830 he published a volume of poems, and from that time took position as a Parisian *littérateur* of the romantic school; was 1836–56 art critic and dramatic censor for the *Presse*; became literary editor of the *Moniteur Universel* 1856, of the *Journal Officiel* 1869. Author of *Albertus* (poem, 1832), some pleasant books of travel, many good novels, and other works, among which are *Les grotesques* (1844); *Trésors d'art de la Russie* (with Richebourg, 1860–63); *Histoire de l'art dramatique en France* (6 vols., 1859), with several poems, librettos, and many fugitive pieces. His style is delightfully clear, but is without the piquancy so much affected by most French writers. His criticism shows adaptations from German philosophy, by which he was profoundly influenced, but without losing his own independence as a thinker. D. in Paris, Oct. 23, 1872.

**Gauze** [from Fr. *gaze*: Span. *gasa*: Mod. Gr. γάζα]: a light fabric of silk or silk and cotton, woven so loosely and with such delicate threads as to be quite transparent. Since the introduction of antiseptic methods in surgery enormous amounts of antiseptic gauze, or gauze impregnated with certain drugs, are used. It is believed to take its name from *Gaza*, in Palestine, where it was once made. Switzerland, France, and Scotland chiefly produce it. The name is also given to other light fabrics, such as the woolen or silk-and-woolen material used for summer undershirts. Fine wire cloth is called wire gauze. It is often of remarkable delicacy and transparency.

**Gavarni**, gaă-vaar'neĕ: the name assumed by Sulpice Guillaume Paul Chevalier; artist; b. in Paris, 1801; first published sketches of the valley of Gavarnie in the Pyrenees, whence his pseudonym; attained great fame by his humorous delineations of Parisian life, exposing the foibles of good society, as well as the laughable eccentricities of low life. He also illustrated several books, among them Sue's *Wandering Jew*. D. at Auteuil, Nov. 23, 1866.

**Gavazzi**, gaă-vaat'seĕ, Alessandro: champion of Italian independence, unity, and evangelization; b. at Bologna, Mar. 21, 1809. In 1825 he joined the monastic order of Barnabites, and was appointed Professor of Rhetoric at Naples in 1829, and in 1840 was transferred to Rome. There he warmly welcomed the liberal movement which characterized the opening years of the pontificate of Pius IX. (before 1846). In 1848 he was made suddenly famous by an impassioned oration which he pronounced in the Pantheon in commemoration of the patriots who had fallen on the plains of Lombardy in the war with Austria. The pope, who then shared

in the national enthusiasm, appointed him chaplain-general and almoner of the Roman legion (16,000 strong), raised to take part in the struggle. These troops, which had marched to Vicenza, were soon recalled. But Gavazzi, instead of returning with them, broke with the pope, and became another Peter the Hermit, preaching a new crusade. The new republic made him chaplain-general of the army. The French occupation of Rome (in July, 1849) drove him into exile. He visited England, Scotland, the U. S., and Canada, lecturing against the Papal Church. In 1851, while in London, he published first his *Memoirs*, and a few months later his *Orations*. In 1860 he was with Garibaldi in Sicily. In 1870 he was again in England, and in 1873 went once more to the U. S. He was the founder of the Free Christian Church of Italy (1870), and of its theological seminary in Rome in 1875, and in it was Professor of Dogmatics, Apologetics, and Polemics. D. in Rome, Jan. 9, 1889. See his *Recollections of the Last Four Popes* (London, 1859); *No Union with Rome* (1871); *The Priest in Absolution* (1877).

Revised by S. M. Jackson.

**Gavelkind** [adapted in form to *gavel*, tribute < O. Eng. *gafol* + *kind*, but originally a Celtic word, Ir. *gabhailcine*, gavelkind, liter., family-tenure; *gabhail*, taking, tenure: Cornish *gavel* + *cine*, race, family]: a system of customary land-tenure prevailing in England in the county of Kent, and found also in other parts, by which at the death of a land-owner his land is equally divided among all his sons; if he have no sons, among all his daughters; or, if he have no issue, among all his brothers. This custom no doubt existed universally throughout the kingdom before the introduction of primogeniture about the time of the Norman conquest, and was retained by the inhabitants of Kent as a part of their ancient liberties. It is a peculiarity of this tenure that the estate has never been subject to forfeiture in case of attainder for felony, and, when feoffment was in use as a mode of conveyance, the heir was capable of selling the land and giving livery of seizin at the early age of fifteen. The special mode of inheritance appertaining to lands held in gavelkind is distinct alike from the usual English system of primogeniture and the law of descent prevailing in the U. S., by which all the children of an intestate, females as well as males, take equal shares in the land. Revised by F. Sturges Allen.

**Gaveston**, Piers: See Edward II.

**Gav'iæ** [from Lat. *ga'via*, a sea-mew]: an order or suborder of birds containing the gulls, the equivalent of the superfamily *Laroideæ* of Stejnegor, or the order *Longipennes* minus the petrels (*Tubinares*). See Gull and Longipennes. F. A. L.

**Ga'vial**, or **Na'koo** [from Mod. Lat. *gavialis*, from Hind. *ghariyāl*, whence Eng. *gharrial*, gavial]: a peculiar species of crocodile (*Gavialis gangeticus*) characterized by long, narrow jaws, inhabiting some of the rivers of India, especially the upper Ganges and its tributaries. The male has a large cartilaginous lump upon the snout, in which the nostrils open. The teeth, though numerous and sharp, are slender, and although the gavial sometimes attains a length of 20 feet it is doubtful if it ever attacks man. The food of the animal is principally fishes. An allied crocodile (*Tomistoma schlegeli*), distinguished by a wider, shorter muzzle, and less numerous, stouter teeth, inhabits Borneo. See Crocodile.

Gavial.

F. A. Lucas.

**Gavilan** (gă̆ă-vē̆ē-laan') **Mountains**: a group of mountains in Monterey co., Cal., near the Pacific coast. The highest point is Mt. Pacheco, 2,845 feet high.

**Gavot'** [from Fr. *gavotte*, liter., femin. of *Gavot*, an inhabitant of *Gap*, the Alpine district where the dance originated; cf. *Schottische* and *Polonaise*]: in music, a gay and spirited dance-tune, written in common time. It has two strains, each of which is repeated, the latter being usually the longer. The gavot was familiar in the seventeenth century and later, and often appears in connection with the *minuet*—as, e. g., in the forty-eight sonatas of Corelli.

**Gay**, gā, Claude: naturalist; b. at Draguignan, France, Mar. 18, 1800; studied zoölogy at Paris; traveled in Greece and Asia Minor, and in 1828 went to Chili, where he was employed by the Government to make an extended survey of the country. In pursuance of this commission he visited every province and the islands, making careful maps and collecting animals, plants, and minerals; he also brought together a large mass of historical material. Returning to France in 1843, he began the publication for the Chilian Government of his *Historia física y política de Chile* (24 vols. and atlas, 1843–51). He also published a large map of Chili, and many important papers on the country. He went to Russia and Tartary 1856–58, and subsequently studied mines in the U. S. D. in Paris, Apr. 6, 1863.

**Gay**, Edward: See the Appendix.

**Gay**, John: poet; b. in Devonshire, England, 1685; was apprenticed in London to a silk-mercer; published *Rural Sports*, a poem (1711), which won him Pope's lifelong favor; became in 1712 secretary to the Duchess of Marlborough, and in 1714 secretary to Clarendon, who was then ambassador to Hanover; acquired wealth, but lost it in the South Sea Bubble, and after 1727 was a dependent upon the bounty of the Duke of Queensberry. He was the author of several very successful dramas, some fine ballads, such as *Black-eyed Susan*, and other poems, like *The Shepherd's Week* (1714) and *Trivia* (1715), remarkable for wit. The excellent *Fables* (1727) and *The Beggar's Opera* (1728) are especially noteworthy. D. in London, Dec. 4, 1732.

**Gay**, Marie Françoise Sophie, Madame: author; b. in Paris, July 1, 1776; married M. Liottier, a broker, but was divorced from him and married M. Gay. D. in Paris, Mar. 5, 1852. The best known of her writings is *Anatole* (1815). Among her other works are *Léonie de Montbreuse* (1813); *Les Salons célèbres* (2 vols., 1837); and *Ellénore* (4 vols., 1846).

**Gay**, Sydney Howard: author; b. in Hingham, Mass., in 1814; studied at Harvard College: gave up the study of law because of his conscientious opposition to slavery; became an anti-slavery lecturer and editor of the *Anti-Slavery Standard*. He was managing editor of the New York *Tribune* in 1862–66, and of the Chicago *Tribune* in 1868–71. In 1874 he entered into an arrangement with William Cullen Bryant to produce an illustrated history of the United States. Mr. Bryant wrote the preface, and Mr. Gay, with the assistance of collaborators on certain chapters, wrote the history (4 vols., 1876–81). He also wrote a *Life of James Madison* (1884). D. June 25, 1888.

**Gay**, Walter: genre-painter; b. in Hingham, Mass., 1856. Pupil of Bonnat, Paris; third-class medal, Paris Salon, 1888; second-class, Paris Exposition, 1889; member Society of American Artists 1880 His picture *Le Bénédicité* is in the Luxembourg Gallery, Paris, and there are works by him in the Metropolitan Museum, New York, and Museum of Fine Arts, Boston. W. A. C.

**Gay**, Winckworth Allan: landscape-painter; b. in Hingham, Mass., Aug. 19, 1821; studied with Prof. Robert Weir, of West Point, afterward with Constant Troyon in Paris; passed several years in Europe, but is best known in his own country in Boston, by his quiet, meditative pictures, chiefly of New England scenery.

**Gaya**, gī'yă̆: a district and city of the Patna division of Bengal, British India; S. of Patna and E. of the river Son. The district lies between the parallels 24° 17′ and 25° 19′ N. lat., and meridians 84° 4′ and 86° 5′ E. lon. Area, 4,718 sq. miles. The country is a nearly level plain, with a gentle slope toward the Ganges; the eastern and northern parts are fertile and highly cultivated, while the southern is infertile and covered with jungle. Pop. 2,000,000 (nearly all Hindus). The chief town and administrative headquarters is the city Gaya, on the river Phalga, lat. 24° 47′ N., lon. 85° 3′ E. Pop. (1891) 79,920. (See map of N. India, ref. 7–H.) It is a sacred city for the Buddhists. The ruined city of Buddh Gaya, 6 miles S. of the modern city, marks the residence of Sakyamuni, the founder of the Buddhist religion, and near it is the sacred fig-tree under which he became Buddha. There are forty-five sacred spots around Gaya, which are visited by from 100,000 to 200,000 pilgrims annually. Gaya is connected by rail with Patna. M. W. H.

**Gayal**, gī'ă̆l [the native name for the domesticated gaur (see Gaur); perhaps from deriv. meaning domesticated of Sanskr. *gaya*, household]: a variety, perhaps a species (*Bos gavæus*), of the domestic ox; found in parts of Bengal and

Farther India, where it is reared in great herds for its hide and flesh. It gives very rich but scanty milk.

**Gayarré**, gī'ăr'rā', Charles Étienne 'Arthur: historian; b. at New Orleans, La., Jan. 9, 1805; was educated at the College of New Orleans, and studied law in Philadelphia; admitted to the bar in 1829; was sent in 1830 to the Legislature, and several times in later years; in 1831 became deputy attorney-general of Louisiana; presiding judge of the New Orleans city court in 1833; was elected in 1835 to the U. S. Senate, but did not take his seat; was Secretary of State in Louisiana 1846–53. He is best known as the author of a series of important works upon the history of Louisiana, partly in French and partly in English (1830, 1847, 1848, 1851, 1852, 1854); *Philip II. of Spain* (a history, 1866); *Fernando de Lemos* (a novel, 1872); *Aubert Dubayet*, a sequel to the foregoing (1882); besides a drama, lectures, and addresses. D. in New Orleans, Feb. 11, 1895.

**Gay-feather**: a local name for the blazing-stars, *Liatris scariosa* and *spicata*, and perhaps for other species of that interesting genus of composite herbs. They grow extensively throughout most of the U. S.; have bulbous roots, a terebinthinate taste, and active medicinal properties. They have beautiful purple flowers.

**Gay Head**: town; Dukes co., Mass. (for location of county, see map of Massachusetts, ref. 6–J); 22 miles W. of Edgartown. It forms the west part of the island of Martha's Vineyard; comprises a bold headland on which there is a lighthouse—lat. 41° 20′ 52″ N., lon. 70° 49′ 47″ W.—with light 170 feet above the sea; and takes its name from the brilliant colors of its cliffs. To the geologist its rocks are peculiarly interesting from its Miocene fossils—coprolites, bones, lignite, iron ores, etc. The inhabitants are chiefly Indians, who engage in farming, fishing, and rearing a breed of small horses called Gay Head ponies. Pop. (1880) 161; (1890) 139; (1900) 173.

**Gay-Lussac**, gā'lü'saak', Joseph Louis: chemist; b. at St.-Léonard, Haute-Vienne, France, Sept. 6, 1778; was admitted Dec. 27, 1797, to the Polytechnic School; assigned in 1800, while still a pupil, as assistant to Berthollet in the government chemical works at Arcueil, where he speedily won the high approbation of his superior, and was promoted soon after to be assistant professor in the Polytechnic. In 1804 he made two balloon ascensions, the first with Biot Aug. 24, and the second alone, Sept. 16, for the purpose of observing the variation with altitude of magnetic intensity, attaining in the last ascent the great height of 7,016 meters, or 23,000 feet. In the same year he became associated with the illustrious Humboldt in eudiometrical experiments, in the course of which he incidentally demonstrated that oxygen and hydrogen unite to form water in the proportions by volume of 100 of the first to 200 of the second. This led to the investigation which resulted in the subsequent announcement (in 1808) that gases always combine in definite proportions by volume. In 1805, in company with Humboldt, he left Paris on a scientific tour through Southern France, Italy, Switzerland, and Germany, reaching Berlin on Nov. 16; was elected to the Academy of Sciences in 1806; Professor of Chemistry at the Polytechnic School in 1809; and also Professor of Physics at the Sorbonne; and in 1832 Professor of Chemistry at the Jardin des Plantes. In 1807 determined the coefficient of expansion of gases at constant pressure with increase of temperature. In 1808, associated with Thenard, he discovered a chemical process for obtaining, from their alkaline oxides, potassium and sodium in quantity—metals which had been previously obtained by Sir Humphry Davy by electrolysis. Other results arrived at by these two discoverers, and published in 1809, were the decomposition of boracic acid and the production of boron, and the demonstration of the probably elementary nature of chlorine (then called oxygenated muriatic acid gas). In 1813 Gay-Lussac investigated the nature of iodine, accidentally discovered two years before by Courtois, a manufacturer of saltpeter in Paris, and pointed out the analogy between chlorine, iodine, and sulphur. In 1815 his most remarkable chemical discovery was made, that of the compound radical cyanogen, with its singularly energetic compounds, especially cyanhydric or prussic acid. In 1816 he invented his portable siphon (or mountain) barometer, since so extensively used. In 1818 he was appointed superintendent of the Government gunpowder and saltpeter works, and was subsequently called on to advise in the administration of the excise; and in 1829 was made chief assayer to the mint. While acting in these several capacities he originated many ingenious processes and instruments for the application of scientific principles to industry. In 1831 he was chosen delegate to the Chamber of Deputies from St.-Léonard, and in 1839 was made a peer of France. This honor, according to his biographer, Arago, would have been conferred on him many years earlier but for the fact that "he worked every morning at the assay office with his own hands"—a fact esteemed by the bestowers of such distinctions incompatible with the dignity of the peerage. The titles alone of his memoirs would fill many pages. They may be found principally in the *Mémoires de la Société d'Arcueil* and in the *Annales de Chimie et de Physique*, of which latter for many years, jointly with Arago, he was the editor. D. in Paris, May 9, 1850, of atrophy of the heart.

**Ga'za** [Heb. *ghazzāh*, strong; Modern *Ghuzzeh*]: in Palestine; the southernmost and strongest of the five royal cities of the Philistines (see map of Palestine, ref. 11–B). It was the limit of the conquest under Joshua (Josh. x. 41). Along with Damascus, it is one of the oldest cities in the world, and still one of the chief cities in Palestine. Commanding the road to Egypt, it has been the scene of repeated and desperate struggles. Samson's exploits have made it famous (Judg. xvi.). It was captured by Alexander the Great after a siege of nearly five months. In 634 it fell into the hands of the Saracens for a time, and since the battle of Hattin in 1187 has remained Mohammedan. Gaza is now about 2 miles from the Mediterranean, nearly the whole space between it and the sea being covered with ruins. It has a port called Majuma. The nucleus stands on a hill, with its buildings of stone, the suburbs containing only mud-hovels. The population is estimated at about 16,000, mostly Mohammedans. Revised by S. M. Jackson.

**Gaza**, Theodorus: Greek humanist and scholar; b. about 1400 at Thessaloniea; left that town on its capture by the Turks in 1430; became rector and Professor of Greek in the gymnasium of Ferrara 1447; learned Latin under Vettorino da Feltre; was employed 1450–56 by Pope Nicholas V., and 1456–58 by Alfonso the Magnanimous of Naples. Bessarion procured him a small benefice in Southern Italy. D. in 1478. His Greek grammar (1495) was long famous; the last edition appeared in 1803. His letters, his Greek treatise on the calendar, and numerous translations from Latin to Greek (Cicero's *De senectute* and *De amicitia*) and Greek to Latin (Aristotle, Theophrastus, Ælian, Dionysius of Halicarnassus, Chrysostomos) have established his reputation. See H. Hodius, *De Græcis illustr.*, etc., pp. 55–101 (London, 1742); L. Stein, *Archiv f. Geschichte der Philosophie*, ii., pp. 426–58. Revised by Alfred Gudeman.

**Gazelle** [from O. Fr. *gazelle*: Span. *gazela*, from Arab. *ghazāl*, wild goat, gazelle]: common name of the *Gazella*

Female gazelle.

*dorcas* and the nearly allied species, antelopes of Africa and Asia. The above-mentioned species is found in Northern Africa, but the ariel gazelle of Asia is a more graceful vari-

ety of the same species. The gazelles are celebrated for their elegant forms and the beauty of their eyes. They are easily tamed, and become great favorites from the gentleness of their disposition. *Gazetta sœmmeringii* and *isabetta* (both African) are among the other closely kindred species. See ANTELOPE.

**Gazette** [Fr. *gazette*, from Ital. *gazzetta*, gazette, orig. a Venetian news bulletin supposed to have sold for a *gazetta*, a copper coin worth a farthing; prob. dimin. of Lat. *gaza*, treasure, from Gr. γάζα, treasure, from the Pers.]: a periodical; a printed journal; applied especially to the official newspapers printed semi-weekly in London, Edinburgh, and Dublin, and containing appointments, official acts, proclamations of the Government, bankrupt notices, and the like.

**Gazetteer** [from Ital. *gazzettiere*, writer of news, deriv. of *gazetta*, gazette. See GAZETTE]: a geographical dictionary; a work containing some account of civil and natural divisions in geography, of mountains, rivers, lakes, seas, etc., arranged in alphabetical order. Gazetteers often are local or national, but there are many, more or less complete, which describe places in all parts of the world. See DICTIONARY.

**G Clef**: in music, the sign or mark indicating the treble staff. Its place is on the second line, or, rather, that line is the axis around which it entwines. This clef was originally compounded of the letters *g* and *s*—the former giving its location the name of G (as two octaves above gamut G), and the latter representing *sol*, or the fifth (in the scale of C) of the series of syllables used in solmization. The name G being thus given to notes on the second line, all others, above and below, on the same staff derive their names from it. In organ and pianoforte music the treble clef is prefixed to the part played by the right hand, and the bass, or F clef, to that for the left.

**Gearing**: See WHEELWORK.

**Geary**, gā′rĕe, JOHN WHITE: soldier; b. in Mt. Pleasant, Westmoreland co., Pa., Dec. 30, 1819; studied at Jefferson College, Cannonsburg, Pa.; became a civil engineer. In the war with Mexico (1846–48) he served with distinction as lieutenant-colonel Second Pennsylvania Volunteers; was promoted to the colonelcy of his regiment, and on the capture of the city of Mexico was placed in command of the citadel. In 1849 he was appointed by President Polk postmaster of San Francisco, Cal., with authority to organize the postal service throughout the Pacific coast territory. Soon afterward he was elected alcalde of the city, and was appointed by the military governor judge of the first instance for San Francisco. He remained in San Francisco till 1852, performing at different times the *ex-officio* duties of sheriff, recorder, probate judge, etc., and exercising a large influence in organizing the government of that city, whose first mayor he was (1850). Returning to Pennsylvania in 1852, he remained in private life till 1856, when he was sent by President Pierce to Kansas as Governor. His territorial administration was not successful, and becoming involved in trouble with Judge Lecompte, Geary was forced to retire, returning to Pennsylvania and remaining in private life till the outbreak of the civil war (1861), when he raised and equipped the Twenty-eighth Pennsylvania Volunteers, which regiment he commanded in several engagements in the Shenandoah valley. In Apr., 1862, he was appointed brigadier-general, and the next year promoted to be major-general and placed in command of a division, remaining in active service till the close of the war. In 1866 he was elected Governor of Pennsylvania by the Republican party, and re-elected in 1869. D. Feb. 8, 1873.

**Geas'ters** [from Gr. γῆ, earth + ἀστήρ, star]: the earth-stars; a genus of PUFF-BALLS (*q. v.*).

**Gebhardt**, OSCAR L., von: See the Appendix.

**Gebweiler**, gāp′vī-ler: town of Upper Alsace, Germany (formerly *Guebwiller*, Haut-Rhin, France); in a valley near Mt. Gebweiler, the highest point of the Vosges; 14 miles S. S. W. of Colmar, on the river Lauch (see map of German Empire, ref. 7–C). It has several spinning, weaving, bleaching, and dyeing establishments, and manufactures woolen goods, silk ribbons, and machinery. It is an old city, dating from the eighth century, but the only building of interest is the Roman Catholic cathedral. Pop. (1890) 12,367.

**Gecko**, gek′ō [: Fr. and Germ. *gecko*, named in imitation of its cry]: a name given to numerous thick-tongued nocturnal lizards of the family *Geckotidæ*. There are about 100 species, among which the *Ptyodactylus gecko* of Africa (whose footsteps were thought to be the cause of the leprosy, and which was considered able to eat steel) and the *Gecko verus* of Asia are among the best known. Other species are found in South America, Australia, etc. They generally have the power of climbing walls, walking upon ceilings with the back downward, etc., after the manner of flies.

**Geddes**, ALEXANDER, LL. D.: Roman Catholic biblical scholar; b. in the parish of Ruthven, Banffshire, Scotland, Sept. 14, 1737; educated in Paris; officiated as priest among the Roman Catholics of Scotland 1764–80, but, in consequence of his extreme liberality and imprudence, getting into difficulty with his bishop, he settled in London, and devoted himself to literary pursuits. D. there Feb. 26, 1802. He is remembered by his translation of the Bible (2 vols., 1792–97) with notes of a rationalistic character, which was not finished further than through the historical books (a partial translation of the Psalms was published 1807); and as one of the scholars who have developed the present Pentateuchal criticism. He adopted in the main the documentary theory of Eichhorn. See his biography by John Mason Good (London, 1803). SAMUEL MACAULEY JACKSON.

**Geddes**, WILLIAM DUGUID, LL. D.: educator; b. in Glass, Aberdeenshire, Scotland, Nov. 21, 1828. He was educated at the academy and university in Elgin and King's College, Aberdeen; was appointed rector of the Aberdeen Grammar School in 1853; elected Professor of Greek in the University of Aberdeen in 1855; was Professor of Greek in the United University, Aberdeen, 1860–85; and then became principal and vice-chancellor. His publications include *A Greek Grammar* (1855); edition of the *Phædo of Plato* (1863; 2d ed. 1885); *Problem of the Homeric Poems* (1878); *Floscuti Græci Boreates* (1882); and, with Peter Duguid, a work on the heraldic ceiling of the Cathedral of St. Machar, in Aberdeen (1888). He is vice-president of the Society for Hellenic Studies.

**Gedike**, FRIEDRICH: See the Appendix.

**Gedro'sia** (in Gr. Γεδρωσία, Κεδρωσία): the name given by the Romans and Greeks to what is now the *Mekrân*, or coast-region of Baluchistan. See GADROSIA.

**Geelong**, gĕe-lōng′: town of Victoria, Australia; 40 miles S. W. of Melbourne, on Corio Bay; has 7 banks, 3 newspapers, fine public buildings, and is connected by rail with Ballarat and Melbourne (see map of Australia, ref. 8–H). It is a center of the Australian wool-trade. It has an excellent harbor. Pop. (Dec. 31, 1895) 24,575.

**Geer**, GEORGE JARVIS, D. D.: clergyman; b. in Waterbury, Conn., Feb. 24, 1821; graduated at Trinity College, Hartford, in 1842, and at the General Theological Seminary in 1845; ordained deacon in Christ church (Protestant Episcopal), Hartford, Conn., by Bishop Brownell, June, 1845; became rector of Christ church, Ballston Spa, N. Y., Sept., 1845; ordained presbyter in Ballston Spa by Bishop De Lancey June 11, 1846; became associate rector of the Church of the Holy Apostles, New York, Nov., 1852; became rector of St. Timothy's church, New York, Oct. 22, 1857; received the degree of S. T. D. from Columbia College, New York, June, 1862, and the degree of D. D. from Union College, N. Y., in Aug., 1862. In 1858, as joint editor with Rev. Dr. Muhlenberg and Bishop Bedell, by appointment of the bishops, he published the *Tune-book of the Protestant Episcopal Church*; in 1871 published a book on *The Conversion of St. Paul*; was the first president of the Free Church Guild of New York; was a member of the General Convention of 1874 from the diocese of New York. D. in New York city, Mar. 16, 1885.

**Geez**: See ETHIOPIC LANGUAGE and ETHIOPIC LITERATURE.

**Geffcken**, FRIEDRICH HEINRICH: See the Appendix.

**Geffrard**, FABRE: a president of Haiti; b. at L'Anse à Veau, Haiti, Sept. 19, 1806; was the son of Gen. Nicolas Geffrard, who had co-operated with Dessalines and Pétion. Young Geffrard was early distinguished for ability, and though himself a *griffe* (three-fourths African blood), took the part of the mulattoes against the blacks. In 1845 he became a lieutenant-general, and in 1849 was made a duke by Soulouque. In 1858 he led in the revolution against Soulouque, and banished him in 1860. Geffrard was president of Haiti 1860–67, when he was himself banished, and retired to Jamaica. D. Dec. 31, 1878.

**Gefle**, yev′lā: town of Sweden; on the Gulf of Bothnia; 100 miles N. of Stockholm (see map of Norway and Sweden,

ref. 10–F). It has considerable trade in iron, timber, tar, and flax, and ship-building and fishing industries. Pop. (1895) 25,569.

**Gegenbaur**, gā'gen-bowr, KARL, M. D.: anatomist; b. in Würzburg, Germany, Aug. 21, 1826; educated at the University of Würzburg; tutor in Würzburg 1853–55; in Jena 1855–72; Professor of Anatomy in Heidelberg since 1873; leading authority in comparative anatomy; author of *Grundzüge der vergleichenden Anatomie* (2d ed. 1870); *Grundriss der vergleichenden Anatomie* (2d ed. 1878); *Lehrbuch der Anatomie des Menschen* (4th ed. 1890). Editor of *Morphologisches Jahrbuch* since 1876. C. H. T.

**Gehen'na** [from Lat. *gehen'na*, under influence of Heb. from Gr. γέεννα, from Heb. *Gē-Hinnōm*, hell, liter., the valley of Hinnom, a valley near Jerusalem where children were burned as offerings to Moloch]: a deep gorge, the valley of Hinnom, lying S. of Jerusalem (Josh. xv. 8). Its exact location is disputed. It was called also Tophet, "place of fire," because the practice of burning infants as sacrifices to Moloch was carried on here by idolatrous Jews (2 Chron. xxviii. 3; xxxiii. 6; cf. Jer. vii. 31; xix. 2–6). To break up this detestable practice, Josiah defiled the place (2 Kings xxiii. 10) and subsequently it became the receptacle of the dead bodies of criminals and of brute beasts, and of all sorts of filth. We are told that perpetual fires were kept up to destroy this offal; hence Gehenna and Tophet became synonyms for HELL (*q. v.*). Revised by S. M. JACKSON.

**Geijer**, yī'er, ERIC GUSTAF: historian; b. at Ransäter, in Wermland, Sweden, Jan. 12, 1783; studied, after 1799, at the University of Upsala; in 1803 obtained the first prize from the Academy of Sciences in Stockholm for his dissertation on Steen Sturé; in 1806 graduated as a master of arts; in 1809 traveled in England; and in 1810 was appointed lecturer in History at the University of Upsala. After a short residence in Stockholm as inspector of the archives, he returned in 1815 to Upsala as Professor of History, in which position he remained until in 1846 ill-health compelled him to resign. He retired to Stockholm, where he died Apr. 23, 1847.

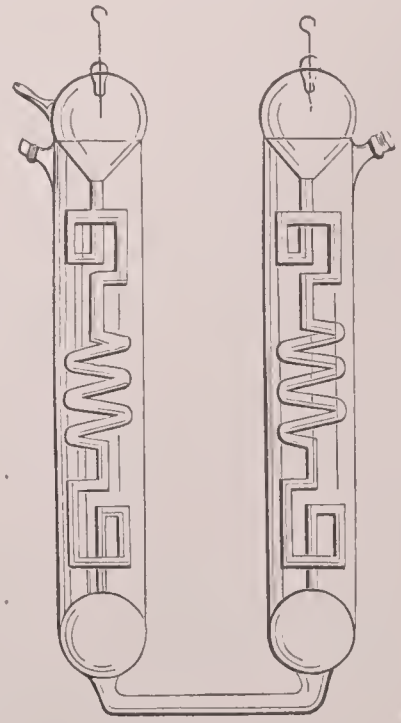
After the revolution of 1809, by which the liberty of the press was established in Sweden, a fierce contest arose in literature between the French classicism, represented by the Academy, and the romantic school, originated in Germany and represented in Sweden by two parties—the Phosphorists, headed by Atterbom, and the Goths, headed by Geijer and Tegnér. But while the Phosphorists, like their brethren in Germany, rushed through all countries and all ages in search of the most wonderful subjects and the most fantastic forms, the Goths concentrated themselves on the national, and took their subjects from the old Scandinavian sagas and the Swedish popular songs of the Middle Ages. The Goths did not take part in the battle, but when the fight was over they kept the field, and the articles of Geijer in *Idnna*, the organ of the party, as well as his poems, contributed very much to the establishment of the taste of the Swedish people, which had been roused, but also completely unsettled, by the Phosphorists. His poems are not numerous, neither have they the brilliancy of those of Tegnér, but they are very powerful. *The Viking* makes an impression as if it were not written on paper, but hewn in stone, and many of his psalms have been incorporated into the Swedish hymn-book. In connection with A. Afzelius he produced (1814–16) an edition of the Swedish popular songs in three volumes, and to many of his own songs he composed beautiful melodies, which immediately became very popular. It was as an historian, however, that Geijer acquired his greatest fame, especially as author of *Svenska Folkets Historia* (History of the Swedish People), published in 3 vols., from 1832 to 1836, and translated into German by Leffler, into French by Lundblad, and into English by Turner. His first historical work was *Svea Rikes Häfder* (Annals of Sweden), 1825, a series of essays on the earliest history of Sweden. In 1839 he published *Sketch of the State of Sweden from Charles XII. to Gustavus III.*, and in 1844 *Life of Charles XIV. John.* He also edited the posthumous papers of Gustavus III. in 1843, and in connection with Fant and Schroeder the *Scriptores Rerum Suecicarum Medii Ævi*, from 1818 to 1828. His *History of the Swedish People* ranks among the very first works of historiography.

**Geikie**, gee'kĕe, Sir ARCHIBALD, F. R. S., LL. D.: director-general of the Geological Survey of the United Kingdom; b. in Edinburgh in 1835; educated at the High School and University of Edinburgh; became member of the Geological Survey in 1855; professor in Edinburgh 1870; general director Geological Survey and Geological Museum in London 1881; and was president of the Geological Society. He was knighted in 1891, and was president of the British Association 1892–93. Author of the *Phenomena of the Glacial Drift of Scotland* (1863); *Geology* (1873); *Physical Geography* (1877); *Field Geology* (1879); *Class-book of Geology* (1886), etc.—His brother, JAMES GEIKIE, LL. D., D. C. L. (b. in 1839), is also a geologist. He joined the Geological Survey in 1861, and became Murchison Professor of Geology and Mineralogy in University of Edinburgh in 1882. President of the Geological Society 1890. He is the author of *The Great Ice Age* (2d ed. 1877); *Prehistoric Europe* (1881); *Outlines of Geology* (1888); and other works. C. H. THURBER.

**Geikie**, JOHN CUNNINGHAM, D. D., LL. D.: b. in Edinburgh, Scotland, Oct. 26, 1824; educated in Queen's College, Toronto; Presbyterian pastor in Canada and England 1851–76; in 1876 entered the Church of England and labored at Dulwich 1876–79; Paris 1879–81; Barnstaple, England, 1883–85; Norwich 1885–89; now resides at Bournemouth. He is the author of *Entering on Life*, a book for young men (London, 1874; 5th ed. 1890); *The Great and Precious Promises, or Light Beyond* (1875; 5th ed. 1890); *The English Reformation* (1875; 12th ed. 1886); *The Life and Words of Christ* (1876; 31st ed. 1890); *Old Testament Characters* (1877; 3d ed. 1887); *Hours with the Bible, or the Scriptures in the Light of Modern Discovery and Knowledge* (1880–85, 6 vols. comprising the Old Testament; n. e. *The Bible by Modern Light*, 1893, *sqq.*); *The Holy Land and the Bible* (2 vols., 1887); *A Short Life of Christ* (1888); *New Testament Hours* (1893). SAMUEL MACAULEY JACKSON.

**Geissler Pump**: a form of mercurial air-pump invented by Heinrich Geissler, Ph. D. (1814–79), a physicist and inventor of Bonn, and used by him for the exhaustion of vacuum tubes. The Geissler pump has come into extended commercial use in the manufacture of the incandescent lamp. It is probably not capable of producing the extremely high vacua obtained by a few skilled operators with pumps of the Sprengel type ($\frac{1}{1000000000}$ to $\frac{1}{2000000000}$ atmosphere), but it gives a degree of exhaustion sufficient for nearly all experimental and practical purposes. See GEISSLER'S TUBES and PNEUMATICS. E. L. NICHOLS.

**Geissler's Tubes** (called also *Plücker's Tubes*): glass tubes from which the air has been partially removed by means of a mercurial air-pump for exhibiting the electric discharge in vacuo. Their electrodes are of platinum. When the pressure has been reduced to a few thousandths of an atmosphere, the discharge obtained by connecting the electrodes with the terminals of an electric machine or induction coil assumes the beautiful form known as the Geissler effect.



Geissler's tubes.

Instead of a spark passing directly between the platinum points within the exhausted tube, the attenuated atmosphere becomes luminous throughout. The color of the discharge depends upon the character of the gas, being violet in the case of nitrogen, greenish yellow in chlorine vapor, etc. The region immediately surrounding the terminals is especially brilliant, and the form of the display differs at the positive end of the tube from that at the negative in a distinctive manner. As the degree of exhaustion increases, the discharge changes character, going through many striking modifications. Finally, when only a few hundred thousandths of an atmosphere of pressure remain, the vacuum, which had been a good conductor of electricity, suddenly ceases to convey the discharge, and the interior of the tube becomes dark.

The inner surface of the glass, however, which during the existence of the Geissler discharge had shown a tendency to phosphorescence, continues to glow. Now follow a very wonderful series of phenomena known as the "Crookes effects," which have been studied at great length by Mr. William Crookes, F. R. S. In these the walls of the tubes play an important part, and substances placed within the tube, especially various crystals and certain chemical salts, become brilliantly luminescent. See *A Fourth State of Matter* (British Association, 1879).

Certain of the rays emanating from these tubes (called *X-rays* by Röntgen) possess the property (discovered by Heinrich HERTZ (*q. v.*), and more fully investigated by Lenard, 1894) of penetrating nearly all substances. This property was utilized by Prof. RÖNTGEN (*q. v.*) for the photography of hidden objects, such as the human skeleton within its clothing of flesh, an instrument within its case, etc.

The Geissler effect has been extensively studied both from the electrical and the spectroscopic point of view. The light has been found to possess a spectrum of bright lines, characteristic of the glowing vapor contained within the tube. The radiant efficiency of the discharge considered as a source of light has been investigated by Staub, of Zurich, and by Knut Ångstrom, of Upsala, and has been found to range between 30 and 90 per cent. Ångstrom has also compared the total electrical energy expended in producing the discharge with the energy of the light-giving radiation, and has found that about 10 per cent. of the energy of the discharge is converted into light.

For spectroscopic purposes the Geissler tube is simply a straight tube of glass of capillary bore throughout nearly its entire length. Tubes for illustration are frequently given intricate forms, and are made of various sorts of glass. (See the cut.) Uranium glass is much used on account of the green phosphorescence which it exhibits under the action of the electrical discharge. E. L. NICHOLS.

**Gela** (in Gr. ἡ Γέλα): a city of Southern Sicily; situated on the river Gelas (Γέλας), from which it took its name. It was founded by the Dorians Antiphemus of Rhodes and Entimus of Crete in 690 B. C. The Geloan meadows were celebrated and Æschylus (who died and was buried here) sang of its fertility. The colony flourished so greatly that in less than a hundred years from the time of its own foundation it could found the city of Agrigentum, which soon became a place of far greater importance than the mother city. Gela was governed mostly by tyrants, and Gelo, Hiero, and Thrasybulus, tyrants of Syracuse, were men of Gela. By the time of Christ Gela had ceased to be inhabited. The ruins of the city are in the neighborhood of Terranuova. See E. A. Freeman, *Sicily*; W. W. Lloyd, *History of Sicily to the Athenian War* (London, 1872).
J. R. S. STERRET.

**Gela'nor** (in Gr. Γελάνωρ): the last King of Argos of the line founded by Inachus, the river-god and aboriginal king. He lost his throne on the occasion of a prehistoric invasion of Argos by the Egyptians, traces of whose influence may still be seen in the vicinity of Argos (Curtius, *Peloponnesos*, ii., 365). Mythology usually refers prehistoric movements of peoples to a single individual, and in the present case the story is this: Danaus and his fifty daughters, in order to escape from the persistent wooing of the fifty sons of Ægyptus, fled across the sea from Egypt to Argos, where Danaus was elected king by the Argives in the stead of Gelanor. While the matter of the throne was still under discussion a wolf killed a bull, the leader of a herd of cattle that was grazing outside the city walls. This was taken by the people as an omen in favor of the foreign princeling, who was at once made king. In memory of the event which led to his elevation Danaus erected a temple in honor of Apollo Lycius (Gr. Ἀπόλλων Λύκειος), an epithet capable of two interpretations, though here it means "Apollo, the Wolf," and is a reminiscence of original tribal totemistic worship. See A. Lang, *Custom and Myth* (London, 1885); *Myth, Ritual, and Religion* (London, 1887); J. G. Frazer, *Totemism* (London, 1888). J. R. S. STERRETT.

**Gela'sius I.**, SAINT: pope; succeeded Felix III. Mar. 1, 492, and, according to Protestants, was the first pope who claimed complete independence of the synods and the civil authority. He wrote against the Nestorian and Eutychian heresies, but several works ascribed to him are probably spurious. D. Nov. 19, 496, and was succeeded by Anastasius II.—GELASIUS II., POPE (GIOVANNI DI GAETA), succeeded Pascal II. in 1118, but was imprisoned in the same year; escaped and fled to Gaeta. The Emperor Henry V. caused the antipope Gregory VIII. to be chosen in his stead. D. at Cluny, Jan. 29, 1119.

**Gelatin**, or **Gelatine**, jel'a-tin [Fr. *gélatine*, from Mod. Lat. *gelati'na*, deriv. of Lat. *gela'tus*, perf. partic. of *gela're*, freeze]: a semi-solid substance of a soft, tremulous consistence, produced from certain animal membranes (skin, fibrous tissue, etc.) by the action of hot water. Isinglass, calf's-foot jelly, glue, etc., are chiefly composed of gelatin. In its ordinary form it contains much water, which may be dried out, leaving a glassy, brittle mass, which swells, but does not dissolve, in cold water. The gelatin from cartilage is called chondrine, and is somewhat different from true gelatin. According to Scherer, dry gelatin consists of 50·05 parts carbon, 6·9 hydrogen, 14·7 nitrogen, and 27·65 oxygen. Others believe that it contains a little sulphur. For a long time it was held to be innutritious, but at present a considerable (but not high) nutritive value is conceded to it. Gelatin is thrown down from the watery solution by alcohol, by a solution of corrosive sublimate, by tannic acid, and by chlorine gas. The organic portion of bones contains gelatin, which may be extracted in two ways: by digesting a bone in dilute hydrochloric acid at a summer heat, when the gelatin is left in a semi-transparent and flexible state, and when boiled with water yields a solution which sets on cooling, or by heating the bones covered with water in a digester to a temperature of 270° to 280° F. As a result of this method the greater part of the gelatin dissolves out. The gelatin obtained from bones is, however, inferior in quality. Gelatin is extensively used in the arts—as *finings* for beer, as a dressing for silk and other fabrics, as a coating for dragees and pills, as a material for the capsules which hold unpleasant medicines, for preparing tracing-paper, as a material for delicate casts, as the basis of numerous jellies; and dried gelatin plates are employed in photo-lithography and the kindred arts. See GLUE, ISINGLASS, etc.

**Gel'derland**, gel'der-land: province of the Netherlands; bounded by the Zuyder Zee, Prussia, and the provinces of Overyssel, Utrecht, and Brabant. Area, 1,972 sq. miles. Along the rivers Rhine, Waal, and Yssel the soil is a rich loam, carefully cultivated, and large crops of wheat, rye, buckwheat, and tobacco are gathered. Farther back the ground becomes hilly and sandy, covered with large forests of pine and oak. Excellent cattle are reared; the horses are highly esteemed, both in France and Germany. Considerable brewing and distilling is carried on, besides manufactures of linen, paper, and leather. Pop. (1896) 548,748. Principal towns, Arnheim, Nymwegen, and Zutphen.

**Gelée**, zhe-lā', or **Gellée**, CLAUDE, commonly but erroneously known as Claude Lorrain (in French *le Lorrain*): painter; b. at Chamagne on the Moselle, now in the French department of the Vosges, in 1600. He was of poor family. In his youth he was taken to Rome as a servant or employee, but the stories of his going thither differ widely. About 1619, however, he was certainly at Rome in the employ of a painter named Tassi, and learning something of the mechanical side of the painter's art. He had the advantage, too, of a short residence in Naples. In 1625 he left Rome for the north, and up to this time seems to have attracted no attention as a painter. He visited Loreto and Venice, and then went over the Alps and to his birthplace, from which he seems to have been called to Nancy, then the capital of Lorraine. Here he painted under the direction of the court-painter of the Duke of Lorraine, but was in Rome again in 1627. His life as an artist may be said to begin at this time. Two pictures for the Cardinal of Bentivoglio are said to have been the beginning of his success, but he was nearly forty years old before his general popularity was established. He never married, and lived only for his art, and during the fifty years of his active practice he painted a very great number of pictures which have generally withstood time and have been well preserved. The galleries of Europe are very generally provided with them.

Claude's art is singularly narrow in range, expressing but few of the aspects of nature, and being made up of pictures very similar in distribution of masses, character of composition, and tone of color. The special charms of his work are clear, soft skies, with beautiful gradation of color, and abundance of light over the whole landscape. Even Mr. Ruskin, his least favorable critic, says that he "first put the sun into the heavens." But these pictures of tranquil landscape, still-water classical architecture, and warm still sun-

shine are lovely pieces of coloring, and charm almost all persons who care for painting at all. Thus in the National Gallery in London two large Turners (see TURNER, J. M. W.) are hung beside two Claudes expressly for comparison, and by the terms of Turner's own bequest. There are many ways in which the Turners excel; and yet even those lovers of art who especially admire Turner's painting, and who would claim that his range and variety and general power as a landscapist are immeasurably beyond Claude's, would still admit that picture for picture each one of the Claudes in question is a more precious work of art than its rival.

Besides his pictures Claude left a number of etchings, also of landscape subject. They are greatly admired for their beauty of composition, and Philip Gilbert Hamerton has called one of them, *Le Bouvier*, the finest landscape-etching in the world, though it is hard to assent to that when one thinks of Rembrandt's work in the same direction. (See REMBRANDT.) Claude's *Liber Veritatis* consists of a number of very small drawings in brown and white, made by himself as memoranda of his paintings, at least as to their general masses and composition. Many of these still exist, and a part of the series was engraved in imitation of the original drawings, and published in 1774.

Of the many large, showy, and attractive pictures by Claude in public galleries or well-known private collections, there are ten in the National Gallery, of which, besides those hung next the two Turners, the *Embarkation of the Queen of Sheba* and the *Embarkation of St. Ursula* may be named. Claude was fond of a seaport, or what was considered in his time the proper conventional seaport of painting—stately Roman architecture and a slightly ruffled sea to contrast with its vertical lines. The so-called *Morning*, in the Bridgewater Gallery, the *Journey of Christ into Egypt*, at Dresden, the *Siege of La Rochelle*, in the Louvre, and a *Sunset* and a *Sunrise*, at Madrid, are famous. This great and strongly individual painter died at Rome in 1682.

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**Gellius**: See AULUS GELLIUS.

**Gelo**, or **Gelon** [Gr. Γέλων, prob. deriv. of Γέλα, Gela]: son of Dinomenes of Gela. He was a general of cavalry under Hippocrates, tyrant of Gela, and when in 491 B. C. Hippocrates died, Gelo at first pretended to conduct the government of Gela in the name of the sons of Hippocrates, but he soon declared himself tyrant. He next became tyrant of Syracuse (484 B. C.), and in time virtual master of the greater part of Sicily. He abdicated the tyranny of Gela in favor of his brother Hiero, and in order to strengthen himself in Syracuse and all Sicily he married the daughter of Thero, tyrant of Agrigentum. Thereafter all his energies were directed toward enlarging and beautifying Syracuse, whose government he administered in so masterly a way that at the time of the invasion of Greece by the Persians, when the Greeks begged him for assistance he willingly agreed to send an army, but demanded for himself the chief command. On being told that an army had been asked for and not a general, he declined to negotiate further, telling the envoys of the Greeks that though they had commanders, they were not likely to have soldiers to command, as they had "deprived their year of its spring." The Greeks warned him that the Persians would attack him immediately after the fall of Greece; therefore, in order to be with the winning side in that case, Gelo sent a ship to Greece to watch events, and instructed his officers to offer earth and water in case the Persians were victorious; but if not, to return home. But, according to Herodotus, Gelo would have taken part in the national campaign against the Persians but for the invasion of Sicily by the Carthaginians under Hamilcar. In 480 B. C. (according to some, on the day of the battle of Salamis) Gelo utterly routed the Carthaginians near Himera, in a battle that was regarded by the Sicilians as equal in importance to the Grecian victory over the Persians. The Carthaginians sued for peace, and Gelo was now lord of Sicily, but his conduct of the government had been so acceptable to the Syracusans and Sicilians that he could dare to present himself alone and unarmed in the popular assembly where every one else was armed, and though he offered to abdicate and allow the Syracusans to subject his acts to the most searching scrutiny, he was unanimously declared "savior and king." He died of dropsy in 477 B. C. Though he had expressed a wish that he be buried in simplest style in accordance with the laws of Syracuse, he was held in such esteem that his wish was disregarded. A magnificent monument was erected in his honor, he was declared a hero, and was thereafter worshiped accordingly. In accordance with his will, his brother Hiero succeeded him as tyrant, though he left a young son. In addition to the literature cited under GELA, see also Grote, *History of Greece*, v., 204–239; Curtius, *History of Greece*; S. Cavallari, A. Holm, ed. E. Cavallari, *Topografia archeologica di Siracusa* (Palermo, 1884); or B. Lupus, *Die Stadt Syrakus im Alterthum* (Strassburg, 1887).

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**Gelse'mium** [also *gelseminum*, Mod. Lat., from Ital. *gelsomino*, jasmine]: a genus of plants of the family *Loganiaceæ*. The yellow jasmine of the Southern U. S. is a beautiful evergreen climber (the *Gelsemium sempervirens*), having large, yellow, fragrant flowers, appearing in early spring. The whole plant is poisonous, but is a valuable medicine. In a proper dose it has excellent sedative effects, but should be given with caution. An overdose causes great prostration and calls for stimulants.

**Gem**: a precious stone, especially one used or intended to be used for ornament or in other ways, after having been cut and polished. (See PRECIOUS STONES, JEWELRY, and MINERALOGY.) The term is used in a special sense to denote a stone carved into a CAMEO (*q. v.*) or engraved, that is, with a sunken device or *intaglio* cut upon it. The latter form of artistic work makes the true *engraved gem*, and it is as an abbreviated form of that phrase that the word "gem" is most often used.

Deep engraving—that is, cutting boldly into the stone, as distinguished from mere scratching—has been practiced by all peoples of artistic civilization from the earliest times. The stones so engraved were intended to be used as seals (see SEAL) among the Egyptians, the Orientals of ancient times, the Greeks, the Romans. If small and disk-like, or lenticular, or approaching the hemisphere in form, they were generally worn in finger-rings; if larger, or if cylindrical, or of approximately conical shape, they were worn on the wrist, or hung around the neck. All ancient gems are found pierced with each a hole in the direction of its length, sometimes very small, and intended for threading with a wire, sometimes large, and probably meant for a larger and softer string of wool or hemp. It is clear, from many indications, that the chief object of the ancient gem-engraver was to produce a beautiful raised figure by means of the impression of his incised pattern upon wax or clay; he had the resulting bas-relief rather than the intaglio in his mind, as the work of art he aimed at. But since the fall of the ancient civilization the peoples of European race have used the antique gems as ornaments, and since the revival of glyptic art in Italy in the fifteenth century gem-engravers have worked in rivalry, and almost always in imitation of the ancient intaglios, considering rather the beauty of the engraved stone itself; although the impression on sealing-wax, pipe-clay, or plaster is used to help to an appreciation of the engraved design.

Egyptian gems are the most ancient that we know. They date back to about 3600 B. C., or to the fourth dynasty. All or nearly all are in the form of a SCARABÆUS (*q. v.*) or scarab; that is, they are more or less close copies of a beetle with its legs drawn close up to its body, the under side being kept flat or nearly flat to receive the engraving. The most ancient Asiatic gems, nearly as old as the Egyptian beetles, are *cylinders*; that is, they are either really cylindrical in form, though not always accurately rounded, or else slightly barrel-shaped, or, again, a little smaller in the middle than at each end. These cylinders are from less than an inch to 2 inches, or even more, in length. The engraving generally covers their whole surface except the ends, and the subject of the engraving is not merely an inscription of words or signs standing for words, as in the Egyptian instances, but includes elaborate figure-subjects, human and divine personages, hunting scenes, or scenes of combat, and also such emblems as the "sacred tree" and the like. The seals of the great men of the Accadians, the Babylonians, the Assyrians, and all the neighboring nations for thirty-five centuries were commonly of this character. Cylinders and scarabs alike were made of many kinds of stone; some as soft as steatite, and from this through many degrees of hardness to rock-crystal, and even in rare cases to still harder stones. A few gems of the same early period are nearly conical in shape, with a neck or a circular groove where a string might be attached, the engraving being on the base of the cone. In the engraving of these early gems there has been constant use of the rapidly revolving drill, whose circular, pit-like cuttings are not perfectly overcome by the

hand work which followed. The diamond point, or a similar cutting edge of ruby or other form of corundum, must have been used on the harder stones to work the design into shape, but these implements were hard to manage for the early workman; they are not perfectly mastered. Still the general excellenee of the polish in the intaglio even in the earliest gems is not easy to explain.

The engraved cylinders and cones and spheres cut away to a plane on one side of the ancient Persian kingdom have their special charm. Persia has always been a land of decorative art, ever sinee the Achæmenian dynasty began, in the eighth century B. C., and these, the earliest of all the surviving works of Persian art, are not the least worthy of study. The style of the figure-snbjects grows continually freer and more artistic up to the time of the conquest by Alexander the Great. Phœnician gems are numerons, and of many eenturies, but they are without national character, borrowing their designs from Egypt or Assyria, and often without any comprehension of the meaning of the signs employed. Etruscan gems have the same skilled workmanship and the same feeble power of design and absence of originality as other works of Etrusean art. They eome from a people just the reverse of the Greeks, loving splendor and shunning simplicity in dress and appointments, great in jewels and ornaments, but feeble in art.

The earliest Greek work is not seen in the earliest gems found in Greeee; they are evidently Oriental. How early the first Greek gems may be there is as yet no means of deciding; they are eommonly of the shape of a lentil, or of a shape approaching that, with the circular edge flattened on four sides, so as to suggest a lozenge with rounded angles, and the engraving is done upon the unaltered convex surface. A beast, or fish, or bird, or a group of two, is a eommon device; probably they really are *devices* in the technical sense, that is, the badges or cognizances of individuals. That which we call *style* in art is characteristic of all these. Indeed the test is applied the other way; the gem which has true style—that is, vigorous artistie charaeter—is at once set down by the expert as Greek, wherever it may have been found. Even in pieces of the most feeble workmanship, where the drill-holes remain undisguised and the polish is by no means uniform, where the early workman has only half-mastered his tools, the evidenees exist of that artistic power which was afterward to bring into being the most perfeet seulpture whieh men have yet produced. After the earliest centuries the form of the stone ehanges, and also the subject of the engraving. Very many Greek gems of the sixth and fifth centuries B. C. are searabs in form, or, rather, are what are called *scarabæids*—that is, they have a form suggested by the beetle, but not resembling it in detail. The subjeets engraved on the plane surface are now historical, or legendary, or mythologieal—personages or groups apparently taken from the same legends as those embodied in the Homeric poems. The gems of the finest period of sculpture, the time of Phidias, or the middle of the fifth century B. C., often have subjeets like those of the wonderful tomb-reliefs (see SCULPTURE) of the same and a later time, simple subjeets, as a draped woman earrying a jar, a nude young man with a staff and a dog, and the like. The dignity and largeness of treatment of these diminutive figures sunk in hard semi-transparent stones ean only be seen by means of an impression on pipe-clay. It would be unique and alone in art but for the wonderful eoins of the same epoch and of the years immediately sueeeeding it. (See NUMISMATICS.) These coins are as fine, and much more numerous, for there are very few gems known to us of the best Greek time. It was with the times of Alexander the Great that gem-engraving became more universal, and from that time on the most common subject, though one whieh had been very rare indeed before, was the single portrait-head. This continued throughout the whole Roman epoch. Aetual likenesses and ideal portraits, as of men long dead and gone, heads of living emperors and of philosophers 600 years dead, heroes of Grecian fable and statesmen of early Roman history, private persons of whom their friends wished to have mementos, and gods, from Jove, the father of primitive Latin belief, to the latest importation from the East, Mithra or Isis, all were common subjects. Every person of consequenee or of affairs had his signet, for the eonstant use of which see SEAL, but also the new custom of "eolleeting" gems, and having them in cabinets, or worn on the fingers many at a time, created a large and constant market, and set Greek gem-engravers to work in all the Mediterranean lands. A high standard of design and execution was kept up for centuries, and it is not until the deeay of all the other plastic and graphic arts in the fourth century A. D. that a notable change for the worse is to be seen in the gem-engraving.

Byzantine art, splendid in so many ways, did little for gems, but Constantinople and the other eities of the Eastern empire were places of safety for those that existed already, and from these cities many gems must have passed into Northern Europe during the Middle Ages. The few elaborate pieces of goldsmiths' work whieh remain to us from that time, covers of manuscripts, proeessional crosses, altar-vessels, and the like, offer many instances of antique gems set in the metal as part of a general decorative design, and some instances are known of a mediæval king having an undoubted antique for his private seal. So was the taste kept alive; but the new growth of art in the fourteenth eentury in Italy was so strongly led by Roman taste and tradition that nothing more would have been needed to create a new school of glyptics in the suceeeding century. As early as the time of Lorenzo the Magnifieent, who was chief of the Mediei from 1469, engraving on hard stones was beautifully done. Often antique works were closely copied, but as often new designs were made in what was thought to be the antique taste; and the most striking distinction between the ancient and the Renaissance work was in this, that the modern engraving, not being meant for use as a seal, was cut in a stone much larger than needed, so that a margin was left all around the subject, which would have been useless make-weight for the signet carried always about the person.

Gem-engraving has never been wholly given up since the Renaissanee, and many portraits of European statesmen of the eighteenth and nineteenth centuries and other quite modern subjects exist. There was even an English school of great ability and sueeess flourishing between 1775 and 1825. Since that time, though cameo-cutting and die-sinking have been cultivated with zeal, there seems to have been little engraving in hard stones, except as forgeries, to be sold for antiques, and sueh slight work as cyphers and armorial bearings.

Besides gems proper, an enormous number of glass (*paste*) intaglios exist, both ancient and modern, some of them of great beauty.

Throughout the Levant and in India a beautiful decorative jewel is produced by engraving lightly in an opaque stone of fire color, such as a turquoise or a blood-stone, and gilding the engraved pattern.

BIBLIOGRAPHY.—There are very many large and costly works on intaglios and cameos, of which generally the most recent are the best, both for text and plates. The large works, giving many engraved plates of gems, are not generally named here, because the representations are seldom aecurate. Brunn, *Geschichte der Griechischen Künstler*, an admirable work on the whole subject of Greek art, devotes much spaee to the authenticity of signed Greek gems. See also Müller-Wieseler, *Denkmäler der Alten Kunst* (Göttingen, 1869), unfortunately a rare book; Köhler, *Gesammelte Schriften* (St. Petersburg); Chabouillet, *Catalogue . . . des Camées et Pierres Gravées de la Bibliothèque Imperiale* (Paris); A. H. Smith, *Catalogue of the Gems in the British Museum*; Ernest Babelon, *Le Cabinet des Antiques à la Bibliothèque Nationale* (Paris); De Voguë, *Mélanges d'Archéologie Orientale* (Paris); Menant, *Recherches sur la Glyptique Orientale* (Paris); C. W. King's works, as follows: *Antique Gems, Handbook of Engraved Gems, Precious Stones and Metals, The Gnostics and their Remains*, and one in which the whole as regards gems is summed up in two volumes, not well-arranged, but full of matter, *Antique Gems and Rings* (published 1872); J. H. Middleton, *The Engraved Gems of Classical Times.* RUSSELL STURGIS.

**Gemara**: See TALMUD.

**Gembloux**, or **Gemblours**, *zhaañ'bloo'*: town of Belgium; province of Namur (see map of Holland and Belgium, ref. 11–F); celebrated as the seene of the great victory of Don John of Austria over the United Netherlanders in 1578. The Benedictine abbey founded here in 922, and now the seat of an agricultural academy, was, in the twelfth and thirteenth eenturies, famous for its riehes and for the learning of its monks. Pop. 4,193.

**Gem'ini** [Lat., twins]: a sign of the zodiac, into whieh the sun enters about May 21, and from which it passes June 21. Also a constellation of the zodiac, now eorresponding to the sign Cancer. Castor and Pollux are the two principal stars—the former a fine double one. The constella-

tion may be seen on the meridian during the evenings of December and January.

**Gemis'tus**, Georgius, or **Georgius Ple'tho**: scholar; b. at Constantinople about 1390; held office under Manuel Palæologus in 1426; in 1438 was a delegate to the Council of Florence; was tutor to Bessarion and the associate of Cosimo de' Medici; was in 1441 engaged in the imperial service in the Peloponnesus, and is said to have lived a hundred years. He is chiefly remembered as a leader of the restoration of learning; was the author of a great number of treatises on history, philosophy, geography, etc., many of which have never been printed, and was the prime mover in the revival of the Platonic philosophy in Italy.

**Gemmill**, John Alexander: Canadian legal writer; b. in County Lanark, Ontario, Mar. 20, 1847; educated at private schools in England and Scotland, and at the University of Glasgow. He is a practicing barrister and parliamentary counsel at Ottawa; president of the Law Association of the County of Carleton; edited and published the *Canadian Parliamentary Companion* 1883–91, and is author of *The Practice of the Parliament of Canada on Bills of Divorce* (Toronto, 1889). N. M.

**Gemona**, jā-mō'năă: Italian town of considerable transit commerce, in the province of Udine; 15 miles N. N. W. of the town of Udine (see map of Italy, ref. 2–E). It has a fine cathedral and several other churches, containing interesting pictures by Pordenone, Cima da Conegliano, etc. The granite font in the Duomo is said to be a work of the eighth century. Many Roman antiquities are found here. It has an active and industrious population of 7,665.

**Gems'bok** [from Dutch, liter., chamois-buck, male chamois, and so used in European Dutch; *gems*, chamois + *bok*, buck]: a fine large antelope (*Oryx capensis*) of South Africa, the *kookam* of the natives, found in small groups upon the open plains. It is often 5 feet long, and has straight horns about 2¼ feet in length. It is courageous, and is said to successfully defend itself against the lion. It is hunted on horseback and proves itself a swift and strong runner. It is asserted that it never drinks, a sufficient supply of water being obtained from the succulent plants upon which it feeds. See also Oryx.

**Gender** [from O. Fr. *gendre*, *genre* < Lat. *genus*, *generis*, race, descent, kind, class]: a grammatical classification of nouns according to their suggestion, be it real or merely conventional, of some characteristic like that of sex. The grammatical mechanism of many languages—e. g. the Chinese and the Polynesian languages—makes no provision for any such characterization. Some languages discriminate in the form of their nouns between objects as animate and inanimate—e. g. the Cherokee—others between objects as rational and irrational, noble and mean, male and female, or sexless. In most cases these characterizations belong to the superfluities of language, not being necessary to the identification of the object. In Modern English, for instance, they are, however, mostly omitted, except as they serve such purpose; cf. *giant* : *giantess*. Radically different is the status of Old English, in which, for instance, *fōt*, foot, is masculine; *hond*, hand, is feminine; *wīf*, woman, is neuter. These genders involve no real suggestion of sex. They are traditional and associated with the word-forms, as may be seen by a comparison of related languages; thus masculine *fōt*, foot, Germ. *der Fuss*, Lat. *pes*, masculine, Gr. *ὁ πούς*, Skr. *pad-*, masculine; O. Eng. *tōð*, tooth, masculine, Germ. *der Zahn*, Lat. *dens*, masculine, Gr. *ὁ ὀδούς*, Skr. *dant-*, masculine; O. Eng. *mūð*, mouth, masculine, Germ. *der Mund*; O. Eng. *mōna*, moon, masculine, Germ. *der Mond*, Lat. *mensis*, month, masculine, Gr. *ὁ μήν*, month; O. Eng. *dæȝ*, day, masculine, Germ. *der Tag*; O. Eng. *hȳd*, hide, feminine, Germ. *die Haut*, Lat. *cutis*, feminine; O. Eng. *niht*, night, feminine, Germ. *die Nacht*, Lat. *nox*, feminine, Gr. *ἡ νύξ*; O. Eng. *tīd*, time, Germ. *die Zeit*; O. Eng. *word*, word, neuter, Germ. *das Wort*, Lat. *verbum*, neuter; O. Eng. *wīf*, woman, neuter, Germ. *das Weib*; O. Eng. *fȳr*, fire, neuter, Germ. *das Feuer*, Gr. *τὸ πῦρ*; O. Eng. *ēage*, eye, neuter, Germ. *das Auge*, etc. As gender departs from connection with natural sex and associates itself with the word as such or with groups of words of a particular form or ending, it is called *grammatical gender*. So strong is the tendency toward merely grammatical gender that words which might be expected to be of common gender often attach themselves firmly to one of the formal groups; thus *mouse* is feminine in O. Eng. (*mūs*) and Germ. (*die Maus*), but masculine in Gr. (*ὁ μῦς*). Even in the parent Indo-European speech grammatical gender had come to associate itself with the different endings or suffixes of words—i. e. these endings were regarded as signs of gender; thus nouns in *-os* were masculine, those in *-ā* feminine. It is not, however, necessary to suppose that the original purpose of these endings was to denote gender. As Brugmann has shown in the works cited below, the suffix *-ā*, for instance, may have acquired its value as denoting female objects from some few words like *gnā*, wife (cf. Skr. *gnā*, Gr. *γυνή*, Eng. *queen*), which chanced to end in *-ā*, after whose analogy words like *ékṷā*, mare (cf. Skr. *áçvā*, Lat. *equa*, Lith. *aszvà*), were introduced as differentiations from words in *-os*, like *ékṷos* (cf. Lat. *equus*, etc.). Under the influence of such sex-words as these, the other words in *-ā*, mostly of collective or abstract signification, like Gr. *φυγά* (Att. *φυγή*), Lat. *fuga*, flight, became technically feminine or quasi-feminine.

In the separate life of the Indo-European languages the formalism of grammatical gender was often incapable of holding words from more natural groupings with words of kindred signification. Thus in Greek names of countries are feminine even when having a masculine ending, as *ἡ Αἴγυπτος*, Egypt; they follow probably feminines like *γῆ*, *χθών*, earth, land. So names of cities, like *ἡ Κόρινθος*, following *ἡ πόλις*, city. Names of months are masculine, following *ὁ μήν*, month. Names of rivers are masculine, following *ὁ πόταμος*, river. Latin *dies*, day, is originally masculine, as is Skr. *div-*, when used in the sense "day," but when referring to a particular day, i. e. as a date, it is feminine, owing probably to the influence of *nox*, night, feminine, Gr. *ἡ νύξ*, on account of the ancient usage of reckoning the progress of time by nights.

Bibliography.—Adams, *Du Genre* (1888): Winkler, *Weiteres zur Sprachgeschichte*, pp. 1–87, *Das grammatische Geschlecht* (1889); Brugmann, *Das Nominalgeschlecht in den indogerm. Sprachen*, *Internat. Zeitschr. für allgem. Sprachwiss.*, iv., 100 ff.; *Compar. Grammar of the Indo-Germ. Languages*, ii., § 57, Rem.; Wheeler, *Grammatical Gender*, *Class. Review*, 1889 (Nov.), pp. 390 ff.; Delbrück, *Comparative Syntax* (in Brugmann's *Compar. Gramm.*), pp. 89 ff. (1893); Lange, *De substantivis femininis Græcis secundæ declinationis* (1875); Behaghel, *Germania*, xxiii., 288 f.; for older view, cf. Grimm, *Deutsche Grammatik*, iii., 311 ff.

Benj. Ide Wheeler.

**Genealogy**, jen-ĕĕ-ăl'ō-ji [viâ O. Fr. from Lat. *genealogia* = Gr. *γενεαλογία*, deriv. of *γενεάλογος*, one who makes or traces a pedigree, liter., descent-teller; *γενεά*, race, descent + *λέγειν*, tell]: the science of descents. As a record of families it holds an intermediate place between biography, which treats of persons, and history, of which the subject is the rise and progress of the nation. The rules and principles of the three are not dissimilar, although the purpose of the first is a little different from the design of the other two. In England, as in most countries in which the feudal system has prevailed, the laws of the descent of families are intimately connected with those of the descent and tenure of lands. Where estates pass to a single heir, it is essential that the derivation of that heir from the blood of the first lord should be clearly proved; and as the lines of descent may become successively extinguished, the order in which collaterals succeeds must be definitely settled. The latter is the work of the lawyer, and its principles are well stated in Blackstone's *Commentaries*. The former is the office of the genealogist, whose duty it is to trace out and record the history and growth of families and the relationship of the several branches to one another. Formerly this was made the duty of the heralds, who in their periodical progresses through England inquired into the condition of all families which were entitled to bear arms, and recorded their pedigrees in the Heralds' College. The "visitations," as the records of their labors are briefly called, are among the most important collections in the College of Arms in London. The visitations were discontinued about the middle of the seventeenth century. Since that time, although official records are still kept, they are derived from voluntary information. For many centuries pains have been taken by the nobility and gentry to preserve the records of their descent. Every great house has its muniment-room, in which are preserved the title-deeds of the estate and documents relating to the history of the family. These precautions are necessary for the reason already given—viz., the possibility of remote collaterals being called to the succession. In the U. S. the work of the genealogist is dif-

ferent. The division of landed estates among the children or other representatives of the last proprietor obviates the necessity of the production of a single heir. The history of land-titles is provided for by a system of public records, and the functions of the genealogist are limited merely to the history of families. The immense field of investigation that is opened in tracing the ancestors and descendants of a single person is astonishing. In the ascending line the ancestors double in every generation. In other words, in the first degree there are two ancestors; in the second, four; and in the fourth, sixteen; and by going back for twenty generations it will be found that every man has more than a million of ancestors. In the descending line the numbers are still larger. Every child of the common ancestor may become the founder of a family, and the relations of these several families to the main stock or oldest line of descent give rise to collaterals, all of whom should be included in a complete pedigree. In the U. S. the labors of genealogists have been turned in this direction. Undeterred by the greatness of the task, students have undertaken to record, for instance, all the ramifications of large families, usually beginning with some emigrant of the seventeenth century, and conscientiously tracing, in the male or female line, or sometimes in both, the history of his descendants.

The results of genealogical investigations are usually embodied either in pedigrees or family histories. The former are sometimes arranged as a tree, in which the common ancestor represents the root or stock, and the descendants are arranged in order in the branches. More commonly, however, pedigrees are constructed in the form of tables, in which the ancestor and the descendants, with a brief statement of the time of the birth, marriage and death of each, appear in successive rows of squares or circles, properly connected by lines which indicate the direct descent of every person. From these methods of arranging pedigrees are derived the common expressions a family tree, a stock, branches, and lines of descent. The advantage of a pedigree is that it gives at a single view all the descendants of a common ancestor. The disadvantages are that while it necessarily involves an extreme brevity, and sometimes even meagerness of statement, it nevertheless requires much space, and may readily become unmanageable from its size. Hence genealogists more commonly adopt a narrative form, called a family history, by which means they are able to condense their records into a volume of moderate size, and at the same time to make their statements at greater length. The objections to this plan are that unless conducted with care and system, it is sure to involve the reader in confusion in the course of a very few pages, and that under any circumstances the labor of consulting such a compilation is very great. To obviate the first of these objections in a measure, genealogists have adopted several methods of arranging the branches, and of designating the various lines of descent. The simplest method appears to be that of giving to every name its own number, which is placed before it in Arabic characters, and in designating the relations of every person to his parents and his brothers and sisters by Roman numerals. Some genealogists, however, prefer designating the successive generations, and not the individuals, by numbers. There is also a difference of opinion as to the order in which the successive lines of descent should follow one another, some thinking it better to take up the sons of the common ancestor in order, finishing the record of the descendants of the first before approaching the second, and so on through the whole; others recording every successive generation in its order. A question has also been raised whether in such a history the descendants of daughters are entitled to stand side by side with those of sons. In Great Britain it is usual to exclude them, but there are special reasons for this in the connection of genealogy with the tenure of land. In male fiefs there can be no possibility of females or their descendants being called to the succession; and in those cases in which lands devolve upon an heiress, they descend afterward either in the line of her husband, or, in the event of her dying without issue, to the collaterals of her father's family. In the U. S., however, where the aim of the genealogist is strictly historical, this reasoning does not apply; and there probably is no good reason, beyond the inevitable increase of the labor of the genealogist and of the bulk of his volume, why the posterity of daughters should not be admitted into it. In answer to the second objection, it may be said that as a book of geography is rendered intelligible by means of maps, so it is easy for the reader of a family history to construct from it brief and compact pedigrees which will be apprehended at a glance.

Genealogy, as a science, insists upon evidence. No genealogist will accept a mere family tradition or an unauthenticated statement, but he always requires sufficient proof. There is so much uncertainty in family traditions that it is found that statements accepted by families and given in good faith are often not merely unfounded, but contrary to existing evidence. The principal sources of evidence are family records contemporaneous with the events which they commemorate, as, for instance, an account written by any person of his own children; public records, such as wills, deeds, and mortgages; church records, letters, and tombstones. A pedigree or a history of descents not authenticated by these or equivalent evidence is not to be trusted, and will surely be rejected by every well-trained genealogist. Among the most eminent genealogists of the U. S. may be mentioned Joseph L. Chester, who was honored with a memorial in Westminster Abbey, and Henry F. Waters, both of whom spent many years making successful researches among the records and archives of Great Britain. See *The American Genealogist* (1875) and Marshall's *Genealogists' Guide* (1885).

Revised by JAMES GRANT WILSON.

**General**: in certain Roman Catholic religious orders, the highest officer of the order. The general of the Jesuits is chosen for life, and holds one of the most influential positions in the Church. He lives in Rome. Most other generals hold office for three years, and they usually reside at Rome. The general of the Augustinians must be of one of the Calceate congregations. The Franciscans have three generals—one each for the Observantines, the Capuchins, and the Tertiaries—besides procurators-general for the Reformed and Alcantarine congregations, and a minister-general for the Conventuals. The general of the Dominicans is chosen for life. Since the time of Simon Stock the Carmelites have had an unbroken line of generals. Other orders have superior officers with special titles. Thus the chief of the Minims is called "general corrector," the superiors of their houses being called "correctors." See GENERAL OFFICER.

**General Assembly**: in the Presbyterian Church the highest of four courts, the other three being, in their order, session, presbytery, synod (see PRESBYTERIAN CHURCH). In the U. S. there are four general assemblies—(1) that of the Presbyterian Church North; (2) that of the Presbyterian Church South; (3) that of the Cumberland Presbyterian Church; (4) that of the United Presbyterian Church. The highest court of the smaller Presbyterian bodies is the synod. A description of the General Assembly of the Presbyterian Church North will serve substantially for all others in the U. S. This court is constituted of an equal number of ministers and laymen. Its meetings are held annually in different parts of the country, as may be agreed upon. Its members are styled *commissioners*, and are appointed by the presbyteries in the following proportion: "Each presbytery consisting of not more than twenty-four ministers shall send one minister and one elder; and each presbytery consisting of more than twenty-four ministers shall send one minister and one elder for each additional twenty-four ministers, or for each additional fractional number of ministers not less than twelve." Its officers are a moderator, chosen annually; a stated clerk, who is also treasurer; and a permanent clerk. The term of the last two officers is indefinite. Temporary clerks are chosen each year to assist the permanent clerk in making a fair record of the proceedings, etc. The duty of the stated clerk is to keep the records and to publish them, together with such statistical tables as the assembly may direct. Each assembly is "constituted" by prayer, and "dissolved" at its close by formal proclamation of the moderator. In every case the constituting act is preceded by a sermon, which is generally preached by the retiring moderator. The business of each meeting is directed in accordance with a simple manual of general rules. The province of this court is thus defined by the constitution of the Church: "The General Assembly shall receive and issue all appeals, complaints, and references that affect the doctrine or constitution of the Church, which may be regularly brought before them from the inferior judicatories; provided, that in the trial of judicial cases the General Assembly shall have power to act by commission, in accordance with the provisions on the subject of judicial commissions in the Book of Discipline. They shall review the records of every synod, and approve or censure them; they shall give their advice and

instruction in all cases submitted to them in conformity with the constitution of the Church; and they shall constitute the bond of union, peace, correspondence, and mutual confidence among all our churches. To the General Assembly also belongs the power of deciding in all controversies respecting doctrine and discipline; of reproving, warning, or bearing testimony against error in doctrine or immorality in practice in any church, presbytery, or synod; of erecting new synods when it may be judged necessary; of superintending the concerns of the whole Church; of corresponding with foreign churches on such terms as may be agreed upon by the assembly and the corresponding body; of suppressing schismatical contentions and disputations; and, in general, of recommending and attempting reformation of manners and the promotion of charity, truth, and holiness through all the churches under their care." To effect these varied purposes each assembly appoints a number of standing committees, whose duty it is to bring all business before the court in its order. For conducting the benevolent and evangelistic work of the Church a number of boards have been established, such as that of foreign missions, home missions, education, etc. These boards report to each assembly, and receive instructions. During the sessions popular meetings in the interest of these boards are held. The legislative work of the assembly has, in the U. S., gradually become subordinate. When cases of appeal are tried by commission, matters of law are to be "referred to the appointing court for final adjudication"; and "matters of constitution and doctrine . . . may be reviewed in the appointing body." In Scotland, Ireland, and Canada the General Assembly is somewhat different from the above as to constitution and method, yet in all essential particulars the same.

Revised by WILLIS J. BEECHER.

**General Average**: See AVERAGE (in maritime law).

**General Bass**: in music, the equivalent in German for thorough bass, or the system of harmony, as commonly written and illustrated by figures over or under a bass.

**General Convention, The**: originally an association of members of the English (afterward Protestant Episcopal) churches in several of the U. S.; formed after the Revolution for the purpose of promoting a closer union among those churches. During the period of colonial dependence the English congregations had been under the jurisdiction of the Bishop of London. When, however, at the close of the war, his authority was withdrawn, they found themselves not only without episcopal superintendence, but without any bond of union beyond that of a common faith and a common liturgy; but as every State, before the adoption of the present Constitution, was regarded as an independent sovereignty, and as the churches in every State asserted for themselves the rights and powers of national churches, there was a real danger that even this slender bond of union might speedily be lost. The problems which the members of the "Church of England in America" were called upon to solve were these: First, to secure the episcopal succession; and, second, to arrange a system by which there might be, as the celebrated Dr. Chandler expressed it, "a uniformity, or at least a similarity—*qualis decet esse sororum*—through the different States." The first was accomplished, after some delay, by the consecration of Dr. Seabury in Scotland, and of other bishops in England, for America. (See EPISCOPAL CHURCH.) The second was attained by the establishment of a General Convention. On May 11, 1784, several clergymen and laymen, members of a society for the "relief of widows and children of clergyman"—a society which still exists—met at New Brunswick, N. J., ostensibly for the purpose of arranging the affairs of that society, but with the further design of consulting one another about the interests of the Church in the several States. In accordance with arrangements made at that meeting, clerical and lay delegates from New York, New Jersey, Pennsylvania, Maryland, and Delaware assembled in New York in October of the same year, and after agreeing upon certain fundamental principles resolved that a convention should be held in Philadelphia in 1785. At the convention of 1785 delegates from the above-named States, as well as from Virginia and South Carolina, were present. A "general ecclesiastical constitution" was adopted, founded upon the declaration of principles of the previous year; active measures were taken for the revision of the Prayer-book; and the union of the churches in the Middle and Southern States was regarded as complete. The churchmen of Connecticut, Rhode Island, New Hampshire, and Massachusetts, however, were not at first disposed to accede to these arrangements. They doubted the propriety of giving seats and votes to laymen in an ecclesiastical assembly, and they strongly objected to a provision by which the bishops were made amenable to their own conventions. The latter provision was corrected, and the objection to the former was apparently withdrawn: and in 1789 Bishop Seabury and delegates from the Eastern States took their seats in the General Convention. In the same year a constitution was adopted, which, though it has been amended from time to time, yet in substance continues in force. This constitution provides that there shall be a General Convention of the Protestant Episcopal Church in every third year; that the convention shall consist of the bishops, who form a separate house, and of four clerical and as many lay deputies, who must be communicants, from every diocese; and that all acts of the convention shall be adopted and authenticated by both houses. The General Convention has power to consent to the formation of new dioceses, to provide the mode of trying bishops, and to establish and revise a Book of Common Prayer. These are all the powers which are given in its constitution. The other articles, which treat of the principles and rules relating to the establishment of new dioceses, of the qualifications for holy orders, and of the consecration of bishops for foreign countries, really confer no powers, and may perhaps be regarded as a concordat between the churches in the several States. In point of fact, however, the General Convention has never limited itself to the powers given by its constitution, but has gradually developed into the governing body of the Protestant Episcopal Church in the U. S. Its extra-constitutional acts (if such an expression may be allowed) appear to extend to all points of discipline and doctrine. It has enacted a code of canons for the government of the Church; it has founded a theological seminary; it has established a system of missions, both within the U. S. and in foreign countries; it has set forth a "Standard" Prayer-book with various offices and ordinals; it has adopted with modifications the Thirty-nine Articles of Religion originally prepared by the Church of England; it has published collections of psalms in meter and hymns, and finally a *Hymnal* (1892); and it has passed a canon which touches the doctrine of the Holy Sacrament. It would, in fact, be extremely difficult to designate with precision the powers which the General Convention possesses or assumes. Some theologians are inclined to limit its functions strictly to those which are specified in its constitution. The obvious objections to this view are that it has not been adopted by the General Convention itself, and that if it be correct most of the acts of that body are unconstitutional and without authority. Other divines are disposed to regard it as an ecclesiastical parliament, possessing powers as vague and unlimited as those of the British Parliament; but here the question arises, Whence could such a body derive such powers? This question has never been answered, and indeed appears to be incapable of solution. The former view seems to have been that of Bishop Seabury, Dr. Chandler, and other leading theologians of the eighteenth century; the latter was adopted by Dr. Francis Vinton in his work on the law of the Church. No attempt is made here to reconcile these conflicting views, or to commend either of them to acceptance. They are mentioned as historical facts.

The sessions of the Church as assembled in convention have been as follows:

Preliminary meetings—May 11, 1784, at New Brunswick, N. J.; Oct. 6, 7, 1784, at New York. Conventions of the Church in the Middle and Southern States—Sept. 27–Oct. 7, 1785, at Philadelphia; June 20–26, 1786, at Philadelphia; (adjourned) Oct. 10, 11, 1786, at Wilmington, Del.; July 28–Aug. 8, 1789, at Philadelphia; (adjourned) Sept. 29–Oct. 16, 1789, at Philadelphia.

At the adjourned convention of 1789 the New England churches under Seabury united with the churches of the Middle and Southern States, of which White and Provoost were bishops, and the convention became "General." The first General Convention held its sessions in New York city Sept. 11–19, 1792, and since that date sessions have been held every three years in some large city. During the civil war the Episcopal Church in the Southern States organized July, 1861, and maintained a separate existence till 1865. Their meetings were as follows:

Preliminary—July 3–6, 1861, at Montgomery, Ala.; (adjourned) Oct. 16–24, 1861, at Columbia, S. C. General Conventions—Nov. 12–22, 1862, at Augusta, Ga.; Nov. 8–10, 1865, at Augusta, Ga.

The Church in the North never recognized officially the secession of the Southern churches. At the General Convention of 1862 the assistant secretary of the House of Deputies, in calling the roll of dioceses, regularly included all the dioceses on the list of those admitted to union with the convention, and in 1865 the same course was pursued so that the representatives from the South were able to resume their places as though no interruption of their attendance and connection had taken place.

Revised by WILLIAM STEVENS PERRY.

**General Issue**: See ISSUE.

**Generalization** [deriv. of *generalize*, from Fr. *généraliser*, deriv. of *général*, general < Lat. *generalis*, general, liter., pertaining to a kind or genus, deriv. of *genus*, kind, genus]: a term defined by Whately in his *Logic* as "the act of comprehending under a common name several objects agreeing in some point which we abstract from each of them, and which that common name serves to indicate." He illustrates the definition as follows: "When we are contemplating several individuals which resemble each other in some part of their nature, we can—by attending to that part alone, and not to those parts wherein they differ—assign them one common name, which will express or stand for them merely as far as they all agree; and which, of course, will be applicable to all or any of them; which process is called generalization, and each of these names is called a common term, from its belonging to them all alike; or a predicable, because it may be predicated affirmatively of them or any of them." Sir William Hamilton groups this act and its kindred processes under the name of "elaborative faculty," which is the faculty of perceiving relations, the discursive faculty, the faculty of comparison, "the judgment—διάνοια, as opposed to the νοῦς." He makes generalization to be "nothing but comparison." "Under comparison may be comprised all the acts of synthesis and analysis, generalization and abstraction, judgment and reasoning." The several phases of this process he arranges in the following order: 1, Composition or synthesis; 2, abstraction, decomposition, or analysis; 3, generalization; 4, judgment; 5, reasoning or inference. "Generalization is dependent on abstraction, but abstraction is not dependent on generalization." Kant holds that every act of judging is an act of synthetical unity performed by means of the "transcendental unity of apperception"; i. e. it is rendered possible by the "I think" or Ego, or subject in consciousness, which furnishes the unity for the multiplicity of sensation, and in so doing generalizes. Generalization is the essential phase of the act of reflection which accompanies all acts of rational intelligence. Even the activity of sense-perception is accompanied, in a conscious being, by the dim perception of self or Ego, as pure subject of the act of perceiving. The Ego or subject is always generic and abstract; indeed, the highest genus, or ultimatum of abstraction, free from all empirical determinations or characteristics, and as a factor of all concrete knowing, furnishes to the thinking being the means of rising above the multiplicity of empirical details through attention to this abstract factor of perception; which act of attention is called "second intention," being attention to the mental process, while "first intention" is directed to the object of the senses —a distinction noted by Avicenna, the great commentator on Aristotle. "When one thing without difference abides," says Aristotle (*Post. Analyt.*, ii., 19), "the universal arises in the soul. Primary things [generic entities] become known to us through induction"; induction being the ascent from particulars of sense to the generic entity of the pure Ego. Self-consciousness is the basis of all generalization, being the act of reflection or of turning back upon itself—the thread upon which all the faculties of the soul are strung—memory, imagination, conception, inference, speculative insight. Thus "second intention" has several degrees, which might be named third, fourth, and fifth intentions also, each higher faculty being the result of a new act of attention upon the activity of the next lower faculty. See FICHTE; also articles on IDEALISM, NOMINALISM, NOTION, PHILOSOPHY (its method), REALISM, and SCHOLASTICISM for the ultimate bearing of this theory.

WILLIAM T. HARRIS.

**General Lien**: See LIEN.

**General Officer**: an officer who has superior charge or right of command, whether civil, military, or ecclesiastical. Thus the superior of the Society of Jesus is styled "the General." According to Bardin (*Dict. de l'Armée*, etc.), the word *captain* (i. e. *head, chief*) became so common in the Middle Ages that the title "captain-general" was appropriated to one who commanded all the rest (i. e. when numerous independent bodies, each with its *chief*, a *captain*, were combined). By ellipsis, the adjective has become substantive, and a general, without qualification, is, properly speaking, one *over all*—a "commander" in the highest sense of the term. And the grade of "general," when it exists, should indicate an officer clothed with right of supreme command. But the designation "general officer" is applied in a qualificative sense to any officer of higher rank than colonel, and in this use it properly distinguishes those officers who form component parts of the essential units of army organization (regiments and companies) from those whose sphere of command is not thus limited; while various distinctive titles are employed to give luster to the office of *general*, such as "captain-general," "field-marshal," or (in France) "maréchal de France." In Great Britain the sovereign is captain-general. The commander-in-chief (under the sovereign) is a field-marshal, a rank held also by three or four others. There are also numerous "generals," as well as lieutenant-generals, major-generals, etc.: Brigadier-general implies, in British military terminology, the command of a *brigade* (i. e. two or more regiments temporarily or permanently united); major-general, in the U. S. service and in some others, the command of a *division* (i. e. two or more brigades temporarily or permanently united); while lieutenant-general, implying deputed power, has had the sense in France of "lieutenant du roi," or viceroy, or a general commanding in place of his sovereign; and also, and more commonly, the general of a division. But the actual standing of these two last-named grades depends upon arbitrary legislation or regulation. The function of "major-general" under Napoleon corresponded to that of a "chief of staff"—one who is the organ of communication between the "general" and his subordinates. ("The military language of France," says Bardin, "offers frequent examples of such disparities.") "General de division" is in France the style and rank of a division commander, while Napoleon gave to the commanders of his *corps d'armée*, when first organized, the grade of "lieutenant-general," which before the creation of "army-corps" was sometimes the special designation of a division commander when the *division* was the largest unit into which an army was divided. Afterward, during the empire, commanders of *corps d'armée* were usually *maréchaux de France*.

As to the history and service of the U. S. it does not appear that the Continental Congress regulated the grades of general officers, but accepted them (major and brigadier generals) as it found them in the several States (or colonies, rather). Washington was chosen as "commander-in-chief," without other designation. Under the existing Constitution successive legislative acts have regulated the number of brigadier and major generals. That of Mar. 2, 1799, declares that "a commander of the army of the U. S. shall be appointed and commissioned by the style of 'general of the armies of the U. S.'"; while it abolished the office and title of lieutenant-general, created ten months previously (May 28, 1798, when war with France was apprehended) and conferred upon Washington. The act of Mar. 16, 1802, provided for but a single general officer of the grade of *brigadier*. The war of 1812–15 of course caused the creation of numerous major and brigadier generals; the act of Mar. 2, 1821, provided for one major and two brigadier generals. In 1846 (Mexican war) the President was authorized to add one major-general (Zachary Taylor, Gen. Winfield Scott being then the single major-general) and two brigadier-generals to the military establishment. Subsequently (Feb. 15, 1855) the grade of lieutenant-general, *by brevet*, was revived to acknowledge "the eminent services of a major-general of the army in the late war with Mexico" (Scott). It would be impracticable to recapitulate the legislation during the civil war by which the number of major and brigadier generals on the army list was greatly augmented. The grade of lieutenant-general, never before conferred by the Federal Government upon any one except Washington (and by brevet on Scott), was renewed and conferred (Mar. 2, 1864) upon Gen. Grant. In 1866 the grade of general was created and conferred on the same officer; that of lieutenant-general, thus vacated, on W. T. Sherman, who became general on the accession of Gen. Grant to the presidency. Lieut.-Gen. Sheridan was appointed general June 1, 1888. On his death the grades of general and lieutenant-general became vacant. There are three major and six brigadier generals, besides the adjutant-general, the inspector-general, paymaster-general, the chiefs of engineers and of ordnance, the quarter-

master, commissary, and surgeon generals, the judge-advocate-general and chief signal officer, who hold the latter rank.

Revised by JAMES MERCUR.

**General Rules**: rules of the Methodist Episcopal Church; written by John Wesley, in consultation with his brother, Charles Wesley, in 1743, and published in a small volume entitled *The Nature, Design, and General Rules of the United Societies in London, Bristol, Kingswood, and Newcastle-upon-Tyne.* Thenceforward the "General Rules" were the only conditions of membership in the Wesleyan societies; and when Wesley dispatched Dr. Coke to organize "the Methodist Episcopal Church in the U. S. of America," they were inserted in the *Discipline* of the latter, and remain there still, as the "terms of membership." In Stevens's *History of the Methodist Episcopal Church* it is said that "the Articles of Religion and the General Rules are both parts of the organic or constitutional law of American Methodism," but the General Rules prescribe the "only condition" of membership, without allusion to the Articles. Conformity to the doctrines of the Church is required by its statute law as a functional qualification for the ministry, but church members can not be excluded for personal opinions while their lives conform to the practical discipline of the Church, and they can be tried and expelled for sowing dissensions in the societies, by inveighing against their doctrines or discipline; that is, in other words, not for their opinions, but for their moral conduct respecting their opinions. These Rules form a remarkably liberal platform of church communion. The same author remarks, in *The History of Methodism*, that it comprises not one dogmatic statement, and hardly what would be called an ecclesiastical requisition. It consists almost entirely of practical requirements. At a later date Wesley exclaims in his *Journal*, "Oh that we may never make anything more or less the term of union with us but the having the mind that was in Christ, and the walking as he walked."

**General Ship**: a ship offered, usually by advertisement, by her master or owners to the patronage of the general public for the carriage of goods upon a particular voyage. Those offering a ship as a general ship become common carriers, and are subject to the rules and obligations imposed upon common carriers in general. See SHIPPING.

Revised by F. STURGES ALLEN.

**General Theological Seminary**: of the Protestant Episcopal Church; situated in New York city; was opened in a room of St. Paul's chapel 1819; removed by the General Convention to New Haven 1820, but restored two years later. It was in a building belonging to Trinity School, corner Canal and Variek Streets, 1822–25; then removed to its present site on Chelsea Square, West Twentieth and Twenty-first Streets, between Ninth and Tenth Avenues. The ground was given by Clement C. Moore, LL. D., Professor of Biblical Learning in the faculty. The gifts of many patrons, and especially the munificence of the present dean, Rev. Eugene A. Hoffman, D. D., have not only greatly increased the educational and literary facilities of the seminary, but since 1883 have housed it in magnificent buildings. It is the principal seminary in the Protestant Episcopal Church.

SAMUEL MACAULEY JACKSON.

**Generation** [viâ Fr. from Lat. *genera'tio*, deriv. of *genera're*, beget, generate, deriv. of *genus, generis*, kin, family]: See REPRODUCTION.

**Generation, Spontaneous**, or **Abiogenesis** [*spontaneous* is from Lat. *sponta'neus*, deriv. of *sponte*, without known external cause]: the supposed origination of living organisms without parent organisms to produce them, out of inorganic, or at least non-living, matter, and under the influence of forces purely physical. The fact that minute forms of organic life constantly make their appearance wherever conditions exist favorable to their preservation, notwithstanding the apparent absence of pre-existing germs from which they may have sprung, has given rise to the idea that no such organic antecedents are necessary at all: that these microscopic forms of life are constantly coming into existence *de novo* under the operation of the ordinary powers of nature, and therefore that they originate by a generation which is truly spontaneous. The advocates of this theory urge that the germ-theory can account only for the propagation of life after life has originated, whereas the theory of spontaneous generation accounts for the origin of life itself.

The notion of spontaneous generation has been entertained by naturalists in every age since the dawn of scientific history. But the earlier naturalists—Aristotle and Lucretius, for instance—conceived that organisms of a high order of complexity, such as insects or fishes or reptiles, might be directly produced out of the moist earth softened by showers, or out of the slime and mud of rivers; whereas those of our time confine themselves to the assertion that life in its spontaneous origin is manifested only under forms of organisms of a very low type, such as the bacteria.

Down to the seventeenth century the belief that living things may originate without eggs or germs or living parents from which to proceed may be said to have been universal in Europe. Curiously enough, scriptural authority was cited in proof of this view, and the Old Testament story of the bees found by Samson in the carcass of the dead lion was presumed to confirm it. The doctrine was held as matter of faith, and those who first assailed it were accused of impiety and irreverence. Prominent, and perhaps first among these, was Francis Redi, an Italian philosopher, scholar, and poet (b. in 1626). He presented a conclusive disproof of the spontaneous generation of maggots in putrefying flesh, by simply inclosing, in open-mouthed jars covered with gauze, pieces of flesh still sound, and leaving them in the sun to putrefy. Putrefaction occurred as before, but no maggots made their appearance. The maggots, nevertheless, did appear on the gauze, and a little observation made their origin manifest. The flies, of which they are the progeny in the larva state, being attracted by the odor of the flesh, but unable to reach it, laid their eggs upon the covering of the jar, and out of these the larvæ were presently developed. Having demonstrated the falsity of the popular belief on this subject in a case so conspicuous, Redi naturally generalized his conclusion, and took the ground that no living thing comes into existence without deriving its life from something previously living. He did not say, "*Omne vivum ex ovo*," but "*Omne vivum ex vivo.*" He still believed that out of a living plant may arise a living animal, as the insect within the gall of the oak, or the worm within the fruit which presents no external puncture. His doctrine was therefore that which Huxley has named *biogenesis*, in contradistinction to spontaneous generation, called by him *abiogenesis*. About the middle of the eighteenth century John Tuberville Needham, an English naturalist, resorted to an experiment which, with various modifications, has been since many times repeated, with the view thoroughly to test the question whether, in its application to infusorial life, the doctrine of biogenesis is universally true. He prepared an infusion, thoroughly boiled it in a flask, corked it tight, sealed the cork with mastic, and covered the whole with hot ashes, designing to destroy by heat any germs which might be in the infusion, in the substance infused, or in the air above the liquid in the flask. After some days or weeks he found that, notwithstanding all these precautions, living organisms did make their appearance in the flask, precisely such as in freely exposed infusions habitually appeared earlier. This experiment was immediately repeated by Spallanzani, an Italian ecclesiastic and naturalist; but Spallanzani, instead of corking his flasks and cementing his corks, sealed the vessels by fusing the glass, and having thus completely cut off communication with the outward air, kept them at the boiling temperature for three-quarters of an hour. No life appeared in the infusions of Spallanzani, and the doctrine of biogenesis was again apparently triumphant.

The question was, however, not yet universally admitted to be settled. Dissentients made themselves heard from time to time; among them Gleichen, Otho Müller, and Treviranus, the latter of whom pointed out the significant fact that while the species of infusorial animals found in infusions of the same kind were constantly the same, those which appeared in different infusions were not so. Early in the nineteenth century the celebrated naturalist Lamarck ranged himself on the side of spontaneous generation. Oken took the same view, and subsequently Bory St. Vincent, J. Müller, Dujardin, Burdach, and Pineau, while on the opposite side appeared, among others, Schwann, Schultze, and Ehrenberg. The experiments of Schultze and Schwann were undertaken for the purpose of testing the accuracy of those of Spallanzani. Since those experiments had been made, the importance of air—or of oxygen, one of its constituents—to the maintenance of animal life had been discovered, and doubts had arisen whether in those experiments the air had not been rendered unfit for the support of life by the operations to which it had been subjected. In repeating the experiments, Schultze admitted to the flasks, after boiling the

infusions, only such air as had been passed through concentrated sulphuric acid, and Schwann only such as had been conducted through red-hot tubes. No animalcules made their appearance; and these results, reached in 1836 and 1837, were regarded by the great body of naturalists as finally settling the question.

The controversy, however, after resting for twenty years, was revived and prosecuted with even more animation than before, by Pouchet, in the first instance, on the side of spontaneous generation, and Pasteur on that of biogenesis. Pasteur showed that in multitudes of instances infusions hermetically sealed while boiling remained for indefinite periods of time free from all traces of organic life, while portions of the same infusions exposed side by side with these, but open to the air, were speedily swarming with animalcules. He found that even an unsealed flask, of which the neck had been stopped during the boiling only with a plug of cotton closely pressed together, continued to be equally free from these organisms so long as the stopper remained in its place. This last experiment presented a rather curious resemblance to that of Redi with his gauze-covered jar; for the cotton forming the plug was found, on a microscopic examination, to contain the germs which its presence had prevented from entering the flask. Wyman, Bastian, Cantoni, and others reported results at variance with Pasteur's, showing that bacteria will make their appearance in infusions which have not only been boiled before being sealed up, but which, after being sealed, have been kept at a boiling heat for many hours; but the methods of bacteriological research which have been elaborated since 1878 have shown that the methods employed by these experimenters would not insure the killing of all spores, and especially of the spores of the hay bacillus, and it may now be considered as definitely settled that there is no evidence that spontaneous generation can occur on the earth under existing circumstances. Whether under any circumstances life can originate in non-living matter under the influence of physical forces only is a question which at present can not be answered. See Bastian's *Beginnings of Life* (1872) and Dunster's *History of Spontaneous Generation* (1876).

Revised by J. S. Billings.

**Genesee' River**: a river which rises in Potter co., Pa., and flows in a general northward direction through the State of New York, and after a course of some 120 miles falls into Lake Ontario 7 miles N. of Rochester. It is navigable for 5 miles by lake vessels. There are grand falls at Portageville, at Rochester, and other points on this river. It affords abundant water-power at many places. The Genesee valley is a very fertile and beautiful region.

**Genese'o**: city (founded in 1836); Henry co., Ill. (for location of county, see map of Illinois, ref. 3–C); on railway; 159 miles W. by S. of Chicago and 23 miles E. of Rock Island. It is the center of a large and productive agricultural district, and is a very important shipping-point for grain and stock. It has a flourishing high school, the Northwestern Normal School, a collegiate institute, flouring-mills, an iron-foundry, and manufactures of agricultural implements, tubs, pails, furniture, wagons, carriages, etc. It is a thrifty and enterprising city. Pop. (1880) 3,518; (1890) 3,182; (1900) 3,356.

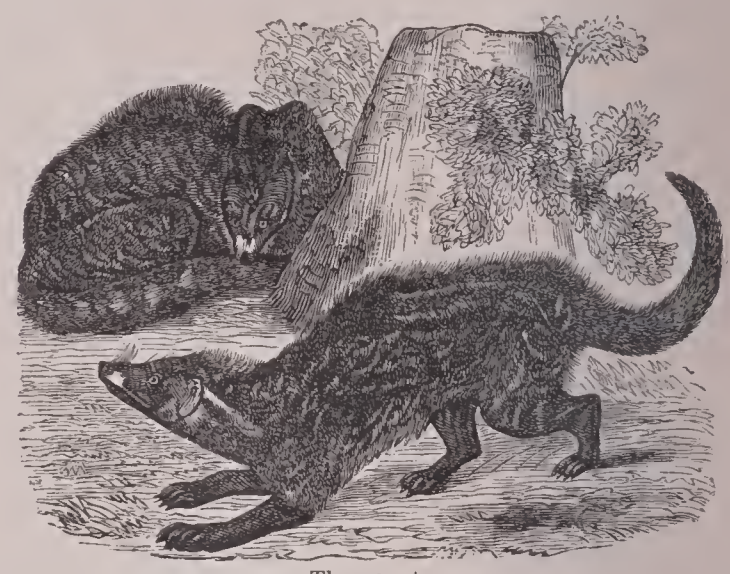
Editor of "Republic."

**Geneseo**: village (founded in 1790); capital of Livingston co., N. Y. (for location of county, see map of New York, ref. 5–D); on railway, and on the east bank of the Genesee river; 29 miles S. of Rochester. It has churches of five denominations, a State normal school, a union school, a public library of over 8,000 volumes, a flouring-mill, planing-mill, glove and mitten factory, canning-factory, machine-shop, water-works, gas, and a complete system of sewerage. Chief industry, agriculture. Pop. (1880) 1,925; (1890) 2,286; (1900) 2,400. Editor of "Livingston Republican."

**Genesis** [via Lat. from Gr. *γένεσις*, becoming, beginning, transl. of Heb. *breshith*, in the beginning, the first word of Gen. i. 1]: the first book of the Pentateuch, one of the most venerable and ancient of existing books, containing an account of the creation, of man's original happy state, his sin and fall, of the Deluge, and the restoration and dispersion of mankind, ending with the story of Abraham and his early descendants. Its authorship is ordinarily ascribed to Moses, but some have questioned its unity, regarding it as a compilation from various older records; and still others have questioned its historical character. For a discussion of these points, see Hexateuch.

**Genest**, *zhe-nā*, or **Genêt**, Edmond Charles: diplomatist; a brother of Mme. Campan; b. at Versailles, France, Jan. 8, 1765, and brought up in the French court; produced when twelve years old a history of Eric XIV., for which Gustavus III. sent him a gold medal; declared himself a republican; was *chargé d'affaires* at St. Petersburg 1789–92, and French minister to the U. S. 1793–94. Washington, however, finally demanded his recall, Genest having taken unwarrantable measures with the design of forcing the U. S. into a war with Great Britain. He settled at Schodack, Rensselaer co., N. Y., was naturalized, and married first (1794) a daughter of Gov. George Clinton, and then (after 1810) a Miss Osgood. Was translator of Idman's treatise on the Finns and their language (1778). D. at Schodack, N. Y., July 14, 1834.

**Gen'et** [from O. Fr. *genette*, from Arab. *jarneit*, genet]: a name given to various carnivorous mammals of the family *Viverridæ* and genus *Ge'netta*. There are several species,



The genet.

mostly African. The common genet (*Genetta vulgaris*), found wild from France to the Cape of Good Hope, is the best known. At Constantinople and other places it is domesticated, and used to destroy rats and mice. It is gentle, and prized for its soft and beautiful fur. It has a faint smell of musk, is reddish gray, mottled and streaked with black, brown, and white; the pupil of the eye is narrow and vertical, and the claws are retractile.

Revised by F. A. Lucas.

**Genetic Psychology**: the science of the mind considered from the point of view of its origin and growth, both in the child and in the race. From the genetic point of view the mind is no longer considered, as in the old faculty psychology, as a fixed unchanging substance with a certain number of faculties, but as a growing, developing activity or function. Instead of trying to find in the infant all the faculties of the man, genetic psychology tries to reduce the mind of the man as far as possible to the simplicity of that of the child, and then to trace, by actual observation and experiment with children, the order of rise of the more complex mental processes and their relative bearing on one another. This general point of view gives to psychology as now treated several distinct points of advantage over the theoretical treatment of the "mental philosophy" of the earlier schools.

1. The events of the infant's consciousness are simple rather than reflective. What we find in a child's mind are simply his presentations, memories, thoughts; not what he himself thinks of them, or what he observes and reports them to be. In adult consciousness, on the contrary, the disturbing effects of reflection have been considered, ever since Kant pointed them out, a matter of notorious moment. It is impossible for me to report exactly what I feel, for example, for by observing it, attending to it, I have myself altered it. But the child's feeling is simple; his emotion is as spontaneous as a spring. He has not yet learned the social and personal prejudices, vanities, and conventions which affect every adult; he does not look at himself through the countless lenses of time, place, and circumstance. So in his mental processes the psychologist finds his data in their purest and simplest form.

2. It is by the study of children that we are able to test the truth of the analyses which we make in general psychol-

ogy. Suppose, for example, we decide with many philosophers that no knowledge is possible without a knowledge of self, we can, after all, go to the nursery and observe the opposite in any infant less than eight months or a year of age. Or suppose we say, with many psychologists, that volition is necessary to all adaptive muscular movement; another appeal to the child shows us so many facts to the contrary that we are able to bring genetic psychology to refute the position.

3. Infant psychology has advantages also over the study of animals and over the study of mental diseases. For in dealing with the consciousness of animals we are never sure that they have all the elements of human mental life in them. The animals never become men, but the children do. The animal's mental growth takes the form of instinct to a remarkable degree, while the man is characterized by what we call intelligence. And in the study of mental pathology, or diseased conditions of the mind, we find consciousness reduced to simple activities, it is true, but not just the same activities, nor in the same proportion as in the child. For example, in mental diseases in which the will is lost the physician finds the patient a prey to violent impulses of an unbalanced kind, quite different from the state of general immaturity found in infancy.

4. On the physical side, the point of view of genetic psychology is also justified. The development of the mind keeps pace with the development of the nervous system, and there is no use looking for a complex mental function at a period when the nervous basis in the brain has not yet become of sufficient complexity to support it. Consequently the genetic psychologist can use all the results of the study of the nerve physiology and anatomy of childhood, and even the results of human and comparative embryology, in determining the order of the rise of the mental functions and their relation to one another. For example, it is clear that volition (see WILL) can not be present until certain medullated nerve-tracts are developed which are absent from the brain at birth, for physiologists have shown that all voluntary action is accomplished by means of these tracts. Similarly, it is impossible that a child should learn to speak until certain brain-centers are developed and duly connected with one another.

The actual development of the child, as genetic psychologists now represent it, may be indicated very briefly as follows. (See Baldwin's *Elements of Psychology*, p. 60.) Shortly after birth the child begins to connect his impressions with one another and to show memory. But both memory and association are very weak and depend upon intense stimulations, as bright lights, loud noises, etc. At three months of age most children will forget a person after a few days of absence. Attention comes in the first quarter of the first year, and is purely reflex. It appears earliest in response to sounds and sights. It is probable that the earliest consciousness is simply a mass of touch and muscular sensations experienced in part before birth. The pain-reflex is not present at birth. Association of muscular sensations with touch and sight gives the infant his first clear indications of the position of his own members and of other objects. The movement of his own limbs in exploring things he sees serves to make his knowledge of things about him more and more exact. The first movements are largely random reflexes, due to discomfort, or aimless spontaneous discharges. About the sixth month the child begins to imitate movements and noises, and he then enters upon a remarkable series of adaptations. In his "try-try-again" or "persistent" imitations the first voluntary efforts occur. The first exercises of will are thus aimed at the control or direction of his own muscular movements. It is only on this basis—that of active muscular exertion—that he gradually builds up the notion of self, and is so entitled to be called self-conscious. As has been said, the development of consciousness is dependent upon the development of the nervous system. If we consider the activities of the nervous system as the permeation of lines of least resistance, we may say that in the very young child such pathways are largely wanting, and must be established by actual exercise. The brain attains most of its size in the period of juvenescence; but its structural development for the higher processes of the mind is then only getting under way.

Apart from monographs on special topics, the following works may be consulted: Preyer, *Mind of the Child* (2 vols.) and *Mental Development of the Child*; Tracy, *Psychology of Childhood* (gives full bibliography); Baldwin, series of articles in *Science* (1891–93); Perez, *First Three Years of Childhood* and *The Child from Three to Seven Years*; Queyrat, *l'Imagination et ses Varietés chez l'Enfant*; Compayré, *l'Evolution intellectuelle et morale de l'Enfant*.

J. MARK BALDWIN.

**Gene'va** (Fr. *Genève*; Germ. *Genf*): southwestern canton of the Swiss confederation; bounded by Lake Geneva, the canton of Vaud, and France. Area, 108 sq. miles. The country is hilly, and is watered by the Rhône and numerous mountain streams. The soil has been made fertile by persistent cultivation. The only important minerals are sandstone, slate, and a bituminous shale from which petroleum and asphalt are obtained. The canton has little historical interest apart from its capital, GENEVA (*q. v.*), the largest city of Switzerland. Pop. of canton (1888) 106,738. See McCracken's *Rise of the Swiss Republic* (1893).

**Geneva**: city of Switzerland; the capital of the canton of Geneva; situated on both sides of the Rhône, at the point where it issues from Lake Geneva (see map of Switzerland, ref. 7–A). Geneva is of great antiquity, and is mentioned in Cæsar's *Commentaries*. In 456 the town came under Burgundian sway, and in 534 it was incorporated with the kingdom of the Franks. Its industry is nearly confined to the manufacture of watches, music-boxes, and jewelry, which, however, is very considerable. Its trade is simply retail. Geneva's monuments are of no great magnificence, but its beautiful situation, the celebrated part it has played in European civilization as the center of Calvinism, and the remarkable manner in which its citizens, through centuries and at every risk, have shown themselves equal to their position, have made Geneva one of the most conspicuous places in Europe. As it was, in the time of Calvin, a religious and ecclesiastical center whose influence was felt throughout Europe, so it has become, since the end of the eighteenth century, the center of a remarkable scientific activity. Here lived Rousseau. De Luc in meteorology, de Saussure in general physics and geology, de Candolle in botany, de la Rive in electricity, Pictet in paleontology, Merle d'Aubigné in history, all masters of the first rank in their respective sciences, have given it celebrity. The educational institutions of Geneva and its scientific collections are very celebrated. Duke Charles II. of Brunswick, who died at Geneva Aug. 19, 1873, bequeathed to the city his whole fortune, about 20,000,000 francs. Pop. (1897) including suburbs, 86,535.

Before the Reformation the city of Geneva was subject to the Bishop of Genevois, who held it as an immediate fief of the German empire. The bishop's right of possession, however, was contested, first, by the Count of Genevois, and afterward by the Duke of Savoy, and by degrees, as the city grew in commercial and industrial importance, a party developed which strove for its liberty and independence. Through the Reformation that party finally became victorious. The first traces of the new movement may be referred back to the French translation of the Bible by Le Fèvre d'Étaples (Faber Stapulensis); in 1528 the Bishop of Genevois, the Duke of Savoy, and the pope were busily engaged in suppressing "that damned book," punishing every one who read or possessed it. In 1532 Farel arrived at Geneva, and in 1533 the Reformed doctrine was allowed to be publicly preached there. In 1535 it was formally adopted as the religion of the state, and in 1536 Calvin arrived. In the meantime the bishop had been expelled—he took up his residence in Annecy—and the city declared itself a free republic. It opened its gates to the religious refugees of Italy, Spain, France, and England, and during the sixteenth century it was justly called the "Rome of Protestantism." The so-called Geneva Bible, which exercised so great influence in England, received its name from its being made in Geneva by English Protestants. In the meantime Rome and the Duke of Savoy were scheming against the religious and political freedom of the city, but the courage and perseverance of its citizens baffled all intrigues and violence. In 1798, however, the city was seized by a French army and incorporated with France. But in 1814 it regained its independence and joined the Swiss confederation as the twenty-second canton, its territory having been largely increased. See the Abbé F. Fleury, *Histoire de l'église de Genève* (Geneva, 1879): A. Roget, *Histoire du peuple de Genève depuis la Réforme jusqu'à l'Escalade* (7 vols., 1870–82).

Revised by S. M. JACKSON.

**Geneva**: city and railway junction (founded in 1836); capital of Kane co., Ill. (for location of county, see map of Illinois, ref. 2–F); on Fox river; 35 miles W. of Chicago.

It has five churches, large school-buildings, a fine court-house erected in 1892 at a cost of $250,000, a large creamery, a foundry, and excellent water-power operating six manufactories, including very extensive glucose-works. Pop. (1880) 1,239; (1890) 1,692; (1900) 2,446.

EDITOR OF "REPUBLICAN."

**Geneva**: city; capital of Fillmore co., Neb. (for location of county, see map of Nebraska, ref. 7–J): on Turkey creek, and the Bur. and Mo. River and Fremont, Elk. and Mo. Valley Railroads; 60 miles W. S. W. of Lincoln. It is in an agricultural and stock-raising region and has three weekly newspapers. Pop. (1880) 376; (1890) 1,580; (1900) 1,534.

EDITOR OF "DEMOCRAT."

**Geneva**: village; Ontario co., N. Y. (for location of county, see map of New York, ref. 5–E); on Seneca Lake, the Seneca and Cayuga Canal and the Fall Brook, the Lehigh Valley, and the N. Y. C. and H. R. Railroads. It is the seat of Hobart College, the State Agricultural Experiment Station, Delancey Divinity School, and the Delancey School for Girls. It has a graded union school, branch schools, two fine parks, a water-cure sanitarium, water-works, and manufactures of steam and hot-water heaters, stoves, ranges, optical goods, patent cereals, canned goods, etc. It is widely known for its nurseries, which occupy about 10,000 acres of land in and near Geneva, giving employment to over 1,000 laborers and hundreds of agents in all parts of the U. S. and Canada; over $1,000,000 worth of nursery stock is shipped annually. There are 6 weekly, 1 monthly, and 1 daily periodicals. Pop. (1890) 7,557; (1900) 10,433.

EDITOR OF "COURIER."

**Geneva**: village; Ashtabula co., O. (for location of county, see map of Ohio, ref. 1–J); on the Lake Shore and Mich. S. Railway, and the N. Y., Chi. and St. L. Railroad; 3 miles S. of Lake Erie, 45 miles N. E. of Cleveland. It is in a rich grape-growing region; has attained popularity as a summer resort; manufactures agricultural implements, electrical goods, novelties, printers' cases, springs, mattresses, fur goods, and flour, and has a normal school, 2 banks, and 2 weekly newspapers. Pop. (1880) 1,903; (1890) 2,194; (1900) 2,342.

EDITOR OF "TIMES."

**Geneva**, Wis.: See LAKE GENEVA, Wis.

**Geneva Arbitration, The**: the settlement of the claims of the U. S. against Great Britain by a tribunal of arbitration which met at Geneva, Switzerland, Dec., 1871, according to the terms of the treaty of Washington signed Feb., 1871. See ALABAMA CLAIMS.

**Geneva, Convention of**: an engagement entered into at Geneva, Switzerland, Aug. 22, 1864, by ten states—France, Switzerland, Belgium, Portugal, Holland, Italy, Spain, Denmark, Baden, and Prussia—for the neutralization and exemption, so far as possible, from the casualties of war of all persons, vehicles, and buildings devoted to the care of the sick and wounded. Since 1864 the accession of twenty additional states, including all the military powers of Europe and of the American continents, except Brazil, has made the application of its rules almost universal. The improvement in and increased destructiveness of military weapons, which began about 1860, and which for a time was unaccompanied by any change toward looser battle formation, led to heavier casualties than the medical staff of one army, the one left in possession of the field, could attend to. The fact of so much unalleviated suffering naturally brought about the offer of assistance in caring for the wounded from humane societies and individuals of neutral states, to supplement the medical corps. The labors of two Swiss gentlemen, Henri Dunant and Gustave Moynier, should be held in honor. For, influenced by them and the facts which they made known, there have sprung up in many countries organized bodies, whose resources and efforts are devoted to the mitigation of bodily suffering of every form in time of peace, and especially in time of war, under the name of Red Cross societies, and have done much to bring about a more humane system of warfare. This is a necessary introduction to a description of the rules of the Geneva convention. These are briefly as follows:

No distinction of nationality is to be made in caring for the sick and wounded. Natives of an invaded country who bring aid to them shall be respected and free. If they receive the wounded into their houses they shall be exempt from quartering of troops or military contributions. These facts shall be brought to their knowledge by the notification of general officers.

Ambulances and hospitals (unless defended by a military force), and their *personnel*, which includes nurses, surgeons, physicians, those in charge of transportation, and administration, shall be recognized as neutral, and be marked by a distinctive flag or arm badge. These shall both bear a red cross on a white ground. The flag must be accompanied by a national flag. The material in military hospitals remains subject to the laws of war. When hospitals or ambulances come into the power of the enemy, their *attachés* may either continue to serve in them or may return to their own army with their personal effects. Sick and wounded who come into the power of the enemy, when cured shall be returned to their own country if incapable of service; otherwise they shall be paroled. An immediate return of wounded soldiers to their own army may be made by agreement.

Commanders-in-chief shall have general control of the execution of the details of this convention, in conformity with its rules and the instructions of their governments. Of course the protecting emblems can be granted only by authority and their abuse will be punished. In 1868 five explanatory articles were added and a similar system, so far as practicable, was extended to naval warfare. Floating hospitals remain subject to capture, but their character can not be changed, and their *personnel* is neutralized. If fitted out by neutrals they are not liable to capture, but must not interfere in naval operations.

Some of the rules of these conventions are not sufficiently clear; it is probable that in some cases, notably during the Franco-German war, the rights granted under them have not been altogether observed. Nevertheless, on the whole, the Geneva convention has worked exceedingly well, and should be considered a valuable agent in lessening the horrors of war.

THEODORE S. WOOLSEY.

**Geneva, Lake of, or Lake Leman** [*Leman* is from Lat. *Lacus Leman'nus*, Lake Leman]: a lake situated 1,226 feet above the level of the sea, between Switzerland and Savoy (now a part of France); extending 45 miles from E. to W. in the shape of a crescent. Its width varies from a mile at the west end to nearly 10 miles at the east end, where its greatest depth reaches 980 feet; area, 223 sq. miles. It is traversed by the river Rhône, which discharges its muddy waters in it, and issues from it at Geneva (whence the name Lake Geneva), at its southwest extremity, a pure and transparent stream of a deep-blue color. This lake, which fills a vast basin between the snowy Alps and the Jura Mountains, is much celebrated for the grandeur of the surrounding scenery and the loveliness of its shores, which teem with thriving cities and picturesque villages. It is navigated by steamboats and sailing vessels, but is not so much used for communication since the completion of the railway on its north shore.

**Genevan Bible**: See BIBLE.

**Geneviève** (Fr. pron. *zhen'veĕ-āv'*), **Canons of St.**: a branch of the Canons Regular; first proposed in 1614 by Charles Faure, who, with the assistance of Cardinal de la Rochefoucauld, established the new congregation. In 1634 Pope Urban VIII. confirmed the organization.

**Geneviève, Daughters of St.**, called also **Miramions**: an order of religious women in France; founded in 1636 by Francesca de Blosset. Its members took no monastic vows, but devoted themselves to teaching and to caring for the sick. In 1665 the order was united to the proper Miramions (founded in 1661). The united order flourished, and attained extensive usefulness.

**Geneviève**, SAINT: patron saint of the city of Paris; b. about 422 at Nanterre, or, according to another account, at Montrière; dedicated in her girlhood to a life of virginity and religious devotion through the influence of St. Germanus of Auxerre. After the death of her parents she went to Paris, where her active charities and holy life won the affection of the people. She prophesied the invasion of the Huns under Attila, but declared that Paris would be spared. The prophecy came true, and added to her reputation for sanctity. On the capture of Paris by the Franks, her intercession caused the city to be treated with great leniency by the conquerors. D. in Paris about 512, and was buried in the church that bore her name. A later edifice built in her honor in 1764 became the Panthéon in 1791.

**Genga**, *jen'gāă*, GIROLAMO: painter; b. at Urbino, Italy, in 1476; he was placed with Luca Signorelli at the age of thirteen, and during his many years of scholarship with

him painted accessories in the master's pictures. He studied also with Perugino. On his return to Urbino he decorated the palace for Duke Guidobaldo, then went to Rome, where he painted a *Resurrection* for the Church of St. Catherine of Sienna, and where the study of antiquity led him to become an architect. Duke Francesco Maria of Urbino recalled Genga to his native city to prepare the festivities for his wedding. He followed this protector into exile, first to Mantua, then to Cosena, where he painted a triptych for the Church of St. Augustine. While in Pesaro he restored the courtyard of the palace, built the Church of St. John the Baptist, designed the convent of the Zoccolanti of Monte Baroccio and the episcopal palace of Sinigaglia; he also embellished the bishop's palace at Mantua. On Duke Francesco Maria's return to power Genga was made court-architect, and intrusted with all public works, even of the fortifications of Pesaro. He was also an able sculptor, musician, and writer on the fine arts. D. in 1551. W. J. Stillman.

**Genghis Khan**, jen'gis-kaan', or **Chinghis Khan** [liter., the greatest khan or ruler], originally **Temudjin**: b. at Deylun Yeldâk, on the Hwang-Ho, in 1162; son of the chief of the Mongol tribe Neyrun; succeeded his father when thirteen years old, but a civil war followed, and in 1178 he was compelled to flee to Toghrul Ungh, Khan of the Keraite Tartars, whose daughter he married, and whose armies he commanded with success. In 1203 he made himself master of the Keraites, and in 1204 utterly overthrew the Nayman tribes and made himself chief of Mongolia. In 1206 he was declared *Genghis Khan*, or chief of rulers, and the civilized Uigurs submitted to him. He soon published his great code: attacked Cathay or Northern China; crossed the Great Wall 1211; sacked and burned Peking 1215; exterminated some rebellious tribes; attacked Allah-ed-din Mohammed, Sultan of Chorasmia, 1218; had conquered all Turkestan 1220; ravaged Balkh, Khorassan, and Persia; plundered all Asia as far south as the Sutlej; and penetrated Europe as far as the Dnieper, carrying slaughter and destruction everywhere. Genghis was the founder of what became the Mogul empire. His chief capital was Karakorum in Tartary It is stated that more than 5,000,000 persons were slain in his wars, which were carried on with the most heartless cruelty; but that through his vast domains he enforced the strictest order, established a postal system, and tolerated all religions. Genghis died at Liupan, China, Aug. 18, 1227. See Howorth's *History of the Mongols* (1876).

**Gengler**, Heinrich G. P.: See the Appendix.

**Gen'ipap** [from *genipapo*, the Guiana name]: the whitish-green fruit of *Genipa americana*, a South American tree of the family *Rubiaceæ*. It has a rich purple juice and an agreeable vinous flavor. The fruit of *Genipa brasiliensis* is not good until over-ripe, but is made into a confection. The juice of this latter fruit is used in dyeing, and yields a deep violet.

**Genitive** [from Fr. *génitif*: Ital. *genitivo* < Lat. *genitīvus*; liter., pertaining to birth; mistranslation of Gr. γενική (in ἡ γενική πτῶσις, the genitive case), pertaining to a genus or class; i. e. the case which indicates the whole of a group; also called by the ancients πατρική or κτητική]: a grammatical case of wide and varied use in the inflectional languages, but which, in its original Indo-European value, indicates a whole of which a part is affected by or involved in the governing word. This governing word may be either a noun or a verb. The fundamental value of the case is seen most clearly in the construction with verbs and in the so-called "partitive" genitive and the genitive of material among the constructions with nouns. Thus, with verbs, the genitive was originally used to denote an object which is affected only as to a part of itself by the action of the verb, in distinction from the accusative which denotes an object lying to its whole extent in the direct path of the verbal action. Thus with verbs of eating and drinking the Greek uses both constructions, to drink wine (πίνειν οἶνον) and to drink of wine (πίνειν οἴνου), the former being used when the material is thought of as ordinary, everyday nourishment. Similar in value are the constructions with verbs of perceiving, remembering, touching, grasping, reaching, ruling, of fullness or want, etc. Cf. Lat. *reminisci virtutis*; Gr. τὸν δὲ πεσόντα ποδῶν ἕλαβεν, he caught the fallen man by the feet; Skr. *víçvasya ékа īçiṣē*, thou alone hast claim on all; Goth. *fulljands akeitis*, filling with vinegar. The partitive genitive, e. g. Gr. οὐδεὶς τῶν παίδων, no one of the children, Lat. *vitæ pars*, part of life, and the genitive of material, Lat. *talentum auri*, a talent of gold, clearly express the whole of which a part is involved in the governing noun. The genitive of possessor indicates the person or thing within the sphere of whose influence or possession the governing idea falls, and the subjective genitive (e. g. *men's fear*) is closely related to it, while the objective genitive (e. g. *the fear of men*) probably does not represent an original use of the case.

The fundamental idea of the genitive overlapped in places upon that of the ablative, as the case of source—the from-case. Hence the two cases often coalesce. This had already taken place for the singular of all but the *o*-stems in Indo-European before the division into separate languages, and in Greek was extended so that the genitive entirely absorbed the ablative, as it did also partially in Teutonic. In some cases the genitive meaning comes in close connection with that of the instrumental, the with or by case, as with verbs of filling (full of, filled with), where the Latin has displaced the genitive in favor of the instrumental, e. g. *hominibus complevit*, filled with men. These examples will illustrate the manner in which the original functions of the case become dislodged and redistributed in the separate languages.

The *form* of the case was in Indo-European marked by the endings *-si̯o* (*-so*), or *-es* (*-os*, *-s*) in the singular and *-ōm* in the plural. The modern Indo-European languages of the analytic type, while preserving relics of the old inflectional endings, indicate the case most commonly by the aid of prepositions; thus Eng. *man's* and *of the man*.

Benj. Ide Wheeler.

**Gen'itum**: See Fluxions.

**Genius**, jeen'yŭs; plur. **Genii**, jee'ni-ī [Lat., tutelar spirit; liter., inborn nature, wit, genius; deriv. of *gi'gnere*, *ge'nĭtum*, beget]: a good or evil spirit who, according to the belief of the ancients, presided over the destiny of human beings. Among the Romans the genii were tutelary spirits attached to places as well as to persons or peoples. Genii were regarded as a kind of guardian angels, and correspond to the δαίμονες of the Greeks. The doctrine of genii was Etruscan. These spirits received worship, especially at wedding festivities and other occasions of joy. Genii are figured in art as winged youths, or sometimes as serpents. In modern translations from the Arabic the Jinn (*q. v.*) are often called genii, but whether the names are kindred to each other is a disputed question.

**Genius**: a person of remarkable gifts of any kind, especially of great creative power in art, science, literature, and the like. From a psychological point of view the gifts which make a man a genius are easily placed under their proper categories, and the processes by which he works may be indicated with sufficient clearness. If we accept the view that a man is a genius only if he creates something—that is, if he adds something to the sum of human achievement in art, literature, or science—there is no difficulty in assigning him to a place among men of great *constructive imagination*. Psychologists distinguish between passive imagination, which is equivalent to fancy, and active or constructive imagination. (See Imagination.) In passive imagination we have the uncontrolled play of mental images taking form largely under the laws of the association of ideas. Dreams are the purest type of it. There is little mental supervision of the flow of ideas, little appreciation of their relative value, little exercise of attention or will in selecting or combining them. The products of fancy are the more accidental—often grotesque—combinations of materials. The active or constructive imagination, on the other hand, is limited, as all imagination is, and as all mental processes are, to the material which memory, experience in all its forms, supplies to consciousness; but we now find not combinations which are accidental or grotesque, but those which appeal in the highest degree to the sense of beauty, utility, logical completeness, love of the true and good. It is the truth and value of what the genius imagines and executes in contrast with other men's imaginings and doings that call our attention to him, and it is his ability to imagine and execute this kind of thing that constitutes him a genius.

Analysis of constructive imagination shows what mental qualities a genius must possess. In the first place, he must be a man capable of prolonged, constant, concentrated *attention*. Attention is the one vehicle of mental creations which escape the charge of being accidental, capricious, grotesque. Only by attention is Apperception (*q. v.*) possible —the function in which all relationships of things, likenesses, differences, causes, effects, in short, all knowledge,

are discovered. By attention only is memory made faithful, and the lessons of the past made available. And, moreover, it is by attention that selections are made of what is really valuable, beautiful, true, useful, and it is just this fact of selection which makes constructive imagination more valuable than fancy. Consequently, if a man can not give prolonged and undistracted attention to one topic, until all he knows about it or has heard about it, all he has ever suspected, thought, imagined about it, falls together in one system or intuition, whose parts admit no other arrangement as comprehensive and all-embracing—if a man can not attain this, the great feat which Newton called "patient thought"—he has not the first mark of genius.

But, in the second place, a genius must be *well informed* in the particular line of work in which he shows himself remarkable, and to be well informed he must be industrious. Any amount of ability is of no avail if it have insufficient material to work upon. The power of "patient thought" or of imaginative synthesis may be present, and often is, in those we know about us, who, nevertheless, never accomplish much. These are the exceptions, however. It is true as a rule of this function—like all other functions, both body and mind—that it grows by exercise and takes its proportions from what it feeds upon. A man may be born to be a genius and turn out a monomaniac. We do not expect great electrical discoveries from men who are not professional or practical electricians. We give no credence to the reported invention of flying-machines by the general run of experimenters. Mathematicians have long since given up the attempt to square the circle, and yet they constantly hear that amateurs have accomplished the feat. In short a discovery by a genius involves the most detailed and exhaustive knowledge of all the elements which enter into the problem, and of all the possible combinations of these elements; and although his final inspiration comes to him, as Wundt has said, "like a flash of lightning," nevertheless it comes to the mind of him who broods patiently over what he already knows, and molds by tireless thinking all his mental store into shape for the final synthesis which puts his genius in evidence. Of these two essentials, however, it is easy to see which is the more important. The man who can not think a thing out, who can not detect what is worthful in shape and color and harmonious in sound—such a man can never make himself a genius by hard work in any one of these lines. He can discipline his powers and inform his mind and make of himself a great man, but still endowment remains the first essential, and there is only a modicum of truth in Carlyle's dictum, "Genius is hard work." A genius must work in order to develop his brain, but work can not take the place of brain.

Coming closer to the individual types of mental endowment, which we call geniuses, we find very wide diversities. Two great spheres of the operation of constructive imagination are recognized by psychologists—the sphere of *art* and that of *science*. So we may distinguish artistic from scientific imagination, and artistic from scientific genius. The distinction has profound psychological justification, and gives us light on that most perplexing phenomenon called the "eccentricity of genius."

Psychology assures us that the mind in all its operations shows a principle of "identity," in accordance with which all mental objects, presentations, images, tend to be identified with one another as far as possible. There is a constant tendency and effort of consciousness to assimilate all new things to the shape and meaning of old things, to keep its categories as few as possible, to bring its knowledge into the unity of a system. Whenever this is done, whenever two elements of content fall together and become one, or get related to each other as elements in a larger whole, then great pleasure is experienced. All identities are the source of mental satisfaction. This being true, it is evident that the products of the constructive imagination may be looked at in two ways—either from the side of the construction itself, the amount of truth and practical value it possesses, or, on the other hand, from the side of its hedonic value, its pleasure-giving effect. In one case we have imagination working under the limitations and requirements of actual truth—i. e. giving rise to inventions, scientific discoveries, astronomical prophecies, etc. In the other we have no such limitation; the object of the æsthetic imagination is the hedonic effect itself, and nature is transcended, truth interpreted, beauty secured by the further advance of construction under more emotional and uncritical rubrics. The scientific man is accordingly most successful when his devices and discoveries are true, no matter what happiness they give; but those of the artist, in literature, in fine art generally, must please, whatever else is true of them. Philosophy expresses this distinction by saying that the ideal of art is an ideal of form, its end is the supreme embodiment of the formal relationships in which the mind takes pleasure, while the ideal of science and philosophy is an ideal of matter or content. The artistic genius therefore is a man with an extraordinary sense of formal relationships, of the fitness of things to go together, and an abhorrence of the inconsistent, the unparallel, the crooked. The scientific genius cares for the same things, as far as the principle of identity is concerned, but he demands truthful construction first of all as the highest kind of identity, and the emotional element is or may be a hindrance to him.

This distinction in types accounts for the mistake so often made by ordinary people, who believe that geniuses are always singular, a little unbalanced, and perhaps abnormal, thus denying genius to men of wonderful scientific imagination, like Newton, Cuvier, Darwin, Agassiz. These are the very sanest of men. But the artists are, in the nature of the case, men of strongest emotional character: their ideals are, in so far, a departure from the prosy facts of things. They have no liking for convention, for conformity, for rule; for artistic creations can never be expressed by formula nor measured by rule. So they are intolerant, often one-sided, often rationally warped, always intensely individual, and never capable of quite the same social normality as their brother geniuses the scientists, or their brother men who are not geniuses. There is sufficient ground, therefore, for the popular view that a genius, i. e. an artistic genius, is likely to be eccentric; but there is not sufficient ground for the view which has been seriously exploited that genius is a form of insanity, or at least of mental abnormity. In history many geniuses have been peculiar, indeed some have obtained part of their repute for genius from their peculiarities; but these peculiarities are still within the range of sanity. Yet it is true that the degree of eccentricity and unconventionality and unsociality so often found in men of great æsthetic genius may indicate a progressive nervous tendency, which in time destroys the man's sanity. But in this case it is easy to see that by the same progress into disease, his genius is destroyed also. Undoubtedly this fact of progressive neuropathic temperament, culminating in positive disease—a thing which in its incipient stages might have an exalting effect upon the sensibilities, and so aid æsthetic creation—accounts for much of the popular impression that a genius is unbalanced. J. Mark Baldwin.

**Genlis**, *zhäN'lēs'*, Stéphanie Félicité Ducrest de St.-Aubin, Countess de: writer; b. near Autun, France, Jan. 25, 1746; in 1752 entered the Church as canoness of Alix, with the title of Countess of Lancy; in 1761 was married to the Count de Genlis; in 1770 became attached to the household of the Duc de Chartres (afterward the citizen Égalité); in 1782 became governess to his children, and, according to the popular opinion, was his mistress. In 1793 she was obliged to leave France. From Napoleon and Joseph Bonaparte she subsequently received liberal pensions. Among her best writings are the educational works designed for her young pupils, the Orleans princes, and *Mademoiselle de Clermont*, a short novel of great excellence. Her personal *Mémoires*, in ten large volumes, abound in scandal, and are full of malignant attacks upon the prominent persons of her time. D. at Paris, Dec. 31, 1830. It is believed that Pamela, wife of Lord Edward Fitzgerald (1763–98), was her daughter by Philippe Égalité.

**Gennes'aret, Lake of** [*Gennesaret* = Gr. Γεννησαρέτ = Aramaic *Genesareth*, fr. Heb. *Genusar*, the name of a fertile district on the Sea of Galilee]: a lake in Palestine between lat. 32° 42′ and 32° 54′ N., now called *Bahr Tŭbarîyeh*; mentioned only five times in the Old Testament (Num. xxxiv. 11; Deut. iii. 17; Josh. xi. 2, xii. 3, xiii. 27), where it is called *the Sea of Chinnereth* or *Chinneroth*; in the Apocrypha called *the Water of Gennesar*; by Josephus called *the Lake of Gennesar*, or *Tiberias*; in the New Testament called once *the Lake of Gennesaret*, but oftener *the Sea of Galilee*, or *Tiberias*. It is 12½ miles long and 8 miles wide. Its surface is 680 feet below the level of the Mediterranean. Its greatest depth is 165 feet. Its waters are clear, cool, and sweet, abounding with fish. Its whole eastern side is bounded by a steep mountain-wall, rising nearly 2,000 feet, and spreading off into the table-land of Bashan. On the

western side there is a similar, though less lofty, wall along the southern half of the lake. The Plain of Gennesaret, famed in ancient times for its fertility, begins about 2½ miles N. of Tiberias, is about 3 miles long, and more than a mile wide. The upper part of this plain was watered by means of an aqueduct from Bethsaida, brought around the head of the promontory which forms the northern boundary of the plain. N. of this promontory the shore of the lake has a broad and gentle slope. Mt. Hermon is in full view from every point. The climate is almost tropical. Though not wholly wanting in grandeur and beauty, the lake is noted rather for its historic associations. It was the center of our Lord's ministry and the scene of many miracles. Nine towns then stood upon its shores, only two of which (Tiberias, with its 2,000 inhabitants, and Magdala, with its twenty mud-hovels) now remain. As on the W. gorges open into it, it has always been noted for its sudden storms. These are alluded to in the Gospels (Matt. viii. 24, xiv. 24; Mark iv. 37, vi. 48; Luke viii. 23; John vi. 18). The chief unsettled question is in regard to the site of Capernaum. Some identify it with *Tell Hûm*, about 2 miles from the head of the lake; others with *Khan Minyeh*, under the promontory on the northern edge of the Plain of Gennesaret. Accepting this identification, *Tâbighah*, about three-fourths of a mile N. of *Khan Minyeh*, is Bethsaida, and *Tell Hûm*, about 1½ miles farther on, is Chorazin.

Revised by S. M. Jackson.

**Gen'oa**: a province of the kingdom of Italy; extending along the Gulf of Genoa, and containing some of the richest, most beautiful, and best-cultivated districts of the country. Area, 1,588 sq. miles. Pop. (1890) 810,562.

**Genoa** [from Ital. *Genova* < Lat. *Ge'nua*, Genoa]: a large maritime and commercial town of Italy; on the gulf of the same name; in lat. 44° 24′ 16″ N., lon. 8° 54′ 24″ E. (see map of Italy, ref. 4–C). The whole Gulf of Genoa is more or less sheltered on the N. by the Apennines—which here approach the sea so boldly as to leave room for towns only at the openings of the mountain-valleys—and the port of the city is formed by a small bay, receding inland, between the torrents of Polcevera and Bisagno. The harbor, consisting really of three harbors one before the other, called the Avamporto (the outer bay), the Nuovo Porto (the new harbor), and the Porto (an inner basin) respectively, is in no danger of being shoaled up, as are so many Italian seaports, for the shore-current is diverted from it by the headland of Portofino, and the little promontories of the Lanterna and the Carignano protect it from the torrent-wash. The annual exports aggregate about $20,000,000, and imports nearly $75,000,000. The city presents an enchanting view from the water as it rises, amphitheater-like, toward the summit of verdant and richly cultivated hills, overtopped by a strong city wall; while the turreted forts of a second line of defense crowning the barren heights beyond add greatly to the picturesque effect. Genoa contains many grand churches and palaces, with some fine streets, though, from the unfavorable form of the hills upon which it is built, the city communication is chiefly carried on by means of narrow, ill-lighted, sometimes stair-like thoroughfares, scarcely passable for mules. Many of the proud structures which once justified the haughty title of the city, La Superba, have fallen more or less into decay, and are now used as hotels or for other public purposes; but some of the old palaces are still occupied by descendants of the "merchant princes" who built them, and possess choice treasures of Italian art. The most noteworthy churches are S. Maria di Carignano, of remarkable architecture; SS. Andrea and Ambrogio, begun in the sixth century; S. Annunziata, very gorgeous; S. Lorenzo, the cathedral, built in 1100, and containing, among other curious relics, the glass cup, with its improbable traditions, brought from Cæsarea by the crusaders, and long believed to be an emerald. The Carlo Felice is the finest and most spacious of the several theaters. In the Piazza d'Acqua is a monument erected in 1862 to Christopher Columbus, who was born at Cogoleto, 15½ miles W. of Genoa, in 1456. The favorite promenade is the elevated park, called Acqua Sola, at the northeast end of the city, behind which, through the Villa Negro, a winding ascent leads to a bastion 150 feet above the park itself, and commanding a noble view.

The traditional history is very obscure, but Livy mentions Genoa as adhering to Rome against Carthage, by which it was destroyed 204 B. C. It was soon after rebuilt by its allies. An ancient bronze tablet, found in the Polcevera in 1506, commemorates the settlement, by Rome, of a dispute between Genoa and a neighboring town (187 B. C.). In the sixth century Genoa fell into the hands of the Lombards, who were dispossessed by Charlemagne. After the dissolution of the empire of the Franks it passed through much the same vicissitudes as other large Italian towns, suffering more, however, from the Saracens, whose depredations forced Genoa to strengthen her navy, thus laying the foundation of her great maritime power. For further security against the Mohammedans it formed an alliance with Pisa, but conflicts were afterward frequent between the two commonwealths. With Venice also Genoa carried on wars disastrous to both, the Levant trade being the subject of their mutual jealousies, and the hostile galleys of the two republics encountered each other, with changing fortune, in all the waters of the Mediterranean. In 1240 Genoa was able to place the emperor of her choice, Michael Palæologus, on the throne of Constantinople, and received from him, in addition to her already extensive Eastern possessions, the cession of Galata and Pera, suburbs of Constantinople, which she retained till 1453, and of the port of Smyrna, so that for a time she controlled the commerce of India through the Black and Caspian Seas. Corsica, Minorca, Almeria, Tortosa, Marseilles, Nice, etc., successively fell into the hands of the Genoese, and their dominion might have extended still wider but for their internal dissensions. The early government of Genoa, democratic in form, was very turbulent until 1270, when the famous Guelph "captains of liberty" assumed the control of the commonwealth under pretext of restoring order; and they retained their power about twenty years. The first doge was elected in 1339. In 1499 France obtained possession of Genoa, and the adventurous Marshal Boucicault was made governor of the city; but in 1528 the renowned Andrea Doria, the admiral of Charles V., restored his country to independence. The conspiracy of Giovanni Fiesco, which has furnished the theme of so many dramas, occurred in 1547. In 1656 Genoa lost 70,000 of her citizens by the plague. In 1746 the Austrians made themselves masters of the city, but were driven out after holding it three months. The victorious Bonaparte in 1796 gave Genoa the title of the Ligurian Republic, but in 1805 he annexed both town and province to France. By the peace of 1815 the Genoese territory became a part of the kingdom of Sardinia, and is now a most important province of united Italy. Here a great *fête* was held from Sept. 4 to 15, 1892, in honor of the discovery of America.

The Genoese are, as they have always been, a bold, independent, energetic, and industrious people. Their commerce is wide and important; their manufactures are very considerable. Ship-building is carried on extensively, many ships being built on commission for foreign countries. Elegant objects of household furniture in wood, such as chairs, tables, cabinets, etc., are manufactured on a large scale, and the silks, velvets, and laces, as well as the coral and silver filigree-work of Genoa, have a wide reputation. Among the coarser manufactures are cotton goods, soap, candles, etc.; the extraction of oil is also an important industry. The construction of the St. Gothard Railway and the important improvements in the railway connection with Genoa have made this city the nearest Mediterranean port for Western and Central Germany, and consequently tend greatly to increase its commercial prosperity. The schools and charitable institutions of Genoa are numerous and well sustained. Pop. (1894) 220,000. Revised by S. M. Jackson.

**Genoa, Gulf of**: the name generally given to the Mediterranean N. of Corsica, where between Spezia and Oneglia the coast of Italy retreats with a large curve. It is a bay, however, rather than a gulf, and receives numerous small rivers. The Gulf of Spezia is its chief inlet. On this gulf is situated the city of Genoa.

**Genovesi**, jā-nō-vā′sē, Antonio [the family name means in Ital. Genoese]: philosopher and political economist; b. at Castiglione, Italy, in 1712; was educated for the Church; ordained a priest in 1736, and shortly after appointed Professor of Rhetoric at Salerno. In 1743 he began to lecture on philosophy in the University of Naples, where he also published his *Elements of Metaphysics* and his *Logic*. As a philosopher he belonged to the empiric school, and the Archbishop of Naples suspected his orthodoxy. In 1754 he was appointed Professor of Political Economy, and his *Lezioni di Commercio* is the first complete and systematic work on political economy in Italian. As a political econ-

omist he belonged to the mercantile school. D. in Naples, 1769.

**Genre**, *zhaañ'r*: in fine art, the use of subjects of simple and everyday nature; domestic scenes, common incidents, and the like. See PAINTING, SCULPTURE, and FINE ARTS.

**Gens**: See TRIBE.

**Gensan'**, or **Won-San**: one of the open ports of Korea; on the east coast, on Yung-Hing Bay; lat. 39° 5′ N., lon. 127° 10′ E. (see map of China, ref. 3–L). The commerce is slight, and entirely in the hands of Japanese. M. W. H.

**Gens d'Armes**, *zhaañ'daarm'* [Fr., liter., people or men of arms]: a title in France anciently applied to the whole body of men liable to military service. From the twelfth to the sixteenth century it designated the body of nobles and gentry serving under the Kings of France. It now denotes the armed and mounted rural police, generally soldiers detailed from the army.

**Gen'seric**: King of the Vandals; the natural son of a Vandal king in Spain, and joint heir of the kingdom with Gonderic, his brother, whom he succeeded in 428 A. D.; crossed to Africa in 429 with 50,000 men, who were joined by the savage native tribes and the Donatists; sacked and burned Hippo in 431; banished the Catholic bishops 437; captured Carthage in 439, and dismantled all the African towns except Carthage; terrified the Mediterranean coasts; overran Sicily 440; took and sacked Rome for fourteen days and nights 455, carrying off the empress and her daughters and robbing the city of its most valued treasures of art; remained master of Carthage and the terror of both the Eastern and the Western empire, successfully repelling all attacks. D. Jan., 477.

**Gentian** [M Eng. *genciane*, from O. Fr. *gentiane* < Lat. *gentia'na*, from Gr. γεντιανή, gentian]: a genus of plants of the family *Gentianaceæ*, of which the most important species is the yellow gentian (*Gentiana lutea*), growing on the mountainous meadows of Central and Southern Europe. This is a perennial plant, with a thick, long, branching root, erect stem 3 or 4 feet high, broad, ovate, bright-green leaves, and rather large, bright-yellow flowers. The name is said to be derived from Gentius, an ancient King of Illyria, who introduced yellow gentian into medicine. The dried root is an important drug. It is of spongy texture, faint odor, but intensely bitter taste. Its active principle is probably a bitter crystallizable neutral substance, the *gentiopicrin* of Ludwig and Kromayer, a body belonging chemically to the glucosides. This, like other simple vegetable bitters, when taken internally tends to increase the appetite and promote digestion by gentle irritation of the mucous membrane of the stomach. The root is accordingly used medicinally as a stomachic tonic in simple digestive debility, being given in the form of solid and fluid extract, compound infusion, or tincture. The roots of the several perennial species of the U. S. have similar medical properties. Many species have very beautiful flowers, as, for instance, the fringed gentian (*G. crinita*), an autumnal biennial. *Horse gentian* is a species of *Triosleum*. See FEVERWORT.

Revised by CHARLES E. BESSEY.

**Gentian Family**: the *Gentianaceæ*; a small group of about 500 species of herbaceous plants, mostly natives of temperate and cold climates, and distinguished by their opposite leaves, regular gamopetalous flowers, and single superior one-celled, many-seeded ovaries. In North America there are fourteen genera, *Erythræa*, *Eustoma*, *Frasera*, *Gentiana*, etc., and 108 species. C. E. B.

**Gentile** [from Lat. *genti'lis*, pertaining to a clan or race, (*gens*), in plur. foreign, i. e. not Roman, *later*, in both sing. and plur. pagan, gentile, a transl. of Gr. ἐθνικός, heathen, gentile, deriv. of ἔθνη (plur. of ἔθνος, people, race), heathen, liter., nations; transl. of Heb. *gōyim*, nations, Gentiles]: one not a Jew; a name applied by the Jews to all who were not of their own nationality. Between Jews and Gentiles there was a profound mutual aversion, the intensity of which it is hard for us to conceive, although the feeling itself is not yet quite obsolete. The Mormons apply the term Gentile to those who are neither Mormons, nor Jews, nor aboriginal Indians, for they regard the latter as a remnant of the ten lost tribes of Israel.

**Gentile da Fabriano**, GENTILE DI NICCOLO MASSI: painter; b. at Fabriano, in Umbria, Italy, about 1350. Before 1422 he had painted some pictures in the ducal palace at Venice, which were destroyed in the fire of 1479. In 1422 he went to Florence, and spent most of his after life in Central Italy. He is classed as one of the Umbrian school, although the character of his art is peculiar in its tendency to minute finish, extreme elaboration of detail, and the addition to it of rich ornament even in the form of embossed and incised gilded work mingled with the painting. He painted at Orvieto, Siena, Perugia, and Città di Castello, as well as at Florence and Rome. His paintings have generally perished: those which exist in European galleries are often only single members of large co-ordinated works, such as altar-pieces, where many separate panels are framed together in an architectural design. As master of JACOPO BELLINI (*q. v.*) he exercised a great influence on the then incipient Venetian school. He died at Rome in 1427–28. A large picture in the Academy at Florence, *Adoration of the Three Kings*, once formed the center of an elaborate altar-piece. This is perhaps Gentile's most valuable surviving work. A *Virgin and Child* in the Berlin Museum, a *Coronation of the Virgin* at the Brera in Milan, a *Madonna* in the town-hall at Fabriano, and a *Virgin and Child* in the Jarves Gallery at Yale College, New Haven, may be mentioned. RUSSELL STURGIS.

**Gentilly**, *zhaañ'teĕ'yee'*: a village of France, in the department of Seine; by the walls of Paris divided into two parts, Great and Little Gentilly, and contains the famous hospital of Bicêtre and numerous manufactories, of which those of chemicals are quite extensive (see map of France, ref. 3–F). Pop. (1896) 6,153.

**Gentleman** [M. Eng. *gentilman*; *gentil*, gentle, genteel, of good family + *man*, after the type of O. Fr. *gentilhomme*, gentleman; *gentil*, gentle < Lat. *genti'lis*, of good family, deriv. of *gens*, family + *homme*, man]: in Great Britain, a man of a rank above that of yeoman. The term *gentry* in a large sense includes the nobility, but in popular use often excludes them. Thus British society is divided into nobility, gentry, and yeomanry, and families are either *noble*, *gentle*, or *simple*. Some of the Plantagenet kings gave patents of gentility. Sir Thomas Smith (1514–77) says, ". . . Whosoever studieth the laws of the realm, who studieth in the universities, who professeth the liberal sciences, and (to be short) who can live idly and without manual labor, and will bear the port, charge, and countenance of a gentleman, he . . . shall be taken for a gentleman." Later authorities make the bearing of coat-armor the test of gentility, but the poet Chaucer puts it on a better ground: "He is gentil that doeth gentil dedes." The French *gentilhomme* was properly a title belonging to those of noble birth.

**Gentlemen-at-Arms** (or, more fully, "Her Majesty's Body-guard of the Hon. Corps of Gentlemen-at-Arms," formerly called "Gentlemen Pensioners"): in the court of Great Britain, one of the divisions of the royal body-guard, the others being the "Yeomen of the Guard" (Beef-eaters) and the Royal Archers (for Scotland). The Gentlemen-at-Arms consist of one captain (Gold Stick), one lieutenant (Silver Stick), one standard-bearer (Silver Stick), one clerk of the cheque, adjutant and harbinger, one sub-officer, and forty gentlemen, for the most part retired officers of the army. It is the oldest corps in her majesty's service. Instituted in 1509 by Henry VIII. this body-guard received the present name in 1834. It is only mustered for duty at drawing-rooms, levées, and great state ceremonies. The captain of the corps goes out of office with the ministry.

**Ge'nus**, plur. **Gen'era** [Lat., birth, race, sort, kind, deriv. of *gig'nere*, *ge'nitum*, beget < Indo-Eur. *gen-* > Eng. *kin*]: the lowest group in the animal or vegetable kingdom with which a name is habitually connected that enters into the composition of the specific designation of each independent species; thus the wolf is (1) a representative of a genus (*Canis*), to which it belongs in common with a number of other animals; and (2) of a peculiar species (*Canis lupus*); the specific name (*Canis lupus*) is, as a whole, peculiar to itself and shared with no other species. The genus, as now limited, has been defined as the expression of the ultimate modification of structure; and this definition is perhaps as good as one of such few words can be, but without explanation it will convey an erroneous idea to those who are otherwise unacquainted with natural science, and the definition can only be appreciated when the group itself is thoroughly understood; and hence it can not be considered as a definition in the true sense of the word. An adequate idea can only be given by example; thus the wolf, in common with the dog, coyote, jackal, and certain other like forms, constitutes a genus, *Canis*, in contradistinction to the red fox

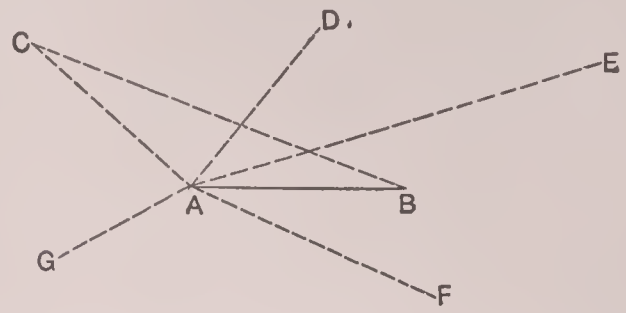
(*Vulpes*), which is also composed of a number of species, and the gray fox (*Urocyon*), of which there are at most but two species: the species in each of these genera are defined by trivial differences in detail of structure or color, and they differ from each other in certain distinctive anatomical characters which are more prominent than any observable within the limits of any one of the genera. A necessary element of the genus, at least in the opinion of the best naturalists, is the possession of some peculiar character, or peculiar combination of characters, which distinguishes it from others. The number of species is no criterion, as a genus may have one or several species, or, exceptionally, hundreds of species. The genus was at an early period employed in natural history, but was not definitely and invariably distinguished and limited to a single name until the time of Linnæus; since his time the limits of genera have been undergoing gradual modifications. A certain conservatism in the adoption of genera is prevalent.

THEODORE GILL.

**Genza'no**, jen-zaa'nō: town of Italy; about 16 miles S. E. from Rome (see map of Italy, ref. 6–E). Little is known of its history before the thirteenth century, after which it passed successively from the dominion of one great mediæval family to that of another. It contains some fine buildings, but it is chiefly known by its yearly festival of the Infiorata, on which occasion (the Sunday of the Corpus Domini) the streets are covered with flowers, so arranged as to produce a kind of floral mosaic—a show which attracts many strangers. Pop. 5,291.

**Geod'esy** [Fr. *géodésie*: Ital. *geodesia*, from Mod. Lat. *geodae'sia*, liter., earth-dividing; Gr. γῆ, earth + δαίειν, divide]: the art and science of surveying large portions of the surface of the earth, determining the curvature and other elements of figure of such portions, thus obtaining data for the construction of maps, and for inferring the figure and magnitude of the entire earth. It differs from surveying, in that the latter covers such small regions that the rotundity of the earth need not generally be taken into account, and does not aim at the highest attainable precision. It is sometimes regarded as a branch of practical astronomy, because astronomical observations are necessary to its successful prosecution, and the instruments and methods are essentially those of astronomy. This article is confined to a brief account of the principles embodied in geodetic operations.

In ordinary life the most natural and familiar method of determining the distance between two points is to take a chain, tape-line, or other measure of length, and, by stretching it along the ground in successive steps, measure the distance between the two points. A little consideration will show that this method is impracticable on a large scale, and would be inaccurate could it be carried out. Mountains, rivers, and natural obstacles of every sort would intervene, and even slight inequalities on the earth's surface would prevent the different stretches of the measure from being in one and the same straight line, and thus interfere with the precision of the result. The fundamental operation of geodesy is therefore that of triangulation. In its simplest form it is a solution of the problem: given the base and angles of a triangle, to find the lengths of the other two sides. To apply this method a base must be given; hence in order to execute a triangulation a base-line must first be measured by an application of the ordinary method, but with the greatest attainable precision. For an extended survey such a line must be several miles in length; it may be chosen in any part of the region to be covered by the survey where the conditions of an uninterrupted nearly level line of the required length, from both ends of which prominent points are visible, can be secured. The apparatus with which the measurement of the base is made consists essentially of a measuring-bar, or combination of such bars, of extreme precision. To protect them from changes of length arising from rapid changes of temperature they are inclosed in long, wooden cases, from the ends of which nothing but the ends of the bars project. To guard against the injurious effect produced by the expansion and contraction of the bar through changes of temperature, it is necessary either to determine and record the temperature very carefully every few minutes during the operation, or, better yet, to employ a self-compensating combination of two bars of different materials, so that the length measured shall be independent of the temperature. The refinements of modern art are such that a 6-mile base can be measured from end to end without an average error of more than an inch; that is, within two parts in a million. Extreme accuracy is necessary, because the errors, whatever they be, will be constantly multiplied as the triangulation advances; an error of a foot in a 6-mile base would produce an error of 100 feet in a triangulation extending over 600 miles.




The ends of the base-line must be so selected that several distant, prominent points, as the summits of hills or mountains, shall be visible from both ends of it. Let AB be the base, and C D E F G five such points. Then by measuring at the end A of the base the angle B A C, and at the end B the angle A B C, the three angles of the triangle A B C will be completely known, and thus the length of the two sides, A C and B C, can be determined when that of the base is known. In practice the geodesist would not be satisfied, however, by simply determining these two angles for each of the triangles in question. What he would do when at A would be to measure all the angles having their vertices at A, C A D, D A E, etc. Not only would this be done at the two ends of the base, but, if possible, he would mount his theodolite at each of the other stations. At C, for example, he would measure the angle C A B, C A G, etc., between as many of the stations as were visible from C. Then the geometrical theorem, that the sum of the angles of a spherical triangle is 180°, plus a small quantity easily computed and called the *spherical excess*, can be so applied as to check the correctness of his measures and enable him to detect any large error, and determine a mean value for each angle which shall be more accurate than any ordinary measures. The angles and distances being thus determined, some one of the lines, as C A, G C, etc., can be used as a new base-line to determine the position of some seventh point, including its distance from two or more of these points. These lines can again be used as new bases for a yet further extension, and so triangle can be built upon triangle and polygon upon polygon across an entire continent if necessary. Such a chain of triangles is now being extended by the U. S. Coast and Geodetic Survey from the Atlantic to the Pacific Ocean, and large stretches upon the continents of Europe and Asia have been measured in the same way.

The length of the lines of sight depends upon the nature of the country. Usually points can be found so that each measured line shall be from 25 to 40 miles long. In mountainous regions, lines of sight 100 miles or more in length are sometimes obtainable. Indeed, in California one sight has been obtained at a distance of 190 miles; but when the limit of 100 miles is exceeded the result can hardly be very accurate.

Direction is, however, as necessary an element as distance; that is to say, there must be known not only the distance apart of the several points, but the direction of the lines joining them, in order that the positions, for the purposes of mapping, may be known. Hence the azimuth of the base-line, the angle which it makes with a north and south line, is also to be determined. This is done by using the pole-star, or other stars very near the pole, as points of observation. Having determined the azimuth, or direction of one line, that of all the others can be found from the angles of the several triangles.

With the triangulations must be combined determinations of the latitude and longitude of some of the stations, by direct astronomical observation. The latitude and longitude can also be computed from the results of the triangulation itself, and the agreement or disagreement of the two will serve to show whether the elements of the figure and size of the earth by which the computation was made are correct. Discrepancies may also arise from deviations of the plumb-line, owing to inequalities in the density of the earth below and around the station. In mountainous regions these local deviations sometimes amount to 20 inches, or even to 30 inches, but usually they do not exceed 2 or 3 inches.

With a geodetic survey are frequently combined determinations of the force of gravity at the principal stations. This is effected by means of the PENDULUM (*q. v.*).

General results of geodetic measures, so far as the magnitude and figure of the earth are concerned, will be found under EARTH. Students of geodesy may be referred to Clarke's *Geodesy* (London, 1880) and Gore's *Geodesy* (New York, 1884) for a full and scientific treatment of the subject. A history of geodesy has also been published by the last-named author, containing an interesting account of the attempts made at different times to determine the magnitude and figure of the earth.

S. NEWCOMB.

**Geoffrey** (jef'rĕe) **of Monmouth**: a Welsh chronicler: became Bishop of St. Asaph in 1152. His most important work, *Historia Britonum*, is a pseudo-chronicle of the early Kings of Britain, such as Lear, Gorboduc, Arthur, etc., but it so abounds in fables as to have small historic value. It was translated into English by Aaron Thompson (London, 1718; revised ed. 1842). Died probably in 1154.

**Geoffrin**, *zhō'frăn'*, MARIE THÉRÈSE (*Rodet*): a Frenchwoman famous for her tact and wit; b. in Paris, 1699; married M. Geoffrin, a man of insignificant character but great wealth. The generosity, tact, and natural keenness of intelligence of Madame Geoffrin enabled her to secure a high position in the society of Paris, where she became the intimate friend of the most distinguished people of the time. She made her house the resort of authors, savants, artists, and representatives of the aristocracy, whom she entertained at regular intervals, appointing a special time for each class of guests. In spite of her defective education she presided over these gatherings with a grace and cleverness that made her the most celebrated hostess in Europe, and in her travels she received the most flattering attentions from foreign courts. Her intimacy with the Encyclopédistes, however, who were not favored by the French Government, prevented her being received at Versailles. Her beneficence was remarkable, and included all classes of society. Many of the literary men of Paris were her pensioners, and Poniatowski, afterward King of Poland, was one among many others who profited by her liberality. D. at Paris, 1777. See Marmontel, *Mémoires*, and d'Alembert, Morellet, and Thomas, *Éloge de Madame Geoffrin*.

**Geoffrion** (Fr. pron. *zhō'fri-ōn'*), FÉLIX: Canadian member of Parliament; b. at Varennes, Province of Quebec, Oct. 4, 1832. He became a notary; was registrar for Verchères from 1854 till 1863; and has been president of the Montreal, Chambly, and Sorel Railway. He was a member of the Canada Assembly 1863–67, and since 1867 sat in each successive Parliament of the Dominion up to 1893. He was appointed Minister of Inland Revenue in 1874, a portfolio which he resigned in 1876. D. Aug. 7, 1894.

**Geoffroy**, *zhō'frwăă'*, JEAN: genre and portrait painter; b. at Marennes, Charente-Inférieure, France; contemporary. Pupil of Levasseur and Eugène Adan; third-class medal, Salon, 1883; second-class, Salon, 1886, *The Unfortunate* (1883) is in the Luxembourg Gallery, Paris. Studio in Paris.

W. A. C.

**Geoffroy Saint-Hilaire**, *săn'tĕe-lãr'*, ÉTIENNE: zoölogist and physiologist; b. at Étampes, Seine-et-Oise, France, Apr. 15, 1772; distinguished himself by his brave rescue of Haüy from the Terrorists 1792; became Professor of Zoölogy in the Muséum d'histoire naturelle 1793; was actively engaged in the Egyptian exploration 1798–1802; was chosen to the Legion of Honor 1803, to the Institute 1807; became Professor of Zoölogy in the Faculty of Sciences 1809. In 1829 his famous controversy with Cuvier regarding the unity of plan lying at the basis of the philosophic or transcendental system of comparative anatomy, the soundness of which system Cuvier denied, broke out. Geoffroy, who was a synthesist, contended that, though all animals are formed according to some common plan, the same forms, owing to a change in the conditions of life, have not been preserved; while Cuvier, who was an analytic observer, maintained the absolute invariability of species. The controversy attracted the attention of the whole civilized world, and the sympathy of the public was pretty equally divided between the two opponents. Geoffroy wrote *Sur le Principe de l'Unité de composition organique* (1828); *Principe de philosophie zoologique* (1830); *Notions synthétiques, historiques, et physiologiques de philosophie naturelle* (1838), etc. D. in Paris, June 19, 1844.

**Geoffroy Saint-Hilaire**, ISIDORE, M. D.: naturalist; son of Étienne Geoffroy Saint-Hilaire; b. in Paris, Dec. 16, 1805; became his father's assistant 1824; took his degree 1829; entered the Institute 1833; became inspector of the Academy of Paris 1840; Professor of Zoölogy in the Museum 1841, and in the Faculty of Science 1854; Professor in the Société d'Acclimatation 1854. Author of the *Life* of his father, and of good treatises on teratology, acclimatization, etc. His principal works are *Histoire générale et particulière des anomalies de l'organisation chez l'homme et les animaux* (1832–37, 3 vols.) and *Histoire naturelle* (1854–62, 3 vols.). D. in Paris, Nov. 10, 1861.

**Geographical Botany**: that department of botany which treats of the differences in the vegetation of different regions, and undertakes to explain the distribution of vegetable life. There are many factors to be considered in studying the subject, and it is impossible to make any summary statement of them which will solve the problem. These factors may be briefly considered as follows:

1. *Preceding Vegetation.*—The vegetation of any region is derived from that which preceded it. This is true not only for the present, in which it is a matter of common observation, but it is also true that modern floras are based upon those of the later geological periods, the Cretaceous, Tertiary, and Quaternary. The origin of the vegetable life of any region must be sought in fossil floras.

2. *The Glacial Period.*—The destruction and change wrought upon the vegetation of northern regions by the great sheets of ice which pushed southward during the glacial period are still plainly seen. In the southward retreat of plants before the advancing cold many species were destroyed, and when with the returning warmth the exiled species moved northward again it was a greatly changed vegetation which took possession of the denuded soil.

3. *Physical Barriers.*—Throughout all time there have been here and there certain physical barriers which have profoundly modified the streams of vegetation, especially during the periods of great migrations. Mountain-chains when of sufficient height effectually prohibit the spread of certain species beyond them. So, too, great bodies of water form barriers to many species, hence insular floras often present marked peculiarities. In like manner great plains, and to a more marked degree sandy deserts, are barriers across which few species migrate.

4. *Temperature.*—For every plant there is a certain range of temperature above or below which it can not live. The maxima and minima vary greatly for different plants, a temperature which would be fatal to some being most favorable to others. The temperature of a region is therefore one of the most important of the factors in determining its vegetation.

5. *Moisture.*—Other things being equal, that region in which the moisture is greatest has the most abundant vegetation. Thus in the tropical and temperate climates vegetation is abundant or not as the moisture is or is not ample. Even in deserts the presence of springs insures an oasis, and the irrigation of a dry plain turns it into a fertile field.

6. *Light.*—The proper supply of light is essential to all green plants, but here again species differ greatly. Some are able to grow in the dark shadows of heavy forests, or the gloomy depths of cañons and narrow ravines, while others languish unless they are supplied with the direct rays of unobstructed sunlight. Many mosses and ferns are entirely absent from the prairies and plains because of the absence of shady forests and ravines.

7. *Elevation.*—Vegetation is generally denser at the lower levels, and at great elevations ceases altogether. This is due largely, but not entirely, to the lower temperature of mountain-tops. While there is a similarity between certain belts of vegetation on mountains and those at lower levels nearer the poles, they are by no means identical. After making due allowance for the influence of temperature, moisture, physical barriers, etc., it appears that mere elevation alone (with its accompanying rarefied air, more powerful insolation, and rapid radiation) must be considered one of the factors controlling the vegetation of a region.

8. *Plant Migration.*—The winds and waters of the earth have through all time been the great agents in the dispersion of plants. Animals of various kinds have carried seeds and spores, and doubtless have contributed not a little to the plant migrations of the past. Thus it is known that birds often carry seeds in their crops for long distances; quadrupeds carry many seeds in their fur; insects often

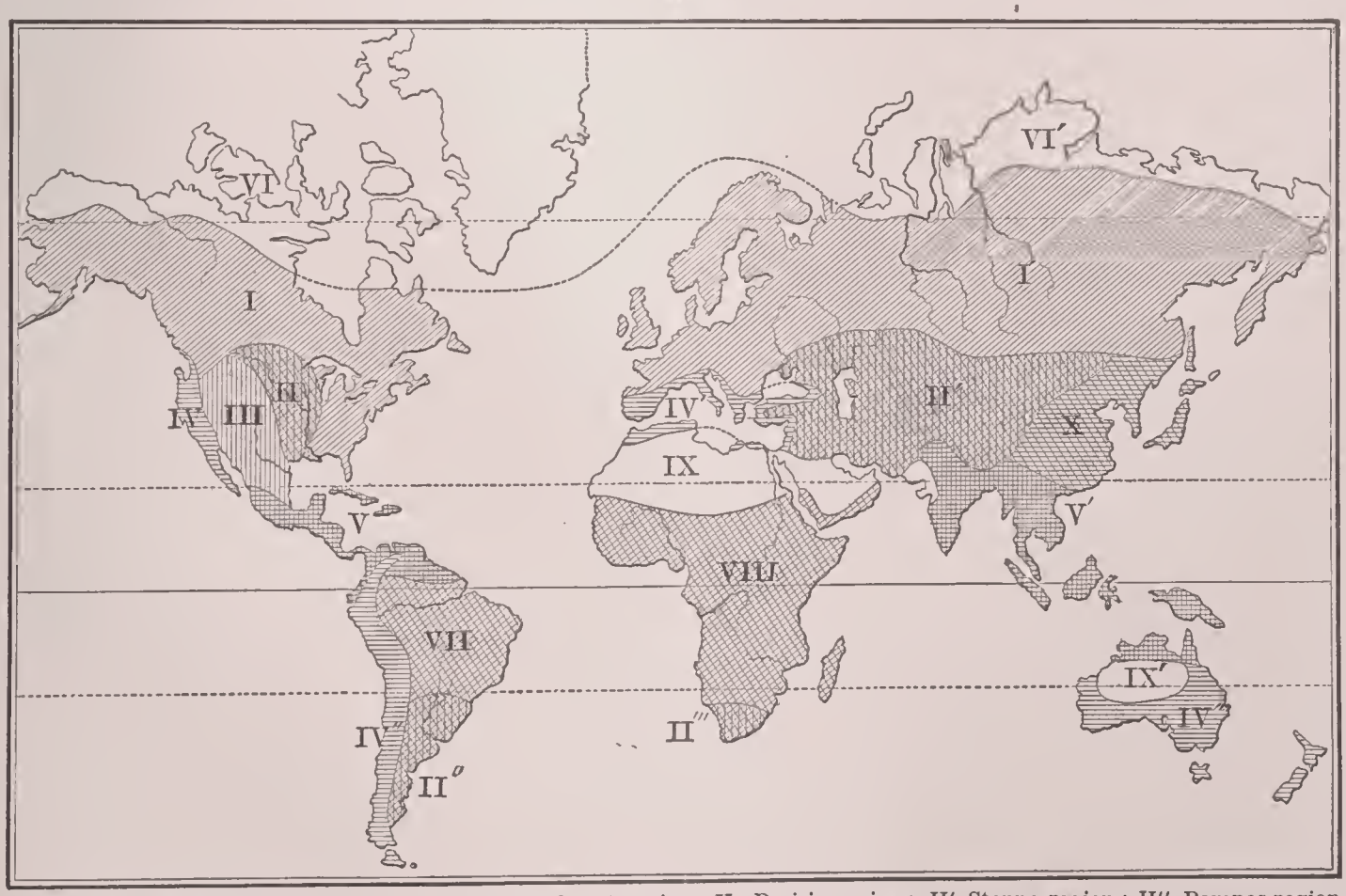
carry spores of fungi; man often purposely, and still more frequently unintentionally, carries seeds and spores with him to all parts of the earth. In these ways many plants have migrated long distances within the historic period, and no doubt they did so from the beginning of time. Probably no species ever remains stationary for any considerable period.

9. *The Influence of the Soil.*—Doubtless soil has some influence upon the vegetation of a region; it is noticed, for example, that certain plants are common only upon alkaline or saline soils, that certain others grow most abundantly upon sandy soils, etc. Yet it is quite certain that the influence of the soil upon the vegetation has been generally overestimated. An adequate supply of water is of much more importance than the nature of the soil.

The foregoing general statements having been made, the actual conditions of vegetation in different parts of the world may be briefly noted.

In each hemisphere there is a great forest region (I., I′.) stretching from ocean to ocean, and bounded on the N. by the barren Arctic region (VI., VI′.), and on the S. by elevated mid-continental plains and regions ameliorated by contiguity with warm seas. These forest regions are the homes of pines, spruces, firs, larches, oaks, beeches, birches, elms, ashes, and maples. While the species of the two hemispheres are rarely identical, they are closely related, and often appear to be little more than geographical variations. Dr. Asa Gray long ago pointed out the interesting fact that the vegetation of the eastern portions of these regions is more alike than that of the adjacent shores of the two oceans. In a number of cases genera are represented by species in the Eastern U. S., and again in China and Japan. In North America the mid-continental elevation (III.) is associated with a region of undulating grassy plains (II.), a condition which is repeated in the mountain and steppe region of Asia (II′.) and the pampas region of South America (II″.). Between the Californian region (IV.) and the Mediterranean region (IV′.) there are many resemblances, as there are between the Chilian (IV″.) and the Australian (IV‴.). The hot and humid West Indian region (V.) has its counterpart in the East Indian region (V′.). The Brazilian region (VII.) is closely related to the West Indian, if not in fact a continental extension of it. Of the Brazilian, and East Indian regions. In the conifers, while the pines, spruces, firs, etc., are mostly northern, *Araucaria*, *Agathis*, *Dacrydium*, and *Fitzroya* occur only from Australia to South America, and other exclusively southern genera are still more restricted in their distribution.

Sedges and grasses are cosmopolitan, but it is only in temperate climates that they form a grassy turf. The aroids are mostly tropical, occurring in great numbers in the West Indian, Brazilian, and East Indian regions. Palms are almost confined to the tropical countries of both hemispheres. The orchids are mainly tropical, but are abundantly represented in temperate climates throughout the world by terrestrial species. The oaks and their allies (*Cupuliferæ*) are mainly northern (I. and I′.), but a few species extend into the East Indian region (V′.) and South America. The spurges (*Euphorbiaceæ*) are mainly tropical, with many representatives extending northward and southward. The *Proteaceæ* are confined to the southern hemisphere, occurring abundantly in Australia, from which they extend to South Africa, the Pacific islands, and South America. The *Leguminosæ* are cosmopolitan, occurring everywhere except in the islands of the extreme south; in New Zealand they are rare. The *Cactaceæ* are confined to the New World, being most abundant from the Rocky Mountain region (III.) through Mexico and Central America. One species is doubtfully supposed to be a native of South Africa and Mauritius, but it was probably introduced by some of the early navigators. The heaths (*Ericaceæ*) are found in all parts of the world. In South Africa they are especially abundant, the genus *Erica* being represented by several hundred species. The plains and prairies of North America have few heaths, and they are not well represented in the Rocky Mountain region, but in the California region the number of species is considerably increased. The *Compositæ* occur in all parts of the world, being especially abundant in temperate climates and regions not densely wooded.




I. North American forest region: I′. Europæo-Siberian forest region; II. Prairie region; II′. Steppe region; II″. Pampas region; II‴. South African region; III. Rocky Mountain region; IV. Californian region; IV′. Mediterranean region; IV″. Chilian region; IV‴. Australian region; V. West Indian region; V′. East Indian region; VI., VI′. Arctic region; VII. Brazilian region; VIII. Ethiopian region; IX., IX′. Desert regions; X. Chino-Japanese region, properly the southeastward extension of I′.

immense continent of Africa little is known. It appears to be botanically unlike any of the preceding regions.

Trec-ferns are pretty nearly confined to the West Indian,

LITERATURE.—The reader who wishes to pursue further the subject of geographical botany briefly outlined above may consult the following works: Bentham's *Notes on the Classification, History, and Geographical Distribution of Compositæ*, in the *Journal of the Linnean Society*, vol. xiii. (1873), and papers in other volumes; Gray's *Darwiniana* (1876), several papers; Gray's *Scientific Papers* (1889), several papers; Grisebach's *Die Vegetation der Erde* (1872); Henfrey's *Vegetation of Europe* (1852); Hooker's *Insular*

*Floras*, in *The Gardeners' Chronicle* (1867); Meyen's *Geography of Plants* (1846); Spalding's *Distribution of Plants*, in *The American Naturalist* (1890). Also papers by Watson, Coulter, Underwood, Halsted, Beal, and Britton, in the *Proceedings of the American Association for the Advancement of Science* (vol. xxxix., 1891). CHARLES E. BESSEY.

**Geographical Distribution of Diseases** is largely dependent upon the *physical conditions* of the various countries of the globe. It has long been known that certain diseases are endemic, or peculiarly prevalent at all times, or at certain seasons of the year, in particular countries and regions. The ancients knew this, and recorded many interesting facts in relation to it; but the idea of a generalization of the known facts, and of a systematic and thorough search after new and unknown ones, originated in the nineteenth century. The topics which physical geography considers are the great facts which bear upon the health of man and the lower animals. Latitude, elevation, surface of country, climatic zones and isothermal lines, variations of temperature, the geological and chemical character of soil, water-distribution in air and soil, the vital characters of different races, the injurious and salutary influences of vegetation—these are some of the topics which must be considered in discussing the geographical distribution of diseases. See also CLIMATE, in relation to medicine.

**Geog'raphy** [Fr. *géographie*, from Lat. *geogra'phia*, from Gr. γεωγραφία, geography, deriv. of γεωγράφος, geographer, lit., earth-describer; γῆ, earth + γράφειν, write]: literally, a description of the earth. A simple description, including the nature of the land and waters, of the climate and natural productions, of the various countries of the globe, together with an account of the people and nations inhabiting them, and of their social and political condition, was the substance of the first geographical writings transmitted to us by the ancients. Though information relating to all parts of the earth is now far more extensive and reliable, geography has, to this day, necessarily retained its descriptive character; for an accurate description of the phenomena observed in nature and in human societies is the only foundation for a scientific knowledge of the earth. It is therefore quite natural that most of the geographical treatises confine themselves to the task of drawing such pictures as will seem to their readers sufficient for practical purposes. This is *General Descriptive Geography*. But the great progress of physical and natural science, as well as of the science of man in all his conditions, has awakened a desire for a higher, more comprehensive, and intelligent knowledge of the earth. To describe without rising to the causes and descending to the consequences of the phenomena is not science. The reflective mind craves more. While studying the earth in its natural aspects, it wishes to learn *why* these natural phenomena are as they appear, *how* they are produced, and what *laws* govern them. It seeks to understand the relations of mutual dependence which bind them together, as causes and effects, into a vast system, into one great individual mechanism, which is the terrestrial globe itself, with all it contains. Such a science must endeavor to discover those incessant mutual actions of the different portions of physical nature upon each other, of inorganic nature upon organized beings—upon man in particular—and upon the successive development of human societies; in a word, to study the reciprocal action of all these forces, the perpetual play of which constitutes what might be called the life of the globe. This is *Scientific Geography*, which may be defined as the science of the general phenomena of the globe and its life, in reference to their connection and mutual dependence.

It may be asked whether a science which thus embraces the whole domain of nature and man has a claim to an individual existence; but when geology has taught the composition of the earth's crust and the history of its gradual formation, physics, the laws which govern matter—when botany and zoölogy have classified the plants and animals according to their affinities and differences in a grand system of life; when ethnography and history have done their special work—it still remains for geography to trace out the relations of these various orders of things to each other. Geography needs the results of all these sciences, but is not to be confounded with them.

Geography, as the science of the earth, is naturally divided into three great departments, corresponding to three orders of facts: the earth considered as a planet, a part of the solar system, or *Astronomical Geography*; the earth considered in itself, the *Geography of Nature*, or *Physical Geography*; the earth considered as the abode of man, the *Geography of Man*. These three departments are usually called *Mathematical*, *Physical*, and *Political* Geography.

*Mathematical Geography* embraces two distinct sciences, both of which need mathematics as their principal instrument: *a. Astronomical Geography*, which treats of the position of the earth in the solar system, of its movements of rotation and revolution around the sun as causes of the daily and annual changes in the distribution of solar light on the surface of our planet, or the succession of days and nights and seasons. (See EARTH.) *b. Mathematical Geography* proper includes geodesy, which teaches the scientific methods of ascertaining the exact form of the earth, and of all portions of its surface, and their precise location in longitude and latitude; *Topography*, which surveys the minor features of relief and position of land and water, the location of mountains, rivers, and places; and *Cartography*, which teaches how to represent them on maps and globes. See GEODESY, MAP, and SURVEYING.

*Physical Geography* is the geography of nature. When it confines itself to a simple description of the natural features of the land it is called *Physiography*. When applied to the waters, it is *Hydrography*.

Physical geography, however, goes further, and seeks by careful comparison to discover the laws which regulate the position and arrangement of the continents; how the relief of the continents controls their drainage and shapes the vast river-systems; how the forms of the lands, together with their size and relative situation, modify the climate, the productions, and therefore the capacity of each country for commerce and civilization; how the great marine currents are set in motion by the sun and modify the distribution of its heat; and how the gaseous and liquid envelopes react on the solid sphere, remodeling its slopes, clothing them with an infinite variety of plants, and peopling them with an infinite variety of animals. In a narrower sense physical geography is the study of the processes of change by which the forms of the surface are created and remodeled. Thus restricted it coincides in part with *Dynamic Geology*, which investigates the processes by which the structure of the earth's crust has been developed and is still modeled, and it is distinguished from the study of the earth's envelopes. The investigation of the causes and conditions inciting and determining ocean currents belongs to the science of *Oceanology*. The determination of the influence of the distribution of land and water, mountain and plain, on the local warmth, moisture, and movements of the air constitutes *Climatology*. (See CLIMATE.) The investigation of the distribution of animals in relation to the various elements of topography and climate is known as the *Geography of Animals* or *Zoögeography*, and its sister science is the *Geography of Plants* or *Phytogeography*. See GEOGRAPHICAL BOTANY. See also CLIMATE (in relation to medicine).

In this cyclopædia PHYSIOGRAPHY and HYDROGRAPHY (*qq. v.*), considered as parts of physical geography, are not summarized in special articles, but are treated in detail under individual continents, countries, mountain-systems, plains, basins, oceans, lakes, etc. Physical geography proper is divided between EARTH, CONTINENT, MOUNTAINS, VOLCANOES, VALLEYS, LAKES, RIVERS, etc. Oceanology is treated under OCEAN and GULF STREAM.

*Political Geography*, or the globe as the abode of human races and societies, can be viewed under different aspects. It may be a simple description of the various races and nations of men as found in their present dwelling-places; *Ethnography*, the scientific form of which, inquiring into the principles underlying their nature, relations, and formation, is *Ethnology*. To give a description of the civilized nations, their characteristics, their boundaries and extent, their territories, an enumeration of their cities, an account of their constitution and government, of their population and resources, is the object of *Political Geography* proper, while *Statistics* gives the numerical data relating to these various branches of the subject. See ETHNOLOGY, MAN, and STATISTICS. Revised by G. K. GILBERT.

**Geological Surveys**: See SURVEYS, GEOLOGICAL.

**Geology** [Germ. *Geologie*: Fr. *géologie*, from Mod. Lat. *geolo'gia*, from Gr. γῆ, earth + λέγειν, tell, say]: the science of the earth. Distinguishing the rocky body of the earth, the *lithosphere*, from its envelope of water and air, geology may be defined as the science of the lithosphere. Though the solid earth has been appealed to by the writers of all ages as

the symbol of stability, it is nevertheless subject to change. Attentive examination from day to day, from century to century, and in many places, serves to show that the surface of the land is washed by rain and streams, beaten by waves, swept by winds, and ground by glaciers; and that the material thus removed from its surface is deposited elsewhere, chiefly under bodies of standing water and in the form of gravel, sand, and mud. It shows that from the throats of volcanoes streams of molten rock issue and flow over the surface of the land; that in places the land is gradually rising so that its coast encroaches on the sea; that elsewhere it is gradually sinking so that new areas are overflowed; and that in time of earthquakes sudden uplifts and downthrows occur, accompanied by the rending of the land. It shows that the leaves and branches of plants and the bones and shells of animals are sometimes strewn over the bottoms of lakes and bays so as to become buried in the slowly gathering sediment. These changes are but modern examples of modifications to which the crust has been subjected during unmeasured eons of time. Great districts have been alternately raised above and depressed below the sea. Mountains and mountain-systems have been thrust upward into the air, and by atmospheric agencies worn away to their bases. The congealed lavas of volcanoes have been bodily buried beneath oceanic deposits or have yielded to slow decay and been washed away. The forms of plants and animals have slowly changed, so that the leaves and shells and bones that were entombed by sediment during one period are different from those of other periods. As nature's destructive chemistry has broken up the rocks of the land so that they could be washed away to the sea, so nature's constructive chemistry, acting on the clays and sands and other sediments derived from the same material and lying beneath the water, has converted them back to rock, gravel becoming conglomerate, sand becoming sandstone, mud becoming shale, and calcareous ooze becoming limestone. When these were lifted from the sea by a new upheaval they joined the land as strata of rock; and in these strata were fossil leaves, shells, and bones, recording the life of the period when they were gathered as sediment. In the uplifting of mountains, masses of strata were broken across and displaced, or were folded together in great arches and troughs. In the process of mountain destruction, arches and uplifted blocks were carved into multifarious topographic forms. The series of changes thus briefly outlined has been long and intricate, so that the earth's crust, or such portion of it as can be examined at the surface or in mines and borings, is compounded of rocks of great variety and diverse origin, is constituted of rock masses whose attitudes and relations are highly complex, and exhibits a varied and sinuous contour.

*Subdivisions.*—In the lithosphere, which constitutes the field of geologic science, it is convenient to distinguish a crust and a nucleus. The crust can be defined only as the outer portion, it being quite conceivable that it is identical in constitution with the nucleus, or, if different, that the passage from one to the other is gradual. Concerning the crust much knowledge has been acquired by direct observation and by well-grounded inference, but knowledge of the nucleus is relatively imperfect and vague. This difference, and the fact that additions to knowledge in the two divisions of the field are sought by very different methods, renders the *Geology of the Nucleus*, for the present at least, a distinct subject from the *Geology of the Crust*. In the study of the crust the chief ends of research are (1) to ascertain the processes by which textures, structures, and configurations of the crust are produced and modified; (2) to discover the nature and sequence of changes whereby the present constitution of the crust has been developed; (3) to determine the localities, extent, and characters of mineral masses useful to man. They are thus philosophic, historic, and economic. The investigation of processes of change constitutes *Dynamic Geology*; it is carried on partly by direct observation of the operations of nature, and partly by study of the constitution of the crust, which may be regarded as the complex product of geologic changes. This study involves the determination and classification of the rocky materials of the crust, of the forms and relations of rock masses, and of the configuration of the surface. The discrimination and classification of rock species by composition, texture, and various other physical qualities constitute *Petrography*; the division of rocks into individual masses or bodies and the relations of these bodies are treated in *Structural Geology*; the classification of surface forms constitutes *Physiography*. It is the function of *Historic Geology* to apply the principles of dynamic geology to the interpretation of the local details of rock character, rock arrangement, and surface form, and thus determine the history of the earth's crust. The rocks whose historic order of sequence is most readily determined are those deposited in strata one above another, and a great part of historic geology is thus *Stratigraphic*. In many of the stratified rocks are fossils, the vestiges of contemporaneous animals and plants, and these, being different at different dates, serve to connect the chronologies of distant districts one with another. The geology of life, or *Paleontologic Geology*, is thus intimately related to stratigraphic geology, and is an important division of historic geology. The application of geologic knowledge to the service of human arts and industries constitutes *Economic Geology*. All branches of the science contribute to this end, but the aid afforded by dynamic, structural, and stratigraphic geology is most highly appreciated, because these determine the mode of accumulation and the structural relations of rocks and minerals, and thereby promote the discovery and the economic exploitation of the rarer ores and minerals. The art of the geologist, or *Geologic Technology*, comprises the methods of observation by which the material of the science is acquired, the taxonomic systems under which it is formulated, and the notations through which it receives graphic expression.

*Relations to other Sciences.*—Geology, as the science of the earth, is related to physical geography, the science of the surface. This relation is peculiarly intimate because the same series of changes which have produced the texture and structure of the crust have also produced the forms of the surface, so that the processes of change belong alike to dynamic geology and physical geography; and physiography is claimed by both sciences. Mineralogy, though strictly a department of chemistry, is interwoven with petrography, and their relations are doubtless destined to become still more intimate as the genesis of rocks and minerals comes to be better understood. Paleontology, though an inseparable part of historic geology, is equally inseparable from biology; but while neither affiliation can be abandoned, there is a well-developed tendency to divide the science into two parts—biologic paleontology being concerned chiefly with the sequence or evolution of living forms as illustrated by fossils, and geologic paleontology with the association of fossils in faunas and floras.

### Geology of the Nucleus.

The rocks exposed on the surface of the land have an average density of 2·7, water being unity. The rocks constituting the ocean-bed are of higher density, probably in the neighborhood of 3·0. The mean density of the whole globe (see Earth) falls between 5·5 and 5·6. It is thus evident that the density of the earth's nucleus is higher than that of its crust. If the nucleus consists of the same material as the crust, it may be supposed that the density increases downward according to a regular law, being determined at every point by the compression due to the weight of the overlying material. It has been estimated that at the center of the earth the pressure is about 90,000 tons to the square inch. If, on the contrary, the nucleus is composed of different matter from the crust, the specific gravity of its material is probably higher than that of surface rocks, so that compression need not be appealed to in accounting for its greater density. Assuming, as appears probable, that the lithosphere was at some remote date in a liquid condition, it may readily be supposed that its materials were partially separated in accordance with gravity, so that the most dense found place at the center. Speculation in this direction regards iron as the substance most likely to occur in abundance within the earth, first, because, in combination with other substances, it is abundant in the crust, constituting the twentieth part of the whole; second, because those minute stars which reach the earth as aërolites usually consist in whole or part of uncombined iron.

The question of composition and density is further complicated by the question of temperature. Wherever the earth's crust is penetrated by borings or by shafts of mines, a downward increase of temperature is observed. On the average a rise of one degree Fahrenheit corresponds to a descent of 50 to 60 feet, so that at the depth of a few miles it seems probable that the temperature is as high as that of molten iron or molten rock. The same story is told by volcanoes, which bring to the surface from unknown depths rock which is actually molten; and other evidence of similar tenor is derived from thermal springs. (See Refrigeration of the

Earth.) If the rate of increase of temperature with depth continues downward indefinitely, the temperature of the nucleus must far transcend human experience, and in any event it appears certain that it is so high as to have important influence on the earth's density. Pressure tends to compress all substances, heat to expand them; and the nucleus of the earth, being subject to pressures and temperatures of a higher order of magnitude than those with which man is familiar, may, for aught that can now be told, be much denser or much less dense than its material would be if conditioned only by moderate pressure and temperature. It is therefore impracticable, for the present at least, to infer the composition of the nucleus from its density.

Equal difficulty is found in determining whether the nucleus is solid or liquid. The determination of high temperature, and especially the extrusion of lavas, early led to the belief that it is in a condition of igneous fusion. This opinion was strengthened by the discovery that rock masses which have been deeply buried within the crust and afterward brought to the surface by denudation exhibit a sort of flow structure, as though they had been in a plastic condition. On the other hand, it is now known that solid rock is denser than liquid, so that if the earth's solid crust were floated on a liquid nucleus the equilibrium would be unstable, and an eruption of molten rock, if once instituted, would continue indefinitely. As eruption does not continue indefinitely, but ceases after a time, the evidence afforded by volcanic phenomena is not wholly favorable to the theory of a liquid nucleus, but tends rather to show that liquidity is limited. The question has been otherwise discussed from astronomic data, it being argued by students of celestial mechanics that if the nucleus were liquid it would respond, along with the ocean, to tidal influence, and the differential tides, which alone we observe, either would not exist or would be of smaller amount.

Thus the questions as to the composition, temperature, densities, and physical condition of the nucleus are intimately interwoven, so as to constitute a complex problem with many unknown quantities; and indeed the complexity of the problem is far greater than might be inferred from the preceding brief statement. Its solution does not appear possible until knowledge of the physical properties of matter has been greatly advanced. Knowledge of the way in which the compressibility of matter is related to volume, and the way in which its expansibility is related to temperature and volume, should be as complete as is knowledge of the relation of gravitational attraction to mass and distance.

## Dynamic Geology.

The processes of change affecting the earth's crust fall into two general classes, those of the one having their source and principal seat beneath the surface of the earth, and hence called *hypogene*, and those of the other having their source and principal seat either on or above the surface, and hence called *epigene*. Hypogene processes include *diastrophism*, or the rising and sinking of continents and the upheaval of mountain-ranges; *volcanism*, or the flow of molten rock from below upward; and *metamorphism*, or changes in the composition and texture of rocks. The epigene processes transfer matter from place to place on the surface, the work being accomplished by a variety of agencies, and having for its general tendency the degradation of the surface of the land and the building up of the bed of the ocean. The hypogene processes, diastrophism and volcanism, are primary or initiative with respect to the epigene processes, which may be called secondary or responsive, for there would be neither degradation nor deposition if there were no land, and the land would long ago have been obliterated by erosion had it not been from time to time restored or enlarged through hypogene processes.

Hypogene Processes. *Diastrophism.*—One of the first questions to which geologic study was directed arose from the occurrence of marine shells, not only at a great distance from the sea, but at a great altitude above it; but a complete and satisfactory answer to the question has never been found. It has been determined that the shells are parts of animals which once lived in the sea, that since their death the boundaries of land and sea have been changed, and that the portion of sea-bed which they inhabited has been converted into dry land by uplift; but the causes of the uplift and of other geographic changes with which it was associated have not been discovered. Until they shall become known a satisfactory classification of diastrophic processes can not be made; but it is convenient in the present condition of knowledge to distinguish two types, the one comprising the uplift and the subsidence of broad tracts, the other comprising the upheaval of mountain-ridges. To the first are ascribed the formation of great plateaus and the principal changes in the extent of continents; to the second mountain-ranges and mountain-systems.

The standard plane to which the altitudes of continents and continental plateaus are referred is the level of the ocean; but the standard is rather convenient than absolute, for changes in the configuration of the ocean bed must affect the capacity of the reservoir and the height of the water-level. It has been suggested that the principal geologic changes in the relations of land and sea may have resulted from oscillations of the sea alone; but there is abundant evidence that the relative heights of adjacent plateaus or even of parts of the same plateau differed in former times from the present. It has been suggested that portions of the crust to which great load is added, as by the accumulation of sediment, are carried downward by their burden, and that land areas unloaded through erosion rise in consequence, and much may be said in favor of unloading and loading as causes of elevation and subsidence. It is specially noteworthy that some of the greatest local accumulations of sediment, constituting rock series many thousand feet in thickness, exhibit at numerous horizons evidence that they were deposited at or near sea-level. There are, however, many instances of great elevation and great subsidence which can not be explained in this way, and it appears from theoretic considerations that this process can at most have only a conservative function, tending to maintain an existing relation of land and sea rather than to institute geographic revolutions. See Continent.

Most mountains are ranges or ridges; that is, their length is great compared to their width. If their structure be carefully studied it is usually found that the principal rock masses of which they are composed are more or less elongate and lie parallel to the ranges. In mountain systems composed of many ranges individual ridges are usually parallel to one another and to the general trend of the system. These facts, taken in connection with the occurrence of folded rocks in many mountains, have led to the theory that mountain ranges in general are produced by horizontal forces acting in directions at right angles to the trends of the ranges. Where rocks are composed of sedimentary strata whose original position and extent can be inferred from a study of the structure, it is possible to estimate the amount of horizontal compression. In the Appalachian mountains, for example, the amount is probably from 5 to 10 miles. In other mountain systems, as, for instance, the desert ranges of Western North America, it appears from the structure that the uplift of ridges was not accompanied by lateral compression, yet the phenomena of trend are almost equally pronounced. The origin of mountains has been the subject of much study, and numerous theories have been proposed, but the subject is still involved in doubt. The theory most widely accepted appeals to the shrinkage of the earth's nucleus. The temperature of the earth's surface is determined by solar radiation and by certain properties of the atmosphere, and is assumed to be approximately constant. The heat of the nucleus is gradually transferred by conduction through the crust to the surface, and thence dissipated by radiation. The nucleus is therefore shrinking from loss of heat, while the crust is relatively constant in temperature, and the adjustment of the rigid crust to the shrinking nucleus produces a corrugation which may be compared to the wrinkling of an apple-skin as the fruit dries and shrinks. Critics of this theory have pointed out that it does not apply to mountains of the desert-range type, and have also argued that the amount of shrinkage which may reasonably be ascribed to the nucleus is not sufficient to account for the observed amount of crumpling. For an account of other theories, see Mountains, and also references at the end of this article to the writings of Dutton, Fisher, Leconte, and Reade.

*Volcanism.*—At all periods of the development of the crust molten rock has moved upward, occupying and traversing crevices in the solid rocks and ascending to the surface. Congealing in subterranean crevices, it constitutes dikes and sheets; issuing at the surface, it builds volcanic cones. The phenomena of eruption and the forms assumed at the surface by the products of eruption are greatly varied, but depend primarily on the temperatures of the lavas and their relation to water. Lava containing little or no water rises quietly to the surface, and flows to a considerable dis-

tance from the vent before being arrested by congelation. If its temperature is considerably higher than that necessary for its fusion, the distance to which it flows is correspondingly great, and the cone formed by the congelation of many successive eruptions has gentle slopes. If the temperature is barely sufficient for fusion, the resulting streams are relatively deep and quickly arrested, and the resulting cone is steep. When the lava contains much water, the water is converted into steam during the rise of the lava through its conduit, the conversion being determined by the diminution of pressure; and the steam thus formed inflates the lava, diminishing its density and causing it to rise more rapidly. The continued explosion of the steam has an expansive effect, tearing the lava asunder and hurling it upward into the air with violence. The evaporation of the water tends also to cool the lava, so that the fragments thrown into the air are solidified before falling to the ground. They are usually so light and sponge-like as to be called cinders, and they accumulate about the orifice in the form of a steep-sided cone.

Eruption is not continuous, but is irregularly rhythmic, and most volcanoes are characterized by periods of activity covering weeks or months and separated by longer intervals of quiet. When activity is resumed its first stage sometimes consists of the charging of the mountain with superheated water, which is finally converted into steam, producing a tremendous explosion whereby the top of the mountain or some other portion of its mass is blown into the air, and an immense crater is formed. The fragments scattered by such an explosion may have the general character of volcanic cinder, or may be combined with so large an amount of water as to constitute a mud.

Sometimes lavas rising from their subterranean sources do not escape at the surface, but are arrested at lower levels, where they gather and congeal in lenticular bodies called laccolites.

The causes of volcanic action are little less obscure than the causes of mountain uplift. The early idea that extruded lava is part of a liquid nucleus is still widely prevalent, although opposed by modern conceptions of the strength of the crust, by the discontinuity of eruptions, and by the lack of sympathy between eruptive phenomena at neighboring vents. It is probable that lava is ordinarily lighter than the portions of the crust through which it rises, so that an essential condition of its ascent is hydrostatic. The rhythmic character of eruption indicates that the igneous material is in some way gradually prepared, and forces its way upward when accumulated in sufficient volume. The process of preparation may involve heat or chemical reaction or, in some cases, hydration. A theory elaborated by Mallet ascribes the preparation of lava to crushing in connection with diastrophic changes, and its extrusion to associated horizontal forces. See Volcanoes.

*Lithifaction and Metamorphism.*—The conversion of incoherent sediments into coherent rocks takes place for the most part at some distance beneath the surface, and the details of the process are little known. Probably a certain amount of adhesion of particles is produced by long-continued pressure, the phenomenon being related to welding. More commonly it is found that the interstices between grains have been partly or completely filled by deposits from percolating water. Such deposits may be of different material from the grains, in which case they constitute a cement; or if of the same material as the grains, they may blend with them so intimately as to constitute secondary growths of original crystals or crystalline fragments.

In many instances rocks are changed by the formation within them of new minerals. These minerals may be derived from the material of the original minerals or in part from foreign material. Their formation involves local movements and interchanges of atoms and molecules, and is essentially chemical. The conditions known to be favorable to such changes are high temperature, great pressure, and viscous flow. They occur chiefly at considerable depth below the surface, and especially in connection with the process of mountain building. They occur also in rocks adjacent to volcanic intrusions. See Metamorphism.

Epigene Processes.—Processes of change originating at or near the surface all include the transfer of matter. Material is subtracted from one place and added at another. The subtractive factors are sometimes called destructive processes, and the additive constructive. As the subtractive processes gradually eat away the material of the crust, they are collectively styled *erosion*; as they reduce the height of the land, they are also summed in the word *degradation*; as they lay bare rocks and structures not previously visible at the surface, they are comprehended under the word *denudation*. The additive processes are collectively known as *deposition*, and their products include all geologic formations except the volcanic. The process of transfer which intervenes between erosion and deposition is called *transportation*. By erosion, transportation, and deposition the configuration of the earth's surface is modified, and hence the congeries of epigene processes is sometimes styled *earth-sculpture*. The agencies by which material is transferred are of several kinds, each involving subtractive, transportive, and additive phases, and for the presentation of the processes it is most convenient to classify them by agencies.

*The Work of Water.*—From the ocean, from lakes, from the leaves of plants, and from all moist surfaces water is absorbed by the air. Through the circulation of the air it is carried to all regions, and it is precipitated in the form of rain and snow. (See Rain.) The water which falls on the land, re-enforced by the water from melting snow, is divided at the surface of the ground into two portions—the one flowing away over the surface, the other penetrating beneath it. That which flows away descends the slopes of the land, and is gradually gathered first into rills and afterward into rivulets and rivers, and ultimately flows to the ocean or to an interior sea. That which enters the ground joins a system of subterranean circulation and may descend to great depths, but it eventually returns to the surface, where it is added to the stream system. From its precipitation until its re-evaporation, water is an agent of geological change, eroding, transporting, and depositing crustal material. It has two modes of action—chemical and mechanical.

When the rain reaches the earth it contains in solution various substances derived from the atmosphere. Among these are air, carbonic acid, and ammonia. In descending through the soil it dissolves other substances, especially certain products resulting from the decay of plants. Thus charged, it not only is able to dissolve many of the minerals constituting rocks, but it induces chemical reactions. Attacking the rocks through which it first passes, it carries with it a portion of their substance, and this dissolved rock affects its ability to dissolve other rocks. As its slow course is continued, new reactions occur, whereby new substances are dissolved, and sometimes portions of its contents are precipitated. One result of its work, as already indicated, is lithifaction. Another result is the concentration into compact masses of substances previously diffused. This is of peculiar importance to man because various rare minerals are thus rendered available for his use. (See Ore Deposits.) A third result, and one which preponderates near the surface of the ground, is disintegration, rocks which were previously firm being rendered incoherent. From sandstones the cement is apt to be dissolved, and the minerals constituting other rocks are partially decomposed. When the water finally issues at the surface it brings with it a certain amount of dissolved rock, so that the net result of its underground action is subtractive or erosive. The water which flows over the surface in streams likewise possesses solvent power, and attacks the rocks which it touches and also the sediment which it bears along. Thus both parts of the aqueous circulation remove soluble matter from the land and carry it to the sea. The more soluble minerals thus delivered to the sea, as, for example, common salt, are stored and accumulated indefinitely, being released only under special conditions. The less soluble, such as calcite, the material of limestone, are deposited as rapidly as received. A large portion, possibly the chief portion, is deposited through the agency of living organisms, as described below; but another part is precipitated by certain chemical reactions and also as a result of the mechanical agitation of the water.

The disintegration of rocks is also effected by the capillary force of water penetrating minute crevices, by unequal contraction due to drying, by unequal expansion and contraction due to changes of temperature, and especially to the freezing of interstitial water, and in various other ways; and it is thus prepared for the mechanical action of water, which is performed chiefly by superficial streams.

As the water of rain gathers in rills and afterward into larger streams, its velocity of flow increases, and with the velocity its mechanical power, so that it becomes able to lift small particles of incoherent soil and carry them forward a short distance before they sink to the bottom. Larger particles are rolled along the bottom, and by these two methods detached fragments are slowly but surely transported sea-

ward. For the transportation of the smallest particles a certain velocity is necessary; for those of larger size a certain greater velocity; and the amount of geologic work which a stream can perform depends also on its volume. See Rivers.

The material transported acts likewise as an agent of destruction. If lifted by the current and allowed to fall, it strikes a blow where it reaches the bottom; if rolled or dragged along the bottom, its rubbing has abrasive power. The transported particles are themselves worn and reduced, and they also wear the bottom, rendering the channel deeper. This degradation of stream channels is known as *corrasion*.

When the velocity of a detritus-loaded stream is checked a portion of the detritus is deposited, and when the stream reaches a body of standing water—a lake or the sea—all of its load falls to the bottom. The coarser part is lodged at the shore; the finer may fall so slowly as to reach bottom only at a considerable distance. The conditions affecting deposition are greatly modified by the currents and other movements caused by winds and by the sway of tides; but in general the deposits are arranged in belts parallel to the coast, the finer being the more remote.

Of all the sculpturing agencies water is the most important. Indeed its work far transcends in amount that of all others combined. Though it works so slowly that its function may readily be overlooked, and though it deals for the most part with minute quantities, it yet labors so persistently and universally that it accomplishes most stupendous and impressive results. The Grand Cañon of the Colorado, 250 miles in length and with an average depth of 4,000 feet, is a result of corrasion through hard rocks, and affords a striking illustration because its narrowness enables the observer to bring both walls under one view, and thus realize the extent of the excavation. But a study of the geology of the river's upper basin shows that a tract 500 miles across has been degraded to an average depth of not less than a mile, the whole task having been accomplished during a small fraction of geologic time.

*The Work of Wind.*—Currents of air, like currents of water, are able to lift and transport particles of disintegrated rock, and in a similar manner they corrade. They are inoperative where vegetation clothes the surface, and their work, being thus restricted to barren localities, has little importance except in arid regions. Usually the coarsest material transported is sand. This may be derived from beaches or stream bluffs or, in desert regions, from the disintegration of sandstone. Its mode of transportation involves the formation of a hill of peculiar type called a *dune*. On the windward side the air current is accelerated, and on the leeward side it is retarded, and in consequence the wind continually removes sand from one side and deposits it on the other, so that the hill, while retaining its general form, travels across the land. See Dune.

The finer particles fall less rapidly through the air, and are carried to great distances. After a desert windstorm the air is charged with dust for many days, and it finally falls to the surface in a thin sheet of great horizontal extent. It is believed that a deep formation covering extensive areas in China has been accumulated in this way, and a similar origin is ascribed by some geologists to the loess of the Rhine and Mississippi valleys. (See Loess.) The march of dunes is arrested when they reach a river, and deposits of æolian dust are usually washed from the land by the next rain. Thus æolian deposits are largely recast by aqueous processes.

*Wave Work.*—Wave work is logically intermediate between water work and wind work. As waves break upon a shore, their water moves violently toward and from the land. The wind by which they are raised produces also a continuous current which usually moves parallel to the shore. By the to-and-fro movement particles are disturbed and lifted, and by the coincident shore current they are carried along. Where the shore current slackens or leaves the coast the fragments are deposited. Thus the aqueous currents caused by the wind erode, transport, and deposit detritus. Where detritus is moved across or against rock, the rock is corraded, and the analogy of wave action with stream action thus becomes complete. The work of waves is limited to a narrow belt where water and land meet; but within that belt, at least on the margin of the ocean, erosion is more rapid than over the surface of the land, and its visible progress early attracted attention, occasioning a false impression of the relative importance of waves as a geologic agency. The carving of broad plains from continental uplifts, or even the excavation of mountain gorges, was for a long time ascribed to "marine denudation," and it was only by degrees that this idea was replaced by the modern doctrine that the great work of degradation has been and is performed by rains and streams.

The coarser part of the material excavated by waves is built into ridge-like structures peculiar to coasts, and called spits, bars, etc. The fine material is carried seaward, chiefly by undercurrents, and is mingled in deposition with sediments brought by rivers. At the mouths of large streams the work of waves merely modifies the distribution of the stream-borne detritus. At the mouths of small streams coastal processes dominate, and the stream detritus is merely added to the larger body that drifts along the beach. See Coast.

*Ice-work.*—In polar regions and on lofty mountains, where the snow of winter is not fully dissipated by the summer's melting, the accumulated ice crystals are welded into glaciers. These flow away from the centers of accumulation, either descending the slopes of mountains or spreading laterally upon plains. An account of the mode and conditions of their formation and progress will be found under Glaciers. As the glacier moves over the land the plastic ice receives into its mass detached masses of rock, and it doubtless possesses in itself power to break away projecting angles and to detach blocks loosened by natural partings. Where the ice-stream follows a valley fragments from the walls of the valley fall upon its back, and some of these find their way through crevices of the ice to its lower portion. In these various ways the under part of the glacier comes to contain a greater or less quantity of bowlders and sand which are dragged over the undisturbed rock beneath. Armed in this way the glacier constitutes a huge, flexible file, by which the land beneath it is abraded. A tract which has been traversed by a glacier and afterward laid bare testifies to this grinding in the smooth, wavy lines of its contours and its striated and polished rock surfaces. The products of glacial corrasion, together with other material transported by the ice, are chiefly deposited at the end of the glacier, where the ice melts, and they constitute peculiar ridges called *moraines*. These consist chiefly of bowlders, pebbles, and sand, confusedly mingled and usually imbedded in a matrix of fine rock flour. The rock fragments are imperfectly rounded, and their faces show scratches of a peculiar and characteristic type. Rock floors and bowlders thus scratched are usually described as *glaciated*. The unsorted detritus is called *till*, or bowlder clay, and the final melting of a glacier may leave a thin sheet of this spread over its entire bed. Sometimes masses of till are deposited beneath the ice, and if these are afterward laid bare they constitute roundish hills called *drumlin*. (See Drumlin.) The melting of the ice near its margin furnishes large streams of water, which sort and distribute portions of the detritus, producing peculiar hills and ridges of gravel and sand called *kames* and *eskers*.

The rate at which a glacier degrades its bed varies from point to point, but on the average it probably does not differ greatly from the rate at which land is degraded by aqueous processes. As glaciers occupy but a small fraction of the entire surface of the earth, their aggregate accomplishment is a correspondingly small factor of earth-sculpture.

*The Work of Heat and Gravity.*—The processes just described all depend on the circulation of air and water, and these in turn are dependent on the co-operation of solar heat and gravitation, but those forces also act directly. Heat works mechanically for the disintegration of rocks, and it has much to do with the subterranean work of water, stimulating the circulation, carrying it to depths that would not otherwise be reached, and promoting the varied chemical reactions by which minerals are transferred and concentrated. Gravity works directly by breaking away the upper slopes of cliffs whose bases are sapped by streams or waves.

*The Work of Life.*—The reagents absorbed by rain water from the air and soil to be used in the disintegration of rocks are chiefly by-products of animal and vegetable life, and it is through these that life affords its chief contribution to erosive work. Disintegration is also promoted by the penetration and growth of roots and by the evacuations of burrowing animals, which continually overturn and mingle the soil. In another way vegetation serves as an obstructive condition, retarding currents and thus interfering alike with æolian and aqueous transportation.

In the deposition of minerals held in solution life plays

an important part. Doubtless all dissolved minerals would eventually be precipitated without the intervention of life, but actually the most important separations are effected by organic processes. Algæ aid in the separation of silica and calcium carbonate from the water of mineral springs. Diatoms, secreting silica in their tests, effect the storage of large quantities of that mineral in the form of infusorial earth. Marsh plants, storing carbon in their tissues, build beds of peat which through lithifaction become coal. A great variety of animals, but more especially mollusca, radiates, and foraminifera, secrete calcium carbonate, building it into shells and corals which survive them, and by their accumulation build up great formations.

It is not easy to separate organic processes from aqueous, but if the discrimination be based on the resulting deposits, the work of life must be ranked as more important than that of winds, waves, and ice.

### Petrography.

The igneous rocks, intruded and extruded by volcanic action from deep sources, are not known to be produced by the modification of other rocks, and are therefore, as apprehended by the geologist, primary. Under the generally accepted theory of the crust's early history, the first rocks were igneous, so that all others are derived from them, directly or indirectly, and may therefore be called secondary or derivative. Those of aqueous deposition, including also the products of wave work and many products of life, are called sedimentary. Deposits due to wind are called æolian, and those due purely to life organic. Glacial deposits constitute a group by themselves. The sedimentary, æolian, glacial, and organic are collectively called clastic. Igneous and clastic rocks alike are subject to metamorphism, and when thus transformed are called metamorphic.

Igneous rocks consist for the most part of crystalline grains of various minerals which have separated from a liquid magma in the process of congelation. These minerals are silica and various compound silicates of aluminium, iron, sodium, potassium, calcium, and magnesium. The varieties of igneous rock are numerous, depending upon original differences of elementary composition and the varied conditions of cooling. The clastic rocks have resulted from a long series of mechanical and chemical changes, in the course of which carbonic acid, chlorine, and some other substances have been added; they comprise three principal petrographic types—sandstone, shale, and limestone. The sandstone consists chiefly of quartz grains, which by reason of their hardness, toughness, and chemical stability have survived all vicissitudes. The shales contain the aluminium of the igneous rocks in combination with silica and water. In the limestones are the lime and magnesia in combination with carbonic acid. The soda in combination with chlorine is largely stored in the ocean, and the iron is widely diffused, constituting the coloring-matter of most rocks. By metamorphism a third series of minerals are evolved, among which the silicates are again prominent. For the detailed classification and description of rocks, see Rocks and the articles on the several species. See also Building-stone.

### Structural Geology.

Rocks occur in distinct bodies, each of which is distinguished from contiguous bodies either by petrographic character or by plane of separation. Each body is a unit genetically, and the arrangement of bodies is determined by their mode and order of origination. Rock bodies are also divided, deformed, and transformed by diastrophic processes.

*Sedimentary Structures.*—Continuous and uniform deposition of uniform material, if such a thing were possible, would produce a structureless or massive rock of indefinite depth. But all sedimentation is varied or interrupted, and these irregularities cause alternations of character and discontinuities in the deposits. Sedimentary rocks are accordingly divided or divisible into layers. They are said to be *foliated* if the layers are thin, *bedded* if they are comparatively thick. A single layer naturally separable from those above and below it is called a *stratum*. A series of contiguous strata of uniform character, but differing in character from strata above and below, is called a *formation*, and the word formation is also applied to genetic units of other derivation.

Strata are usually deposited on gentle slopes; under certain conditions, found in deltas, river-bars, and beaches, they are formed on steep slopes, and it frequently happens that the additions to a steep slope are so regulated that the inclined strata collectively constitute a thick bed whose upper and lower limits are nearly level. In such cases the oblique structure is called *cross-stratification* or *cross-bedding*.

Under certain other conditions currents of water or air act rhythmically, so as to throw the surface of the deposit into small parallel ridges called *ripple marks*.

After the deposition of a formation a change in the position of land and water sometimes occurs, of such nature that the next succeeding formation extends farther over the land. The second formation is then said to *overlap* the first. If after a period of deposition the formations are lifted above sea-level and eroded, and are afterward depressed so as to receive a new deposit, the surface produced by erosion is called a surface of *unconformity*, and the formation above it is said to rest unconformably on the formation beneath.

*Structures caused by Aqueous Transfer.*—Through chemical reactions, the nature of which is little understood, certain minerals originally disseminated through formations are concentrated along certain zones or about nuclei. When gathered about nuclei they produce spherical or spheroidal bodies called concretions. The minerals most frequently separated in this manner are calcium carbonate and various compounds of iron. The original cavities of rocks, as, for example, the bubbles of lava, and cavities afterward produced, as by the solution of fossils or by fractures, are frequently filled by mineral substances precipitated from percolating waters. The filled bubbles in lavas are called *amygdules*. Larger cavities lined with deposited minerals are sometimes called *geodes*, and still larger mineral bodies, more or less sheet-like in form, are called *mineral veins*. See Ore Deposits.

*Diastrophic Structures.*—Most rock bodies are naturally divided, at least near the surface of the earth, by planes of separation occurring in parallel systems. These are called *joints*. Usually the same body is divided by two or more systems, so that it is naturally separable into prismoid parts. The same system of joints may divide many rock bodies. The origin of this structure has not been demonstrated, but a plausible suggestion ascribes it to the passage of earthquake waves. A somewhat similar structure, called *cleavage*, characterizes slate, a metamorphic derivative of shale. Cleavage planes are separated by smaller interspaces than joints, are more exactly parallel, and are often flexed. Usually the material between the planes of separation splits readily in the direction parallel to them. The structure is believed to result from small shearing movements caused by diastrophic strains. A third structure, called *schistosity*, likewise characterizing metamorphic rocks, appears to consist in large part of the parallel arrangement of certain cleavable minerals, such as mica. The surfaces of parting are discontinuous, flattish rather than flat, and imperfectly parallel. Rocks exhibiting this structure are called *schists*.

The attitude of a stratum is determined by comparing its surface with a horizontal plane. The direction of the line of intersection of the two planes is called the *strike* of the stratum. The angle between the two, measured in a vertical plane at right angles to the strike, is called the *dip* of the stratum. The original dip of sedimentary rocks is usually very small, but the processes by which they are lifted into mountains produce high dips. When rocks are folded the medial line of the fold is called its *axis*. If the strata dip away from the axis on both sides, the fold is called *anticlinal*; if they dip toward the axis it is called *synclinal*.

The mountain-making processes also fracture rock bodies, and the dissevered parts are dislocated, the mass on one side going up and that on the other side down. The dislocation is called a *fault*. The amount of dislocation is the *throw* of the fault. The inclination of the plane of dislocation, as compared to a vertical plane, is its *hade*. Faults in which the hade descends toward the block that has gone down are called *normal* faults; those of opposite character are called *reversed* faults. The name *overthrust* is applied to reversed faults whose hade is large.

*Volcanic Structure.*—Volcanic rocks are extruded and intruded. A single extruded flow, spread over a surface and congealed, constitutes a bed or sheet. It may afterward be buried by sediments, and thus acquire a position within a series of strata. Intrusive igneous rocks usually occur in thin, flat bodies, which may traverse other rocks in any direction. If they break across earlier formations they are called *dikes*. If they occupy the partings of sedimentary

rocks they are called *intrusive sheets*, and are by this name distinguished from the sheets originally formed at the surface, which are called *contemporaneous* sheets. The conduit through which lava passes upward to supply a volcano usually has an irregular tubular form, and the volcanic material which finally occupies it, if afterward laid bare by erosion, is called a volcanic *neck*. In some cases the lava intruded among the partings of strata has lifted the superjacent rocks to a considerable height, so as to create for itself a large lenticular cistern. The body of igneous rock occupying such a cistern is called a *laccolite*.

### Physiography.

The comparative study of the forms of the earth's surface belongs more especially to physical geography, and its full treatment will be found under Physiography, Mountains, Valleys, etc., but certain phases of the subject are of such importance in geologic interpretation as to require brief treatment in this place.

*Base-level Plains.*—In the degradation of a river basin by the river and its branches there is an interaction of each part upon all other parts which eventually results in an orderly system of surface slopes. At the margins of the basin, where streams are small, the slopes are steep; near the river mouth slopes are gentle, and the transitions are gradual. When this condition has been reached, the local rates of degradation are harmoniously adjusted, being most rapid at the outer margins. It is probable that the rate is everywhere approximately proportional to the height above the *base level*, that is, of the water body to which the river discharges. After the harmonious adjustment of slopes, degradation tends constantly to reduce the basin to a plain, but the rate of degradation diminishes as the basin becomes flatter, and an absolute plane is never produced. The actual result is called a *base-level plain*. As contiguous basins reduced nearly to base level constitute practically a single plain, this term is often applied to a broad district, irrespective of its drainage system.

If the attitude of a base-level plain is changed, one part being relatively lifted or depressed by earth movements, the system of slopes is thereby thrown out of adjustment, and the streams are caused to corrade in some places and elsewhere to deposit detritus. If the plain be bodily lifted, or if the water surface determining its base level be lowered, all corrasion is stimulated and its streams deepen their channels. A plain dissected by deep waterways is thus significant of a change of base level.

In the degradation of the land by aqueous processes the surface is sculptured into valleys, hills, ridges, and plains, and the forms of these are further determined by climate, vegetation, and the character and arrangements of rock masses. Topographic details are thus greatly varied, but they nevertheless have certain characteristics by which their origin may be determined. The characteristics of valleys, hills, ridges, and plains wrought by glacial process differ from those of aqueous origin in such ways that the two can be discriminated. Similarly the topographic features wrought by waves have a peculiar facies. The geologist is thus enabled by the study of topographic forms to recognize those portions of the land which have been recently abandoned by sheets of ice or by sheets of water, discriminating them from each other and from the land areas whose sculpture has long been modified by rains and streams.

### Historic Geology.

The investigation of the earth's origin and early history belongs to astronomy, and has been prosecuted chiefly by the comparative study of the members of the solar system. That study renders it probable that the earth was at one time so much hotter than now that its surface was an ocean of molten rock. Afterward the crust became solid, and in some way not yet understood surface irregularities were produced, so that the aqueous envelope did not cover the whole sphere, but was held in oceanic hollows. With the differentiation of land and ocean erosion and sedimentation began, and there was initiated a stratigraphic record of events. By subsequent changes in the position and configuration of land and sea the field of sedimentation was shifted. The strata lifted into land were wholly or partly eroded, and the record was further complicated and enriched by metamorphism, eruption, and life. It is the function of historic geology to read from this record the history of terrestrial events.

The methods employed in this work of interpretation are many, and each year witnesses their increase and improvement. Those which have heretofore proved most acceptable may be grouped as stratigraphic, paleontologic, and physiographic.

*Stratigraphic Geology.*—When the geologist examines clastic rocks arranged in strata of even thickness, his first inference is that at the time of their formation the locality was submerged. Since erosion is the inseparable correlative of deposition, he may also infer that not all the earth's surface was then submerged. From the composition and texture of the strata he may draw a variety of inferences as to the conditions affecting depositions. Fine sediment usually implies either that the receiving basin was small or that the locality was remote from the shore. Sediment requiring strong currents for its transportation implies proximity to shore. Ripple marks tell of shallow water; coal seams of quiet lagoons or coastal marshes. If the locality under examination exhibits several formations in sequence, each formation tells a separate story, and collectively they describe a series of geographic changes. As neither of the formations could have been begun until the one below it was completed, their physical sequence implies a chronologic sequence.

Examining the rocks of a neighboring locality, the geologist will rarely find precisely the same kinds and quantities of strata, but the similarities may be such as to enable him to identify each formation, or he may be able to trace the outcrops of some of the formations from locality to locality, and thus establish equivalences. But if he continues this process far enough, he will eventually find that some formations of his original locality disappear and other formations appear. Sometimes he will observe a gradual change in the composition of a formation, and in such case he may be able to say, for example, that a sandstone at one locality is the precise equivalent of a shale at another; but ordinarily the formation which disappears does so by thinning toward its limit, and new formations first appear as thin beds which grow to important magnitude further on. These phenomena of the rocks reflect that which may be observed in modern fields of deposition. No extensive body of water receives the same sort of deposit throughout its entire area, but the material brought to it is sorted by waves and currents, and the various kinds gather on different tracts. The margins of the tracts are indefinite and are shifted to and fro by temporary changes of conditions.

Despite the difficulties thus arising, the geologist might develop a complete chronology from the study of strata if the whole of each formation were accessible to him, but his means of observation are narrowly limited. In each district every formation except the highest is partly covered, and can be examined only where its edges outcrop. The majority, indeed, could not be seen at all but for subsequent erosion, and the erosion which thus permits partial examination has also partly destroyed them. That which remains may lie in districts widely separated, and the difficulty of identification increases with distance. When an ocean intervenes the stratigraphic method of identification practically fails. The limited district within which the chronologic relations of formations can be established by stratigraphy is usually called a geologic province.

Within a geologic province there may be many formations, each recording a special local phase of geologic history; but the changes from phase to phase or from formation to formation are not of equal importance. If, for example, sandstones and sandy shales rapidly alternate through a great stratigraphic thickness and are then succeeded by a series of limestones and calcareous shales, the change from series to series is manifestly more significant of geographic revolution than the minor changes of each series, and it may be used as a basis for the broad classification of local chronology. Of similar and even superior classific importance is unconformity, for the interruption of a stratigraphic series by unconformity shows that the ocean receded from the province and returned again after a lapse of time, which may have been short or long. The plane of unconformity, though without thickness, may represent as much time as do many formations, and during that time great series of formations may have been accumulated in other provinces.

*Paleontologic Geology.*—The chronologic arrangement of formations is greatly facilitated by the study of their contained fossils. Wherever the sequence of a large number of formations has been determined by means of their superposition, it is found that the fossils of each formation differ

# GEOLOGICAL MAP O

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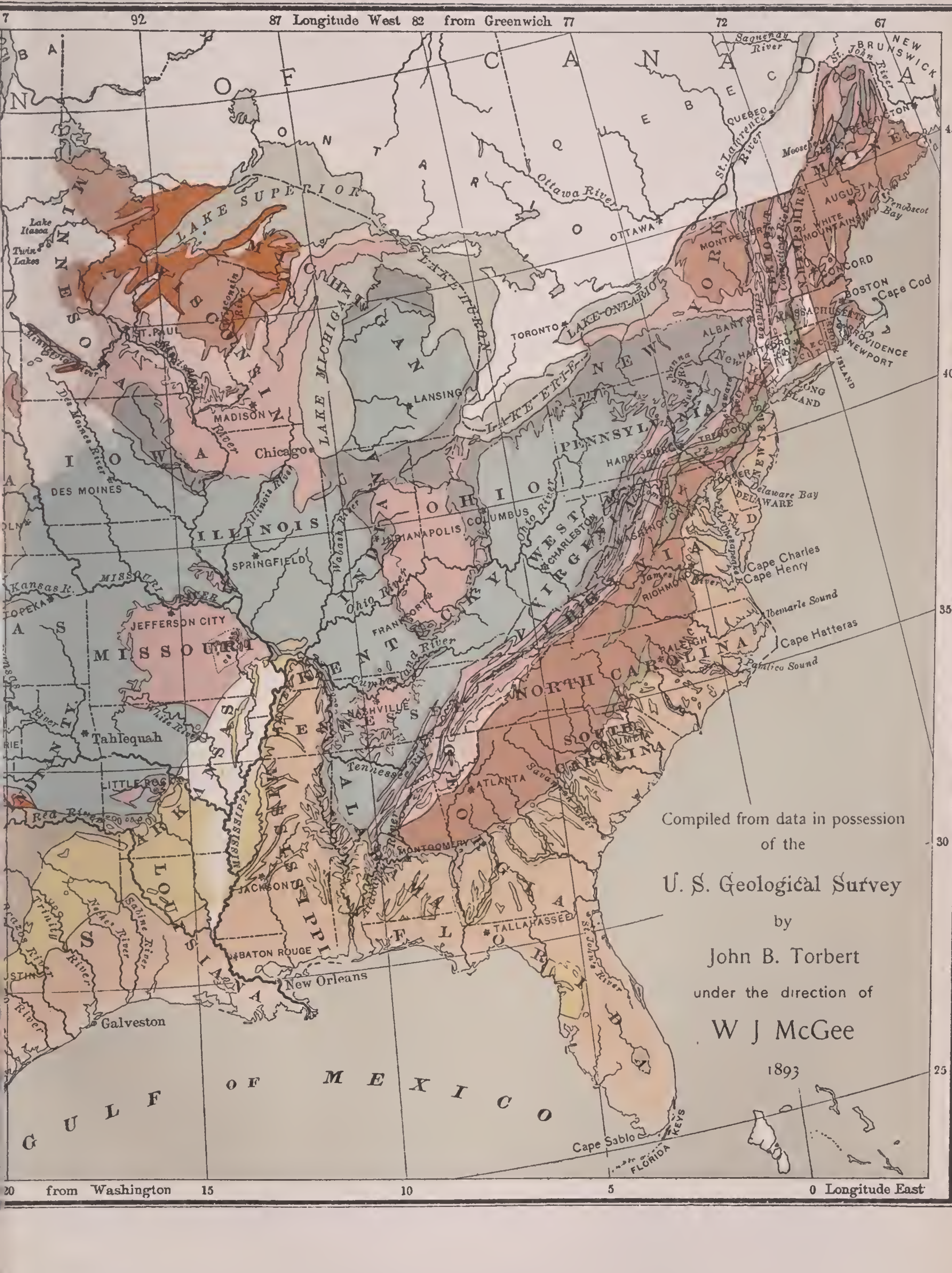


from those of each other formation, and in general that the differences are greatest between the newest and oldest formations. Thus a local life sequence is determined. Comparison of the life sequence of one district with that of another always leads to the discovery of important similarities, and from the comparison of many life sequences it has been determined that the life of the globe has undergone a continuous and orderly evolution from the time of the oldest fossiliferous rocks to the present. Thus paleontology comes in where stratigraphy fails and affords the basis for a universal geologic chronology. With the aid of paleontologic standards it has been found possible to determine the approximate chronologic relations of series of formations belonging to widely distant provinces.

But while the study of fossils is indispensable to a comprehensive chronology, there are certain limitations to their utility which should not be overlooked. One of these arises from the imperfection of knowledge of ancient life. Some formations contain no fossils, others but a few, and those which hold many can never be supposed fully to represent the life of their times. It results that a species which survived many formations may happen to be preserved locally in but one, and thus may apparently represent too small a portion of time. To avoid this difficulty cautious students consider collectively all the fossils contained in a formation whose age is in question, and faunas rather than species are regarded as diagnostic.

The second limitation is connected with habitat. As at the present time, so in the past each animal and plant was restricted to certain areas where the conditions were favorable to its mode of life. Those which inhabited warm water could not live in cold, and *vice versa*; some flourished only in quiet water, others only in rapid currents. Hence neighboring formations deposited at the same time may contain different assemblages of fossils. The difficulty thus occasioned is partially met by consideration of the fact that to a great extent the conditions of life coincide with the conditions of sedimentation. The animals that like rapid currents leave their remains in coarse deposits; the remains of those which require quiet water may be found in clays and shales. Accordingly, when the stratigraphic series exhibits rapid alternations of shale and sandstone, the fossils of neighboring sandstones are usually found to be more closely related to each other than to the fossils of the intervening shales. Careful students accordingly give attention to the nature of the sediments with which the fossil faunas are associated.

A third limitation is associated with geographic distribution. It appears to have been true in the past, as in the present, that the fauna of one ocean or one continent differed widely from that of another ocean or continent. It seems, moreover, to be probable that the partial diffusion which gives general similarity to all the faunas of a geologic period was accomplished by migrations which became possible only at rare intervals, when geographic changes permitted animals restricted to a particular habitat to cross the line of what had previously been an insuperable barrier. Thus through migration under changing conditions a fauna may occupy one geologic province at one time and afterward occupy another. From these considerations it is believed that the correlation of formations by means of fossils is generally less precise as the distance between the localities is greater.

*Physiographic Geology.*—The erosion of the land on the one hand furnishes material for sedimentation, and on the other carves out certain topographic forms. Land forms are therefore the correlatives of contemporaneous deposits. When a base-level plain is uplifted and the streams corrade channels adjusted to a lower base level, the process of removing the plateaus between stream channels is gradual, and for a long period portions of the old plain survive and can be recognized. The material eroded during this period is built up in deposits elsewhere, and the horizon of the base of these deposits is contemporaneous with the plain of the old base level. By the aid of such relations it is possible to extend geographic knowledge concerning the later geologic periods to districts which were not submerged. This method can not often be applied to the older periods, their base-level plains having usually been completely obliterated.

Physiographic data are also extensively used for the interpretation of the history of the latest geologic period, which involved the enormous expansion of glaciers, accompanied by abnormal relations of land and sea and the enlargement of certain inland waters. The peculiar types of topography produced by the glaciers and by the waves of the encroaching seas constitute a morphologic record which, for the investigation of this particular period, has proved more serviceable than the stratigraphy of fossils.

*Associated Phenomena.*—Through stratigraphy the local sequence of the sedimentary formations is determined, and they are grouped in local systems. Through paleontology the local sequences and systems are correlated, and a general chronologic scheme is developed. To this general scheme all other geologic formations and events are referred by means of their physical relations to the sedimentary formations. The date of a mountain uplift is determined between limits by ascertaining the age of the newest formation involved in the disturbance and the age of the oldest undisturbed formation in the disturbed region. Contemporaneous sheets of lava are correlated with the inclosing sediments. Intrusive sheets and dikes are recognized as newer than the youngest rocks they traverse and older than any formations partly derived from their material. Mineral veins are recognized as newer than the formations constituting their walls, and their age is often more precisely fixed through the diastrophic or volcanic changes which determined their formation.

*Chronologic Scale.*—Each formation represents a portion of geologic time. The formations and unconformities of a district represent successive local changes in the geologic history of the district. The formations and unconformities of another district represent also geologic time, but a different history. In each district geologic time may be divided into parts by means of local geologic events, but the classifications thus obtained will not agree. Nevertheless it is important to secure for geology a universal time-scale. In human history a similar need, conditioned by a similar difficulty, has been met by the adoption of an arbitrary unit, the century. This fits the events of no country, but is equally available for all as a standard of comparison. In geology arbitrary standards are gradually being adopted, but greater difficulty is experienced because neither the absolute nor the relative time consumed by geologic events can be closely approximated. The first classification of geologic time was based upon the stratigraphy and paleontology of Great Britain, its divisions being limited by the discontinuities of sedimentation and of life record in that country. It is thus a natural classification for Great Britain and an artificial classification for most other countries. It has been almost universally adopted as a standard, originally because of an erroneous impression that a universal natural system was possible, and finally because priority of use afforded an available basis for the selection of the elements of an arbitrary scheme. The comparison of British stratigraphy with the stratigraphy of other European countries has led to a slight modification of the British scheme for European purposes, and still further modification has been found advantageous in more distant lands. The following table shows the periods used by the director of the Geological Survey of Great Britain, and also those used by the U. S. Geological Survey:

THE GEOLOGIC TIME SCALE.

| ERAS. | PERIODS. | |
|---|---|---|
| | U. S. Geological Survey, 1890. | Geikie's text-book, 1885. |
| Cenozoic. | 11. Pleistocene. | Recent.<br>Pleistocene. |
| | 10. Neocene. | Pliocene.<br>Miocene. |
| | 9. Eocene. | Oligocene.<br>Eocene. |
| Mesozoic. | 8. Cretaceous. | Cretaceous. |
| | 7. Jura-Trias. | Jurassic.<br>Triassic. |
| Paleozoic. | 6. Carboniferous. | Permian.<br>Carboniferous. |
| | 5. Devonian. | Devonian. |
| | 4. Silurian. | Silurian. |
| | 3. Cambrian. | Cambrian. |
| Agnotozoic. | 2. Algonkian. | Archean. |
| Azoic (?). | 1. Archean. | |

Periods are themselves grouped into *eras*, and the practice of authors with respect to these exhibits great diversity. Periods are also subdivided into *epochs*. An attempt has frequently been made to include epochs in the universal time standard, but as the difficulties of correlation increase rapidly with the narrowness of the standards such attempts have been unsuccessful. In modern practice the epoch is usually treated as a unit of local geologic chronology just as the reign of a monarch is sometimes used as an historic standard for the events of a single kingdom.

*The Periods.*—The Archean period is the time occupied in the formation of the oldest known rocks. These rocks are largely of igneous origin, but probably also in part sedimentary. They have, however, been so profoundly metamorphosed that the determination of their early history is difficult, and present conclusions are largely tentative. A peculiar structure discovered in Archean formations of Canada has been supposed to be a fossil, and was named *Eozoon*; but it is now regarded by most students as inorganic, and the metamorphic condition of the rocks renders it highly improbable that fossils will ever be found in them, even if originally contained.

The formations representing the Algonkian period are manifestly clastic, and are in general less metamorphosed than the Archean. A few ill-preserved fossils have been found, and the presence of life during the period is indirectly indicated by the abundance in its formations of minerals which are now deposited chiefly by organic processes. It is also indicated by the high development of the Cambrian fauna. In the classification of the animal kingdom rank is ascribed to the different groups in accordance with their degree of organization—that is, in accordance with the extent to which special organs are provided for special functions. Paleontology shows that the progress of life from Cambrian time to the present has in general been toward high organization, and it is analogically inferred that the first forms of life were little organized. As the organization of Cambrian forms is not of low type, it is inferred that life began much earlier. The Algonkian formations in some regions are of great thickness, and are divided into systems by unconformities representing great lapses of time. It is believed that the period was not only much longer than any succeeding period, but possibly equivalent to all succeeding periods.

The periods from Cambrian to Neocene inclusive are characterized by their several faunas, and the formations representing them are for the most part identified by means of fossils. In general the older formations are more thoroughly indurated than the newer, but to this rule there are many exceptions. The formations of each period represent all types of sedimentation, so that petrographic characters can be used only in local classification. Certain minor exceptions to this general fact are of interest, but have not yet been shown to have important significance. One of the most striking occurs in the case of the Triassic formations, which are characterized by red color in many different provinces, but there are other provinces where this character is wanting. The Carboniferous period was so named on account of the coal contained in some of its formations in Europe, and the Carboniferous of eastern America is similarly characterized by coal seams; but in western America coal occurs in Cretaceous and Cenozoic rocks, and the Carboniferous formations are barren. Chalk, which is a rock of rare occurrence, is so characteristic of Cretaceous formations in England and France as to have given its name to the period, and is developed among formations of the same age in Texas and neighboring States. Glauconitic rock, or greensand, having its greatest development in the Cretaceous of England, occurs also in Cretaceous rocks of the coastal plain of the U. S.

Among the rocks of all periods occur formations characterized by fresh-water shells, or otherwise shown to have been deposited in inland water, but these are peculiarly abundant in the Eocene and Neocene. The explanation of the peculiarity is probably found in the fact that lake beds are specially liable to be carried high above base level by continental changes, and therefore often completely disappear through degradation of the land. Those of the later periods are better preserved because exposed to erosive agencies for shorter times.

The Pleistocene period, which was closed by the CHAMPLAIN EPOCH (*q. v.*), was shorter than any other, and is peculiar in that its chief events were primarily climatic and its most important deposits are glacial instead of sedimentary. As its formations overlie all others, their original contours are usually preserved, and physiographic methods have replaced stratigraphic and paleontologic methods in their study. In all regions, but more especially in Arctic and temperate zones, glaciers then advanced far beyond their present limits, and immense ice-fields were developed in Europe and America, the retreat of which was marked by characteristic deposits, such as the ERIE CLAY (*q. v.*). In the tracts covered by these ice-fields and in their immediate vicinity Pleistocene phenomena are sharply distinguished from all others, and an effect of the associated climatic changes has been recognized in the enlargement of inclosed lakes and seas. To a limited extent also certain coastal changes have been connected with glacial phenomena, but over the greater portion of the land Pleistocene formations have not been discriminated from the Neocene.

Further information concerning each period will be found in the article bearing its name. Their faunas are described in the articles treating of fossil plants, fossil invertebrates, fossil vertebrates, and paleontology. For the enumeration and description of formations and the history of geologic events, the reader should consult one of the manuals mentioned at the end of this article.

*Duration of Geologic Time.*—As the subdivision of geologic time into periods is arbitrary and essentially a matter of convenience, it has not been found advantageous to attempt the determination of periods of equal length. Since the older formations, being largely buried by the newer, being greatly invaded by erosion, and being in places obscured by metamorphism, are difficult of correlation, they have been grouped under periods relatively long. The Pleistocene period, whose formations overlie all others and are at once exceptionally convenient for study and of peculiar economic importance, is the shortest of all; and it is approximately though not strictly true that the duration of the periods is proportioned to their outcrop. The time ratios implied by these statements have been deduced by the comparison of the thicknesses of deposits representing the several periods, it being assumed either that the rate of accumulation has been substantially uniform or that it has varied in a uniform way. It is believed that the Cenozoic era was twenty to one hundred times as long as the Pleistocene period, that the Mesozoic era was two to four times as long as the Cenozoic, the Paleozoic three to six times as long as the Mesozoic, and the Agnotozoic one to three times as long as the Paleozoic.

The determination of the earth's age in years, or of the number of years represented by the clastic formations, is even more difficult; and though it has been attempted often and by a great variety of methods, the only result which can yet be claimed with confidence is that the time is very long. One method compares the modern rate of sedimentation with the amount of sedimentation during geologic time. The rate can not be determined directly, but is estimated by observing the amount of detritus carried annually by rivers. Most rivers which have been investigated in this way traverse settled countries, and their records are vitiated by the cultivation of the land, which tends to increase the output in sediment. It happens, however, that a very large river, the Mississippi, was studied at a date when only a small portion of its drainage district was under cultivation, and the data thus derived are therefore of special value. Reliable measurement was made of the volume of sediment suspended in the water. It was ascertained that another large body of sediment is pushed along the bottom of the channel, but of this it was not found practicable to make measurement. A third factor, the matter in solution, has been determined only at a single stage of the river, and it is not yet possible to compute its annual quantity. By the aid of rude guesses at the undetermined quantities it has been provisionally estimated that the basin of the Mississippi is degraded a foot in 4,500 years. By accepting this rate, with or without qualification, as the average rate for all the land, by assuming that the land area in earlier ages has been the same as now or that it has differed in a definite way, by assuming that the average geologic rate of degradation has been the same as at present or has differed in a definite manner, and by determining the total amount of material contained in the sedimentary rocks and the amount which has been removed from them by erosion, it is evidently possible to obtain an estimate of geologic time. The determination of the volumes of sedimentary rocks does not admit of high precision because only a small portion of them is accessible, the remainder being buried deeply beneath

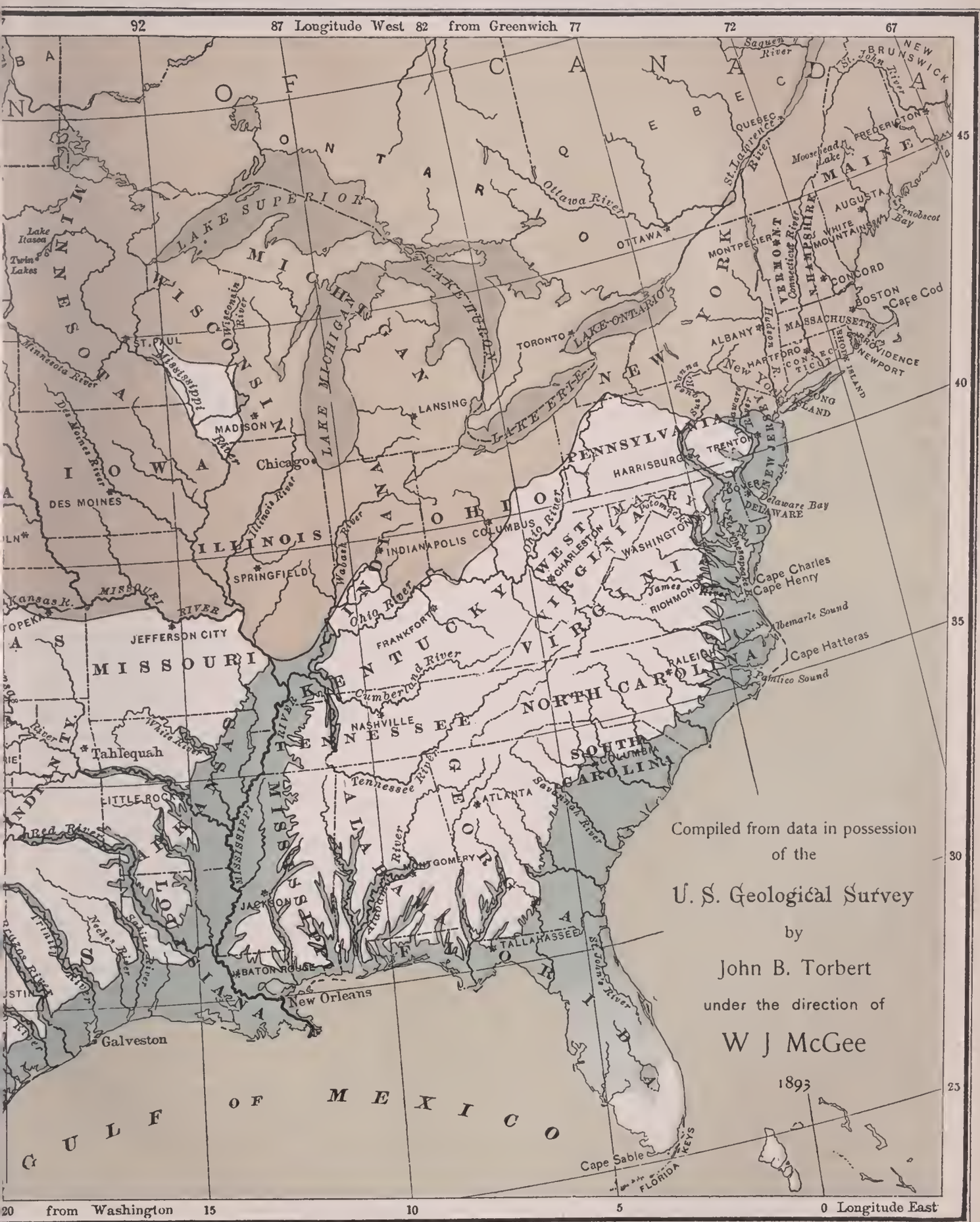
# GEOLOGICAL MAP O

*Showing the distribution of Pleistocen*

Engraved expressly for

# THE UNITED STATES,

*work and Water-work so far as known.*




Universal Cyclopædia.

newer formations or concealed by the ocean, and the extent to which the earlier formations have been removed by erosion is not easy of estimate. A parallel line of approach considers only the calcareous factor in degradation and deposition, as this factor, depending largely upon solution, is believed to be least subject to fluctuation.

Another line of approach is partly physiographic. By observing the rates of certain changes now in progress, especially the corrasion of river channels and the silting up of lakes, it obtains units of change which are applied in measuring the antiquity of certain Cenozoic dates recorded by base-level plains or by glacial formations. In this way the duration of an epoch is computed; and the computation is extended to periods and eras by means of the time ratios based on thickness of formations.

Yet another method derives a limiting value for geologic time from considerations connected with the cooling of the crust. It is postulated that at the time the surface of the earth first became solid the temperature of the crust was uniform, and that heat has ever since been dissipated from the surface in accordance with a constant law. The present temperature gradient, viewed as a result of the history of the cooling, serves as an index to the time. One difficulty encountered by this method is the uncertainty of the heat gradient, which has thus far been determined only for sedimentary rocks, whereas the crystalline rocks are believed to be the true representatives of the crust. Another difficulty concerns the law of heat diffusion, which is known to vary with temperature and probably varies with compression, but the rate of its variation under conditions of high pressure and high temperature is quite unknown. Discussions along this line likewise include the postulate that matter greatly compressed may flow as a liquid if its temperature is sufficiently high, whereas physical science has as yet given no sure indication of the viscosity of intensely hot matter when condensed to small volume.

A limit is independently derived from the hypothetic history of the sun. The processes of erosion and sedimentation essential to the production of the geologic record depend on the heat imparted to the atmosphere by the sun. If that heat were much greater than at present the ocean would be vaporized; if it were much less the waters of the earth would become fixed in ice; and in either case sedimentation would cease. During the whole period covered by the geologic record the sun-derived heat can have varied only within narrow limits. If it be true that the sun is rapidly dissipating heat, and if there is no adequate process for its continuous renewal (and none has been discovered), then it must be drawing on an original store, and the most competent original source of heat which has been suggested yields a computed amount which is definitely exhaustible. See Sun.

Estimates of the earth's age based on geologic data have ranged from ten or twenty million years to as many billion years. Limits derived from the refrigeration of the earth range from twenty million to four hundred million years. The limiting period determined by the sun is estimated at from ten to twenty million years. Reference to the literature will be found at the end of this article.

*Changes of Climate.*—The moraines of a great ice-sheet cross Pennsylvania and Ohio, and it is thus known that in Pleistocene time the climate of Greenland was carried 20° farther south. Leaves of oak, beech, and other trees, found in Neocene strata of Greenland and Spitzbergen, testify to a temperate climate far within the Arctic Circle. Thus and in many other ways geologists learn that the climates of the earth have not always been as they are now, and the problem of the cause of climatic change is of great interest. The Pleistocene changes are especially important, because it is probable that they are continuous with changes now in progress.

As the heat of the atmosphere is derived from solar radiation, the greatest climatic changes might arise from changes in the condition of the sun; and one theory of geologic climates refers them to variations in solar radiation.

Another theory springs naturally from consideration of the laws of distribution of temperature and other climatic factors on the earth's surface. The chief agents of this distribution are oceanic and atmospheric currents, and the oceanic currents, which are of prime importance, are conditioned by the form and depth of the oceans. It is unquestionable that climates may be modified in the most important respects by such changes of the distribution of land and water as are known to have occurred in the past, but it has not yet been shown that the particular geographical arrangements associated with Cenozoic and Pleistocene climates were of the character necessary to produce the actual climatic peculiarities.

A third theory appeals to secular variations of the relations of the earth to the sun. When the eccentricity of the earth's orbit is small, solar heat is received at a nearly uniform rate. When the eccentricity is great, heat is received more rapidly at perihelion than at aphelion. The inclination of the earth's axis to the plane of its orbit, which produces the alternation of summer and winter, undergoes a periodic change of direction, so that for each hemisphere perihelion is reached at different periods of the year, the cycle occupying about 25,000 years. An intricate but plausible analysis of climatic conditions indicates that certain cumulative interactions tend to produce glacial conditions in the hemisphere which during a period of high eccentricity has its winter in aphelion, and that the opposite hemisphere will at the same time be characterized by a genial climate, even in polar regions. During each period of high eccentricity glacial conditions should obtain alternately in the two hemispheres, and during low eccentricity they should be closely restricted to polar regions. With the aid of astronomic constants the dates of periods of glaciation have been computed under this theory.

A fourth theory postulates changes in the geographic position of the earth's axis of rotation. This theory also appears quantitatively and qualitatively adequate, but no adequate cause has been discovered for the postulated shifting of the axis.

The first and fourth hypotheses are little discussed, probably because the changes of condition to which they appeal are not known to take place. The second and third, appealing to changes which demonstrably occur, have been elaborately developed, and have given great stimulus to studies of Pleistocene geology.

### Economic Geology.

The arts of civilization are founded on scientific knowledge. To a certain extent that knowledge is acquired with a view to its practical application to needs already felt; to a certain extent it is pursued for the pleasure which discovery yields; to a large extent it is gathered from broad motives of philanthropy, it being believed that in the future the arts will continue to draw upon the world's store of knowledge, and that the value of the draft will be proportioned to the extent and variety of the store. Only a small part of the work of the geologist is directly utilitarian, but the economic applications of geologic knowledge are so vast and they are so dependent upon its general body that the economic importance of the science is generally recognized, and its work has been greatly advanced by governmental endowment. See Surveys, Geological.

Uses have already been found for the greater part of the materials of which geology treats, and it may be predicted that all will eventually be used. Some of these materials are very abundant, and may be obtained at the cost of digging or quarrying. Others are so rare that their discovery involves extensive search, or they occur in deposits so thin that mining is necessary to obtain the desired quantities. Search and exploitation are both directed by knowledge of the geologic relations peculiar to the rare substances, and for this reason special and elaborate studies are made of their mode of origin and laws of distribution.

Of prime importance among mineral substances are the soils. Over the greater part of the earth's surface soils consist of the upper portion of the mantle of disintegrated rock where it is mingled with carbonaceous matter from the decay of plants. Such soils, which are called *sedentary*, correspond in detail with the varieties of rock beneath them, so that the map of the geologist which delineates the outcrops of the formations is at the same time a map of soils. The material of other soils has been transported. *Overplaced* soils occur on hillsides, where the earth slowly creeps downward in consequence of alternations of temperature and moisture. In them the disintegration products of the various rocks of the hillside are mingled. *Alluvial* soils constitute the bottom lands of streams, and are derived from all the rocks of the stream basin. Resulting from the uniform mingling of fragments of many rocks, they are less varied than other soils. *Glacial* soils, resulting from a less thorough mixture of fragments, have more diversity. Soils of glacial till, resulting from mechanical abrasion, are peculiar in that they contain all the original elements of the parent rocks without loss from leaching.

Co-ordinate in importance with the soils of the earth are its waters. The courses of subterranean water are determined by the textures and structures of rock. The substances they bring to the surface in solution give to them qualities which affect their uses, and they are otherwise modified by subterranean temperatures. Questions of supply for agricultural, domestic, and municipal uses, and questions of contamination, are in large part geologic. See Artesian Wells, Irrigation, Thermal Springs, and Water.

Building stone, brick clay, limestone, sand, cement rock, slate, and other materials of construction abound in many localities and are used in vast quantities. Fertilizers, abrasive materials, precious stones, pigments, glass sand, coal, asphaltum, petroleum and natural gas, and salt occasion each a separate industry or group of industries. Each of these and many other mineral products are treated under separate heads.

Compounds of the useful and precious metals occurring in such concentration as to be available for mining are called *ores*. They are all so rare that search is necessary for their discovery, and the greater number are so related to other rocks that much skill and labor must be applied to their successful exploitation and separation. See Ore Deposits, Mines and Mining, and the names of the several metals.

## Geologic Technology.

Geology, like all other objective sciences, is developed through the interaction of observation and theory. Special modes of investigation subordinate to the general method are invented by the geologist as occasion requires. With the progress of the science its data have been classified, and there have thus arisen categories of knowledge to which additions are made by uniform methods. To whatever extent this uniformity obtains, the acquisition of new data becomes an art, and there is thus a body of geologic art subsidiary to geologic science.

*Surveying.*—For many purposes of geological generalization, and especially for the purposes of economic geology, it is important that the attitudes, arrangement, and extent of rock bodies be known. The process of ascertaining these is called geologic surveying. Horizontal relations are exhibited on maps, vertical relations in sections. To obtain the areal data the geologist first ascertains the stratigraphic and other structural elements of his district, and then traces the boundaries of these by direct observation in the field, either marking them at once upon a topographic map or taking such notes as will enable him to do so afterward. Where portions of boundaries are concealed, as by overplaced soils, their position is inferred by considering the geologic structure in relation to topographic configuration. Usually the prominent topographic features are so dependent upon geologic structure as to afford important aid. The instruments and other means of measurement employed in this work do not differ essentially from those of topographic surveying, but are in general simpler. When the boundaries have all been marked out the areas between them represent the surface outcrops of the several formations.

The third dimension, or the vertical element of geologic structure, is determined, first, by observing the dips of strata, the hades of fault planes, and in general the inclination of division planes as seen at the surface; second, by data derived from wells and other excavations or borings; third, by inferences employing certain general principles of structural geology. Dips and hades are usually measured by means of a special instrument called a clinometer. Vertical data and the associated inferences are afterward compiled in structure sections, each of which represents the intersection of the rock mass by a vertical plane. Usually in the delineation of the structure of a region a number of sections are prepared, corresponding to a like number of ideal intersecting planes distributed so as to exhibit the characteristics of different parts of the region.

*Nomenclature.*—Whenever the development of a science involves a large number of particulars requiring separate names, confusion can be avoided only by the adoption of a systematic nomenclature, and this is eventually controlled by a body of conventional regulations. (See Nomenclature.) In geology there are three departments requiring such regulation—petrography, paleontology, and stratigraphy.

That part of petrography which pertains to the clastic formations possesses a nomenclature which, though created largely before the birth of geology as a science, is nevertheless convenient and adequate. Its terms come from many languages and dialects, and have no formal similarity; but they serve to distinguish the rock species dependent on mode of genesis, as well as many varieties dependent on composition.

The igneous and metamorphic rocks, having comparatively few modes of genesis but varying in composition, have proved so difficult of classification that the principles of their nomenclature are not yet fixed. It is believed by some petrographers that there is a limited number of types under which all varieties are naturally grouped, and that these types afford a natural basis for classification and nomenclature. By others it is held that there is a complete gradation between all extremes of composition, whether chemical or mineralogic, and that classification is therefore necessarily arbitrary. See Rocks.

Paleontology, being a comparatively recent addition to the science of biology, has inherited its elaborate system of classification and nomenclature. See Paleontology.

In stratigraphic geology much confusion has arisen from the indefiniteness of the phenomena. Whatever definition be given to a formation, more or less difficulty will be found in its application; and however definite the separation of strata into formations in one region, doubt always arises as to the distance to which the local classification can be carried. Nevertheless, the number of formations is so great that systematic classification is essential to their discussion. When higher units than the formation are considered the difficulty does not diminish, and the attempts to correlate the groups of formations recognized in different districts have led to many discrepancies and controversies. An international congress of geologists, first convened in Paris in 1878, and afterward meeting at Bologna, Berlin, London, Washington, and Berne, has undertaken to establish a system of universal conventions for geologic nomenclature. One of its most important decisions affects the rank to be assigned to the terms employed in stratigraphic and chronologic taxonomy. As each stratigraphic unit corresponds to a portion of geologic time, a series of time terms are made the equivalents of a series of stratigraphic terms, as follows:

| STRATIGRAPHIC TERMS. | TIME TERMS. |
|---|---|
| Group. | Era. |
| System. | Period. |
| Series. | Epoch. |
| Stage. | Age. |

The word *formation* is applied to any stratigraphic unit, large or small, when considered with reference to its mode of origin.

To what extent the discrepancies of nomenclature will be remedied by this congressional action is uncertain; but, notwithstanding the evident convenience of uniformity, the authors employing the English language did not promptly modify their usage. The U. S. Geological Survey, in preparing a scheme for the publication of its geologic maps, adopted the term *period* as defined by the congress; but it selected *formation* instead of stage as the lowest unit of stratigraphic classification. No action was taken by the survey with reference to the other terms of the scheme; but usage in the U. S. is approximately conformable with respect to the terms *era*, *epoch*, and *system*. It departs widely with respect to *group*, making it intermediate in rank between formation and system.

The Geological Survey has further regulated the nomenclature of its maps by providing that each new formation name shall consist of a noun indicative of the kind of rock, and a geographic adjective indicative of a locality where the formation is well exhibited; e. g. *Potsdam sandstone.*

*Map Notation.*—In the publication of geologic maps many notations are employed. Some of these consist of patterns of various kinds, others of colors, and yet others of patterns and colors combined. The most effective maps employ colors only, but when a very large number of formations are to be distinguished on the same sheet colors need to be supplemented by other means; and for an atlas of a large country, for example the U. S., the number of distinctions to be made is entirely beyond the possibility of distinction by color alone, unless the same color be used on different sheets for different things. Most national surveys have therefore employed combinations of colors and patterns. An attempt was made by the geological congress to establish a universal map notation, but great diversity of opinion was encountered and the attempt was finally aban-

doned. The U. S. Geological Survey has adopted for its own use a notation in which four kinds of patterns are employed severally for the fossiliferous clastic rocks, Pleistocene rocks, igneous rocks, and crystalline schists. Within each group all colors are employed, and for the fossiliferous clastics a color is assigned to each period, the arrangement of colors following the order of the spectrum. The accompanying geologic map of the U. S. exhibits the selected period colors.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PETROGRAPHY.—Iddings's *Origin of Igneous Rocks* (Phil. Soc. Washington, *Bull.*, vol. xii., pp. 89–214, 1892); Merrill's *Stones for Building and Decoration* (1891); Teall's *British Petrography* (1888); Rosenbusch's *Mikroskopische Physiographie der Mineralien u. Gesteine* (1877); Rutley's *Study of Rocks* (1881); Zirkel's *Lehrbuch der Petrographie* (1893).

HISTORIC GEOLOGY.—For lists of paleontologic works, see PALEONTOLOGY, VERTEBRATES (Fossil), FOSSIL INVERTEBRATES, and PLANTS (Fossil). Works devoted to the stratigraphy of districts and problems of correlation constitute the great body of geologic literature. For North America they are largely contained in the official reports of the State surveys and of the national surveys of the U. S. and Canada. They are briefly summarized in the manuals above, and the principles of stratigraphy are discussed in a series of bulletins by the U. S. Geological Survey on the American formations of the various periods (*Bulletins 80* to *86*, U. S. G. S.). *The Present Standing of the Several Hypotheses as to the Cause of the Glacial Period* is given by Chamberlin in *The American Geol.* (vol. viii., p. 137, 1891), and a paper by the same author, entitled *Rock-scorings of the Great Ice Invasions*, may be found in the *Seventh Annual Report* of the U. S. Geological Survey (p. 147, 1888); Croll's *Climate and Cosmology* (1885); Croll's *Climate and Time* (1875); King's *The Age of the Earth* (*Am. Jour. Sci.*, 3d ser., vol. xlv., pp. 1–20, 1893); McGee's *Comparative Chronology* (*Am. Anthropologist*, vol. v., No. 4, 1892); Reade's *Measurement of Geologic Time* (*Geol. Magazine*, Dec. 3, vol. x., No. 343, 1893); Upham's *Estimates of Geologic Time* (*Am. Jour. Sci.*, 3d ser., vol. xlv., pp. 209–220); Upham's *On the Cause of the Glacial Period* (*Am. Geologist*, vol. vi., No. 6, 1890).

ECONOMIC GEOLOGY.—Fremy's *Encyclopédie Chemique*; Fuchs and de Launay's *Traité des Gîtes mineraux et métallifères* (1893); Kemp's *Ore Deposits of the United States* (1893); Patton's *Natural Resources of the United States* (1888); Phillips's *Ore Deposits* (1884); Whitney's *Auriferous Gravels of the Sierra Nevada of California* (1880); *Transactions of the American Institute of Mining Engineers*, from 1871. Much is also contained in the reports of the various State geological surveys, in the reports of the U. S. census for 1879 and 1889, and in the reports of the U. S. Geological Survey. Among the latter are *Mineral Resources*, beginning with 1882; Becker's *Geology of the Comstock Lode* (1882); Curtis's *Silver-lead Deposits of Eureka* (1884); Chamberlin's *Requisite and Qualifying Conditions of Artesian Wells* (1884); Emmons's *Geology and Mining Industry of Leadville* (1886); and Becker's *Quicksilver Deposits of the Pacific Slope* (1888).

GEOLOGIC TECHNOLOGY.—*Tenth Annual Report*, U. S. G. S., pp. 56–79 (1890); *Proceedings of the International Congress of Geologists*: Paris (1878), Boulogne (1881), Berlin (1885), London (1888), Washington (1891). G. K. GILBERT.


**Geometrical Mean**: the second of three continued proportionals, or the second of the terms of a geometrical progression containing three terms. The geometrical mean of two numbers is equal to the square root of their product. If we assume two terms, and insert any number of terms, so that the whole forms a geometrical progression, all the inserted terms are called geometrical means to these two.

**Geometrical Progression**: a series of numbers, each one of which is the product of the preceding one multiplied by a common and constant ratio. A geometrical progression may be increasing or decreasing, according as the constant ratio is greater or less than unity.

**Geometry** [from O. Fr. *geometrie* < Lat. *geometria*; from Gr. γεωμετρία, geometry; deriv. of γεωμέτρης, geometer, land-measurer; γῆ, earth, land + μέτρον, measure]: that branch of mathematics which investigates the general laws of space or the laws governing the relation of bodies in space. In the familiar form taught in academies it has come down from the most ancient times. So perfectly were its first principles developed by Euclid that they are still taught in substantially the same form in which that writer presented them more than 2,000 years ago. In the present article some general idea will be given of its branches, its methods, and its history.

What distinguishes geometry from the physical sciences is that its conclusions are based entirely on abstract reasoning. Nothing is assumed but those necessary laws of space which are evident to every thinking mind, and those conceptions which are derived in earliest infancy from the observation of material bodies. For example, the Pythagorean proposition that the sum of the squares described on the sides of a right triangle is equal to the square described on the hypothenuse was not derived by measurement, but by reasoning upon the properties of these three squares. In conducting such reasoning it is conceived that geometrical figures can be moved about like material objects without changing their size or form. Equality is proved, in the first place, by showing that two figures must coincide in every part. There is no way of proving two figures equal except by an operation which is equivalent to showing that one or both may be so divided into parts that each part of the one may coincide with a separate part of the other. What is peculiar in geometry is that this operation is not performed by actually cutting bodies to pieces and fitting them together, but by supposing them cut to pieces and showing how they would fit or coincide. It would not be possible to bring two material cubes or actual masses of matter into coincidence because of their mutual impenetrability, but in thought there is no difficulty in doing so and supposing that each corner and side of the one coincides with a corner and side of the other.

The subject of geometry has been so extended that a classification of the various systems on which the subject may be treated is necessary. In this classification what is sometimes called the *metrical* or *Euclidean geometry* comes first. Under this system the fundamental idea is that of measurement, or of comparison of magnitudes with respect to their equalities or ratios. Thus a circle is considered as a portion of a plane, bounded by a line, every part of which is equally distant from the center. It is what in ordinary language we might call a circular disk. A straight line is considered as having two ends, and the main quality with which the reader is concerned is its length. Solids are considered as portions of space completely separated from all other parts of space by their bounding surfaces, and the propositions concerning them relate principally to the relations of their volumes.

This method of considering geometrical figures as quantities to be measured imposes restrictions on the conceptions which are not conducive to the development of the subject. Hence from ancient times another set of ideas has come down to us with which the name of Apollonius is associated as the name Euclid is associated with metric geometry. In its present form this system is variously known as

*graphic* or *projective* geometry. On this system geometrieal figures are not so mueh quantities to be measured as objects whose properties are to be investigated. A straight line is eonsidered as going out without end in either direction. A portion of sueh a line bounded by two ends is considered simply as a part of the infinite line from whieh it is cut out. This geometry is largely oeeupied with the anharmonic ratios of points in a straight line or of straight lines passing through a point. The properties with which it is concerned are ealled projeetive, beeause if the figure whieh they eoneern is projeeted on a plane (as by easting its shadow from a luminous point) its properties are thereby unaltered. For example, if two curves are tangent to eaeh other, their projections will also be tangent to each other; if four points are in a straight line so are their projeetions; and the latter have the same anharmonic ratio as the points themselves. Cireles are not considered as portions of a plane, but are defined wholly by their bounding eircumferenees. A quadrilateral eonsists of four indefinite lines, no three of which pass through the same point; henee it has six vertiees instead of four. Instead of two diagonals, as in the Euclidean geometry, the quadrilateral of the graphie geometry has three, each line joining the points of interseetion of any two pairs of sides.

In colleges the term *analytic geometry* is frequently used as if it were a separate kind of geometry. This, however, is not so much a new development of geometry as a different method of teaehing or investigating the subjeet. Geometry treated by the methods of Euclid and Apollonius is ealled synthetic, in opposition to this analytic geometry, where the mode of reasoning is algebraie. But the synthetie and analytie methods ean be applied to either of the two braneheS, and, as a matter of faet, the subject may be taught in both ways, sometimes one method and sometimes the other being found best.

Both metrie and graphie geometry are founded on familiar coneeptions of spaee; but during the nineteenth century a further extension has been made, sometimes known as hypergeometry and sometimes as non-Euelidean geometry. The term hypergeometry is generally applied to that system in which spaee is assumed to have more than three dimensions. Notwithstanding the inconceivable charaeter of this hypothesis, the reasonings upon it may be eonduеted with entire rigor. The idea on which it proceeds may be explained in this way: The beginner is first eoncerned with plane geometry, in which he considers figures which lie in the same plane. They have length and breadth, but no thiekness. It is therefore ealled a geometry of two dimensions. But when he passes to solid geometry, a third dimension in spaee is recognized and new possibilities arise. For example, in a plane, two lines whieh are not parallel will neeessarily intersect if eontinued far enough, but in space they need not interseet beeause one might pass above or below the other. In a plane only a single line ean be drawn which shall be perpendieular to another line at a given point. But in space any number of sueh perpendieulars ean be drawn, some passing above the plane and some below it. The only restriction upon these perpendiculars is that they will all lie in one plane perpendicular to the given line. Now four dimensional geometry may be eoneeived to start from this question: Suppose spaee had four dimensions instead of only three, then what further extension would be made to geometrical theorems and possibilities?

One result would be that four straight lines eould pass through a given point, eaeh of which would be perpendicular to the other three. Solids eould be turned inside out without tearing them. A knot in an endless rope could be untied without passing the ends through it. A world of possibilities of the most extraordinary kind would be brought to light. So far as relations to the aetual universe are concerned, this system of geometry is a pure fancy; yet it is useful in assisting the language and conceptions of eertain braneheS of the higher mathematics.

The term non-Euclidean geometry is generally applied to those systems in which the famous Euclidean axiom of parallels is no longer supposed true. The axiom in question is sometimes expressed by saying that through any point in a plane one line may be drawn which shall be parallel to a given straight line, and therefore never interseet it, while any other line through the point will necessarily intersect it if eontinued far enough. It has long appeared that this axiom ought to be proved rather than assumed, and innumerable attempts have been made to supply a satisfactory proof. Every one of them, however, is found to rest upon some assumption whieh is equivalent to basing the reasoning upon its own eonclusion. The fallaey of all these attempts suggested to Lobatsehevsky the question whether it was not possible to eonstruet a system of geometry in which this axiom should not be true, in whieh, in fact, several straight lines might lie in one plane and neither intersect nor be parallel. He showed that the system was quite possible, and in perfeet aecord with reasoning in every other point. In this system the sum of the three angles of a triangle is less than two right angles, the amount of the defieiency increasing with the area of the triangle. When Lobatschevsky's conelusions were studied it was found that the opposite hypothesis might equally be made, namely, that the sum of the three angles of a plane triangle should exeeed two right angles; then any two lines in a plane, even though parallel in starting, would ultimately intersect. A straight line would return into itself just as a eirele around a sphere does. Paradoxieal though this appears, no formal disproof of it ean be construeted. True, it seems contradictory to one's eoneeptions, but the solution of the question may be imagined by supposing animals living on the surface of an immeuse sphere like the earth without any idea of a space either outside the sphere or within it. These animals would be unconseious of living on a eurved surfaee and would suppose themselves upon a plane. Their geometry would be our ordinary plane geometry; yet were they to attempt to eontinue their straight lines forever they would ultimately pass around the sphere and so return into themselves. In this system spaee is not absolutely infinite, but ineludes only a certain number of cubic miles. Faneiful though the idea is there is no way of absolutely disproving it. This eonsideration has led to different new and valuable ideas of the relations of ordinary graphie and metrie geometry. As a thing is never thoroughly understood until it is compared with things outside of itself, so a eomplete eonception of ordinary geometry is found only by eomparing it with what it would be were the spaee in which we live restricted as it is by Euclid's axiom of parallels.

*History of Geometry.*—The following sketeh of the history of geometry has been eompiled, mostly from Rouché and de Comberousse. Ideas of form and extension are as old as the human race, but the first attempts to co-ordinate and systematize them were made by the Egyptians and Chaldæans. Geometry, as a seienee, was introduced into Greece by Thales of Miletus (637–548 B. C.); he founded the Ionian sehool, and is said to have demonstrated many propositions whieh were afterward ineorporated with Euelid's *Elements*. It was Thales who diseovered the properties of similar triangles. Pythagoras of Samos, a diseiple of Thales (580 B. C.), founded in Italy the celebrated school which bore his name. He demonstrated the relation between the three sides of a right-angled triangle, and showed that the eircle contains a greater area than any plane figure having the same perimeter, and that the sphere contains the greatest volume bounded by a given surface. He also investigated the properties of regular polyhedrons, and established those relations whieh formed so eonspieuous an element in the cosmogonies of the Middle Ages. Plato (430–347 B. C.) laid the foundatiou of the analytieal method; he investigated the nature of the eonic seetions and developed the fundamental prineiples of geometrical loci. It was in the sehool which he established that the noted problems of the *duplication of the cube* and the *trisection of an angle* were first diseussed. It is said that Plato himself gave a solution of the first of these problems. Euelid, who belonged to the famous school of Alexandria, flourished about the year 285 B. C. He wrote on various mathematical subjeets, but he is especially noted as the author of the *Elements of Geometry*, in whieh he colleeted and systematized all the truths and principles of elementary geometry that were known before his time, and to whieh he added many new ones. It is in Euclid's *Elements* that the method of proof known as the *reductio ad absurdum* first appears. Many of his works have been lost, the most important of which is his treatise on porisms. His *Elements of Geometry* have been translated into all eivilized tongues, and to the present day form a favorite text-book for elementary instruetion. Immediately after Euclid eame Arehimedes and Apollonius, two of the most distinguished geometers of the most brilliant era of the Alexandrian school. The attention of Archimedes (287–212 B. C.) was speeially directed to metrical geometry. He determined the ratio of the diameter of a eirele to its eireumferenee, and also investigated the areas of the circle and parabola. He diseussed the properties of spirals, the relation of the sphere to its

circumscribed cylinder, and the cubature of spheroids and conoids. The writings of Apollonius (287 B. C.) relate to the geometry of form. He composed a treatise on conic sections in which he developed the properties of asymptotes, foci, conjugate diameters, and normals. He also wrote on the subject of maxima and minima, and was the author of the theory of cycles and epicycles, which was employed for so long a time in explaining the apparent motion of the bodies of the solar system. The successors of Archimedes and Apollonius directed their studies toward those branches of geometry which have a particular bearing on the science of astronomy. Hipparchus (150 B. C.) discovered the method of projecting the sphere stereographically, also the properties of transversals in both rectilineal and spherical triangles. Pappus discovered the principle of the theorem now known as Guldin's; he also discovered the fundamental principle of the anharmonic relation and the properties of a hexagon inscribed in a conic section. The school of Alexandria was destroyed when that city was taken by the Arabs about 640 A. D. During the following centuries there sprung up in the school of Bagdad a few able commentators on those writings of the Greeks that had escaped the disasters incident to the Arabian conquest, but throughout the rest of the world a profound stagnation took place, which remained unbroken for nearly 1,000 years, and clearly marked the line of division between ancient and modern geometry. The ancients were in full possession of the two great methods, geometrical synthesis and geometrical analysis, and by their aid "they built up a grand and symmetrical fabric of geometrical truth, which certainly may contest the palm with the achievements of any age, and whose positive value has only been surpassed by the acquisitions of our own." It was not till the middle of the sixteenth century that geometry showed any signs of revival. Vieta (1540–1603) developed the science of symbolical algebra, and applied it to the solution of problems in geometry. He constructed graphically the roots of equations of the second and third degrees, and was the first to solve the problem of drawing a circle tangent to three given circles. In the writings of Kepler (1571–1631) and of Fermat (1570–1633) are found the first germs of the method of infinitesimals. Pascal (1623–62) and Desargues (1593–1663) extended and improved the ancient methods of geometrical analysis, and laid the foundation of that new geometry which received such a wonderful development during the nineteenth century. The ancients studied the properties of conic sections on the cone itself, and often made use of tedious demonstrations, differing in method for each of the three classes of curves. Desargues, whom Poncelet calls the Monge of his age, generalized the methods of investigation, and by an extension of the properties of the circle which forms the base of the cone he reached demonstrations that were equally applicable to all of the classes.

Descartes (b. in 1586, d. in 1650) created the science of analytical geometry, which produced a complete revolution in the method of geometrical investigation, and for a time checked the progress of pure geometry. A few eminent writers, among whom may be named Huyghens and La Hire, resisted the change, and worthily sustained the character of the ancient methods. The discovery and development of the infinitesimal calculus by Newton and Leibnitz gave an additional check to the progress of pure geometry. The ease with which this new branch of mathematics could be applied to geometrical investigation and the study of natural phenomena caused it to absorb almost exclusively the labors of the most illustrious geometers of the age. There were, however, a few exceptions. Newton showed in the *Principia* that the ancient methods could be employed in researches of the highest order. Cotes and Maclaurin applied their methods to the study of geometric curves. Halley and Simpson also strove to revive a taste for the ancient geometry, but no decided advance was made till the time of Monge and Carnot. At the beginning of the nineteenth century the creation of descriptive geometry by Monge marked a new era. This new science was of immense assistance in studying the properties of bodies. It showed the intimate relation between plane figures and figures in space, and at once enriched the science of geometry by many new and elegant methods of investigation; by permitting the deduction of properties of figures of three dimensions from those of two dimensions, it contributed in no small degree to the revival of pure geometry. The appearance of Carnot's *Geometry of Position* and his essay on transversals still further directed the attention of mathematicians to the possibility of obtaining, by the principles of pure geometry, all the results that had been reached by the analytical methods of Descartes. To the labors of Carnot and Monge must be added those of Poncelet, who, in his treatise on the properties of projections of figures, was able, by a skillful employment of the principle of continuity and the beautiful theories of reciprocal polars and of homological figures, to deduce all the known properties of lines and surfaces of the second order. Passing over numerous writers on the recent geometry, mention must be made of Chasles, whose great works are his higher geometry, his treatise on porisms, and his memoir on duality and homography. These developments of the recent geometry are a continuation of the methods of geometrical analysis of the ancients, as revived by Pascal and Desargues, but they possess an immense advantage over those methods in their generality and systematic uniformity of proceeding. See MATHEMATICS.

Revised by S. NEWCOMB.

**Geometry, Descriptive**: a branch of practical mathematics, the object of which is to obtain representations on plane surfaces of accurately defined bodies in space, for the investigation of their metrical as well as descriptive properties. It differs from ordinary perspective, inasmuch as by the latter method the actual dimensions of a body can not be ascertained from its representation. In descriptive geometry points in space are represented by their orthographical projections on two planes at right angles to each other, called the planes of projection. It is usual to suppose one of the planes of projection to be horizontal, in which case the other is vertical; and the projections are called horizontal or vertical according as they are on the one or the other of these planes. Any curve in space will be represented by two curves in the horizontal and vertical planes, and a curved surface by the corresponding representations of certain points and curves on that surface. Thus a plane would be completely defined by its intersections with the planes of projection. The intersections of a line or surface with the planes of projection are called its traces. Again, a sphere may be represented by the projections of its horizontal (or vertical) great circle; a cylindrical surface by its trace on one of the planes of projection, and the projection of any generator on the other; a cone by the projections of its vertex, and by one of its traces, etc. Although applicable to sculpture and all mechanical arts, it is especially useful to civil and military engineering. Among the best works on the subject are those of Monge, Hachette, Lacroix, and Leroy.

**Geo'mori** (in Gr. γεωμόροι): one of the three classes into which the Athenian citizens were divided: the Eupatridæ (= the city nobility), the Geomori (= the country nobility), and the Demiurgi (= the mechanics). That the term refers to the country nobility and not to the peasants is clear from the fact that, in Samos and Syracuse the term γάμοροι was certainly applied to the country aristocracy. See C. Wachsmuth, *De tribuum quattuor atticarum triplici partitione* (Kiel, 1825); Haase, *Die athenische Stammverfassung* (Breslau, 1858); Gilbert, *Die altattische Komenverfassung* (Leipzig, 1872); Sauppe, *De phratriis atticis commentatio* (parts i. and ii., Göttingen, 1886 and 1890); Toepffer, *Attische genealogie* (Berlin, 1889); Schoell, *Die kleisthenischen Phratrien* (Munich, 1890). J. R. S. STERRETT.

**Geoph'agism**, or **Dirt-eating** [*geophagism* is from Gr. γῆ, earth + φαγεῖν, eat]: a habit of earth eating which prevails among the people of certain uncivilized nations. The Ottomacs of South America eat upon an average, it is said, a pound and a half of ferruginous clay daily. Clay for eating is a regular article of merchandise in Bolivia; and the Negroes and lower classes of whites in some parts of the U. S. have a similar practice. In Lapland and Northern Scandinavia bergmehl is mixed with flour in making bread, but it is by no means unlikely that the diatoms it contains are nutritious to some extent. From Lollhagysyön alone hundreds of cartloads of bergmehl are sold yearly. Dirt-eating is a common habit among the West Indian blacks, and in the Hudson's Bay country among the Indians, where a soft steatite is eaten, probably to allay hunger. Dirt-eating is also one of the forms of the *pica*, *malacia*, or depraved appetite, common among chlorotic young women, in whom it is not improbable that some stomachic uneasiness of local or reflex origin may be relieved by it.

Revised by WILLIAM PEPPER.

**George**, SAINT: patron of England since 1348; reputed to have been born in Palestine in the third century. Ac-

cording to the legend, he became a prince in Cappadocia. He was a Christian, and suffered martyrdom at Nicomedia in 303, some say Apr. 23, for having torn down the edict of Diocletian against Christians, the emperor himself being then in the city. St. George is venerated in the Eastern and Latin Churches, and even by the Mohammedans is regarded with great reverence. He is distinguished for his exploit of rescuing a king's daughter from a dragon; but this story is a mediæval invention. He is sometimes identified with George of Cappadocia, a fuller, who in 361 was killed by the pagans. But authorities decide that they are not identical.

**George I.**: the first Hanoverian King of Great Britain; b. at Osnabrück, May 28, 1660; was the son of Ernst August, Elector of Hanover, and great-grandson, on his mother's side, of James I. of England. In 1682 he married his cousin, known as Sophia of Celle, from whom in 1694 he was divorced on account of her adulterous intrigue with Philip, Count Königsmark. In 1698 he became elector; served against the Danes and Swedes 1700; and held a high command in the war of the Spanish succession 1701–09; succeeded Anne as sovereign of Great Britain in 1714 in consequence of the exclusion of the Stuarts; was never popular in England, which he in turn disliked, although he served British interests faithfully and with more than ordinary ability; but his private character was thoroughly bad. Memorable events of his reign were the first Jacobite rebellion (1715–16); the failure of the South Sea Company (1720); the restoration of the Order of the Bath (1725); the Spanish war of 1726. D. near Osnabrück, June 10, 1727.

**George II.**: King of Great Britain; b. at Hanover, Oct. 30, 1683; was throughout life an object of dislike to his father, in consequence of which his education was slighted, and his intellect, not naturally brilliant, suffered from this neglect; married in 1705 the Princess Wilhelmina Carolina of Brandenburg-Anspach, whose remarkable abilities for many years made good the defects of her husband; fought with conspicuous valor at Oudenarde 1708; succeeded his father in 1727. His reign was singularly adorned by men great in art, letters, war, and diplomacy. The king's fondness for war led him to take command at the battle of Dettingen (1743), where he won a victory in spite of tactical blunders. Other great events of his reign were the battle of Minden 1739; of Fontenoy 1745; the second Stuart invasion 1745–46; the wars of Clive in India; and the conquest of Canada. The king was a man of obstinate temper, and was far more fond of Hanover than of Great Britain, where he was personally unpopular, but he advocated liberal measures, by means of which the country made great material and industrial progress. D. at Kensington, Oct. 25, 1760.

**George III.**: King of Great Britain; son of Frederick, Prince of Wales; b. in London, June 4, 1738; succeeded his grandfather, George II., in 1760. He was the first Hanoverian king who had a British education and a deep regard for his country, but his patriotism proved a far worse thing for his subjects than the neglect and open dislike shown by his predecessors. He was a man of conscientious principles, and felt a high regard for religion and morals, which contrasted strangely with the lewdness of the two preceding as well as the two succeeding monarchs, but this was neutralized by his intellectual sluggishness, his blind obstinacy and craft, his revengeful and implacable hostility to those who opposed his reactionary policy, and his equally blind partiality to his political friends. The annals of his reign of sixty years, the longest in English history, are replete with great events, among which are the Spanish war of 1762–63; the Wilkes controversy 1762–82; the passage of the American Stamp Act 1765; the publication of the Junius letters 1769–72; the American Revolution 1775–83; the Fox and North coalition 1783; the French Revolution 1789, *seq.*; the Irish Rebellion 1798; and the Napoleonic wars. (See NAPOLEON I.) The king's mind was naturally infirm, and in 1810 a fifth attack of insanity came on and proved incurable. Blindness also supervened, and in 1811 the Prince of Wales became regent. The Tory foreign policy of the king was continued until Napoleon's power was finally crushed. D. at Windsor, Jan. 29, 1820. His reign is memorable for great literary and industrial activity.

**George IV.**: King of Great Britain; b. in St. James's Palace, London, Aug. 12, 1762; received a careful training, but became early conspicuous for his loose habits. In 1781 joined the Whig opposition to his father's public policy; in 1791, in consequence of misconduct on the turf, he got into trouble with his Whig friends, and then became, and ever after remained, a Tory; married Caroline Amelia of Brunswick 1795, and in 1796 separated from her on the ground of her supposed adultery, for which she was, however, not brought to trial until 1820, and was then acquitted. In 1811 George became regent, and in 1820 king. The wars with Napoleon, that of 1812–15 in the U. S., the Roman Catholic emancipation, the conquest of Aracan, and the Tenasserim provinces, the slow but healthy advance of liberal ideas in Great Britain, so vigorously and constantly opposed by able Tory leaders, and, above all, the progress of the physical sciences, pure and applied, in England, make the reign of George IV. one of the most interesting periods of British history. See Thackeray's *Four Georges* (1860); *The Greville Memoirs* (1874). D. at Windsor, June 26, 1830.—Princess Charlotte Augusta, his only child by his wife, Queen Caroline, and greatly beloved by the English people, was married in 1816 to Leopold of Saxe-Coburg, afterward King of the Belgians, and died in the following year.

**George V.**: ex-King of Hanover. See CUMBERLAND AND TEVIOTDALE, DUKE OF.

**George I.**: King of Greece, with the title "King of the Hellenes"; b. at Copenhagen, Dec. 24, 1845; second son of Christian IX., King of Denmark. In 1863 he accepted the offer of the crown, King Otho having been deposed. In 1867 he married Olga Constantinovna, daughter of the Grand Duke Constantine of Russia. His children are bred in the Greek faith, but the king is a Lutheran.

**George**, HENRY: political economist; b. in Philadelphia, Pa., Sept. 2, 1839; attended the public schools until 1853; went then into a counting-house, learned to set type, became a sailor, and went to California in 1858. After working at the case for some years he became first a reporter and afterward the editor of the San Francisco *Times*, and was in 1876 appointed State inspector of gas-meters for California, but moved in 1880 to New York. In 1880–81 he visited the United Kingdom, and soon became widely known as a writer and lecturer on subjects of political economy and social reform. Among his publications are *Our Land and Land Policy* (1871); *Progress and Poverty* (1879); *The Irish Land Question* (1881); *Social Problems* (1884); *Protection or Free Trade* (1886). He was nominated by the Central Labor convention, Sept. 23, 1886, for mayor of New York, but was defeated in the election. He was again candidate for mayor of New York in 1897, but died Oct. 29, a few days before the election.

**George**, JAMES ZACHARIAH: U. S. Senator; b. in Monroe co., Ga., Oct. 20, 1826; educated in the common schools; served as private in the Mexican war; on his return studied law; reporter of the high court of errors and appeals 1854–64; voted for the ordinance of secession in Mississippi 1861; colonel and brigadier-general in Confederate army 1861–65; chief justice of Supreme Court of Mississippi 1879–81; elected to the Senate as Democrat from Mississippi in 1880; re-elected 1886 and 1892. D. at Mississippi City, Miss., Aug. 14, 1897. C. H. T.

**George, Lake**: a beautiful sheet of water in the State of New York, extending N. N. E. and S. S. W., and having Warren County on the N. W. and Washington County on the greater part of its S. E. border. Its length is 36 miles; its breadth, from 1 to 3 miles. Lake George was the scene of important military operations during the French and Indian war of 1755–59. Here stood Fort George, Fort William Henry, and other works. The lake is 310 feet above tide. Its outlet flows into Lake Champlain. The lake contains some 300 islands. Its waters are clear, and are in some places 400 feet deep. Steamboats ply upon it in summer. It is sometimes called Lake Horicon, but its Indian name was Caniaderioit.

**Georges**, KARL ERNST: Latin lexicographer; b. in Gotha, Germany, Dec. 26, 1806. Studied classical philology in Göttingen and Leipzig from 1826–29. His *Latin-German Dictionary* (4 vols., 10 edit., 1882), while not aiming at the completeness of a thesaurus, is the most reliable and scientific work on Latin lexicography published up to date (1893). He is also the author of a *German-Latin Lexicon* (2 vols., 1882, 7 edit.) and a very valuable *Wörterbuch der latein. Wortformen* (1891). ALFRED GUDEMAN.

**Georgetown** (commonly called **Demerara**): capital and chief town and port of British Guiana; on the right bank of the Demerara river, a mile above its mouth (see map of

South America, ref. 2–E). The Demerara at this point is a mile wide, and forms an excellent harbor, but the bar only admits vessels of 10 feet draught. The city is built on low and flat land; it is well laid out, with wide streets, but most of the houses are of wood. The water-supply is poor and the inhabitants are largely dependent on cisterns, supplemented by artesian wells. Mean temperature, about 89° F., varying little with the seasons. Formerly yellow fever was endemic here, but the place is now fairly healthful. There is an active trade, nearly all the foreign commerce of the colony being carried on through this port. A railway runs to Mahaica and Berbice. Georgetown was founded in 1774 by the Dutch, who called it Stabroek. Pop. (1891) 53,176.
HERBERT H. SMITH.

**Georgetown**: a prosperous town and port of Prince Edward Island; on the eastern coast; 39 miles by rail from Charlottetown (see map of Quebec, ref. 1–C). It is the best winter port of the island, and has a large shipping trade in agricultural produce. Pop. 1,200.

**Georgetown**: village; Equessing township, Halton County, Ontario, Canada (for location, see map of Ontario, ref. 4–D); on Credit river and the Grand Trunk Railway; 30 miles N.W. of Toronto. It has excellent water-power, paper-mills, knitting and woolen factories, knitting-machine works, and other industries, and contains 7 churches, 1 bank, public, high, and grammar schools, town-hall, fine stores, and many handsome residences. Pop. (1881) 1,473; (1891) 1,509; with suburbs, 2,100.
EDITOR OF "HERALD."

**Georgetown**: town; capital of Clear Creek co., Col. (for location of county, see map of Colorado, ref. 3–D; on Clear Creek and the Union Pacific Railway; in a beautiful valley in the heart of the Rocky Mountains; 52 miles W. of Denver. It is the center of the great silver region, and has four sampling-mills. There are several public parks, gas, water, and electric-light plants, 5 churches, public and parochial schools, Roman Catholic hospital, 2 banks, and 2 weekly newspapers. Pop. precinct (1880) 3,294; (1890) 4,083; town (1900) 1,418.
EDITOR OF "COLORADO MINER."

**Georgetown**: town; capital of Sussex co., Del. (for location of county, see map of Delaware, ref. 6–N); on the Phila., Wil. and Balt. Railroad; 40 miles S. of Dover. It has several churches and graded schools, a bank, and 3 weekly newspapers, and is principally engaged in the canning industry. Pop. (1880) 895; (1890) 1,353; (1900) 1,658.

**Georgetown**, D. C.: See WASHINGTON, D. C.

**Georgetown**: town; capital of Scott co., Ky. (for location of county, see map of Kentucky, ref. 3–H); on North Elkhorn creek and on the Ky. Mid. Railway, the Louisville S. Railroad, and the Queen and C. Route; 12 miles N. of Lexington, 20 miles E. of Frankfort. It is in the heart of the "blue-grass country," and is the center of large farming and stock-raising interests. It is the seat of Georgetown College (Baptist, organized 1838) and of the Georgetown Female Seminary, and has excellent water-power, several private schools, 3 banks, and 3 weekly newspapers. Pop. (1880) 2,061; (1890) not separately returned; (1900) 3,823.

**Georgetown**: village; capital of Brown co., O. (for location of county, see map of Ohio, ref. 8–D); on White Oak creek and the Cin., Georgetown and Portsmouth Railroad; 7 miles N. of the Ohio river, 42 miles E. of Cincinnati. It is in an agricultural and blue limestone region, and tobacco-raising is an important industry. It has 4 churches, fine court-house, woolen-factory, steam flour-mill, 1 bank, and 2 weekly newspapers. Pop. (1880) 1,293; (1890) 1,473; (1900) 1,529.
EDITOR OF "NEWS-DEMOCRAT."

**Georgetown**: town; capital of Georgetown co., S. C. (for location of county, see map of South Carolina, ref. 6–G); on Winyaw Bay, at the mouth of the Waccamaw river, and on the Georgetown and West. Railroad; 50 miles N. E. of Charleston. It is a port of entry, with direct water communication with New York; contains several lumber-mills, rice-mills, and turpentine distilleries, and has a large export trade in rice, pine lumber, and turpentine. It has one bank and a weekly newspaper. Pop. (1890) 2,895; (1900) 4,138.

**Georgetown**: town; capital of Williamson co., Tex. (for location of county, see map of Texas, ref. 4–H); on the San Gabriel river, here spanned by a handsome suspension bridge, and on the International and Great Northern Railroad; 25 miles N. of Austin. It is in an agricultural region; has manufactories of furniture, saddles and harness, plows, ice, all kinds of woodwork for building purposes; and contains 3 hotels, 2 banks, and 2 weekly newspapers. It is the seat of Southwestern University, which has the patronage of the five annual conferences in Texas of the Methodist Episcopal Church South, and an annual attendance of students of 600; and the Texas Chautauqua Assembly is established on the other side of the river. Pop. (1890) 2,447; (1900) 2,790.

**Georgetown College**: See the Appendix.

**Georgetown University**: an institution of learning at Georgetown, D. C.; founded in 1788, when the first building was begun; classes opened in 1792; chartered by Congress as a university 1815; astronomical observatory erected in 1845; medical department organized 1851; law department 1870. Other buildings were added from time to time, chief among them the new stone college building, 317 feet long, begun in 1878, the new law school 1891, the Riggs Library 1890, and the Dahlgren Memorial Chapel 1892. Students can enter the preparatory department at any age, though young children are not admitted, and no previous scholastic attainments are required beyond the mere rudiments of knowledge. The applicant is examined, and placed in the class for which he is fitted by his previous course of study. For those who begin at the lowest point a seven years' course is required; this term may be shortened by extraordinary diligence or proficiency, but promotions are rarely made except at the close of the scholastic year. Rewards are distributed in medals or books, or by honorable mention, at the close of the year. No distinction is made in the reception of students on the ground of religious belief. The schools of law and medicine are conducted in Washington. Lectures are given in the evening in these schools, which enables clerks in the employ of the Government and other persons engaged during the day to avail themselves of the study of law or medicine. The university is, and always has been, directed by the Jesuits. It is supported by tuition fees.

**Georgia**, jōr'ji-a [by false association with *Georgia*, a state, and *George*, from Pers. *Gurj*, *Gurjistān*, Georgia; native name is *Karthveli*, Russian *Grusia*]: formerly a kingdom, comprising the territory S. of the Caucasian mountains, between the Black and the Caspian Seas, and bounded S. by Asiatic Turkey and Persia; now divided into the Russian governments of Tiflis, Kutais, Elizabethpol, Baku, and Erivan. After the death of Alexander the Great the Georgians succeeded in establishing themselves as an independent people with a government of their own; and although they were conquered and made tributary several times by the Arabian caliphs, by Timur, and by Persia, they maintained a political position as a state until the beginning of the nineteenth century, when Georgia was merged into the Russian empire. Early in the fourth century (318 A. D.) the Georgians were converted to Christianity, but at present many are Mohammedans. Their language forms a very interesting intermediate link between the Indo-European languages and the monosyllabic tongues of Eastern Asia. (See GEORGIAN LANGUAGE AND LITERATURE.) Georgian women are celebrated for personal beauty.

**Georgia** (so named in honor of George I. of England): one of the South Atlantic States, and one of the original thirteen (see map of Georgia), lying between 30° 20′ and 35° N. lat. and 80° 48′ and 85° 38′ W. lon.; bounded N. by North Carolina and Tennessee, E. by South Carolina and the Atlantic, S. by Florida, and W. by Florida and Alabama; extreme length from N. to S., 320 miles; extreme breadth from E. to W., 254 miles; area, 59,475 sq. miles, or 38,064,000 acres. According to the census of 1900, Georgia ranks twelfth among the States in population, fourth in value of marble products, sixth in value of granite, and eleventh in iron.

*Topography—Mountains, Rivers, etc.*—Georgia is well watered. Of the rivers running to the Atlantic the principal are the Savannah, forming the boundary between Georgia and South Carolina, and its affluents; the Ogeechee and Cannouchee; the Altamaha, formed by junction of Oconee and Ocmulgee, and their affluents, Little Ocmulgee and Appalachee; the Satilla and St. Mary's (between which is the great Okefenokee swamp) drain the S.E. The Withlacoochee and Allapaha, uniting in Florida to form the Suwannee, the Ochlochonee, and the Flint and Chattahoochee, uniting at the Florida line to form the Appalachicola, are the principal rivers flowing directly into the Gulf. There are also in the N. W. large affluents of the Alabama, the Coosa, formed by the junction of the Etowah and Oostanaula, and some tributaries of the Tennessee. There are numerous islands along the coast, and seven sounds between these and the main-

land. The coast, for 20 miles inland, is low and swampy; at that distance it rises by a terrace formation 70 to 100 feet for 20 miles more, when a second terrace appears, rising gradually to 575 feet above the sea in Baldwin County, 160 to 200 miles from the sea. Here the foot-hills begin, and

Seal of Georgia.

rise in the W. and N. W. to 2,500 and 4,000 feet. The mountain district covers 25 counties, lying mostly N. W. of the Chattahoochee. The hills run in nearly parallel ranges with each other, though with outlying spurs. There are many beautiful cataracts and waterfalls in this region.

*Geology, Minerals, Mining, etc.*—Georgia is characterized by four distinct belts, representing (*a*) the crystalline rocks, supposed to be Archæan, occupying a large portion of the northeast part of the State; (*b*) the Palæozoic group occurring only in ten counties, in the extreme northwest; (*c*) the Cretaceous, in the middle west part of the State around Columbus; (*d*) the Tertiary, covering the entire southeast and south part of the State. A large portion of the country, underlaid by the crystalline rocks, consists of the so-called Piedmont plains, or a gently rolling country with an altitude of from 700 to 1,200 or 1,300 feet above the sea; but in the more northwestern portion of this belt the crystalline rocks rise into bold mountains intercepted by valleys. The Palæozoic country consists of a number of broad valleys from 800 to 1,000 feet above the sea, traversed by many ridges a few hundred feet high, and some narrow mountains rising from 1,500 to 2,000 feet above the sea. The Cretaceous country occupies a rather small triangular area, 500 or 600 feet above the sea, and consists of plains intersected with many deep valleys. A considerable portion of the Tertiary country has an altitude of from 400 to 600 feet, and consists of plains with, however, some higher ridges; but the country gradually descends to near sea-level.

The total annual value of mineral products according to the census of 1880 was $553,913; by the census of 1890 it was $2,988,935—an increase of $2,435,022, or 439·60 per cent. In the mineral resources may be mentioned exhaustless beds of marble of excellent quality. Georgia, though only lately developing this source of wealth, already ranks fourth among the States in marble products. Iron ores are found in exhaustless beds all over the northern section of the State. Extensive coal-fields are to be found in Northwest Georgia, corundum and asbestos in the northeast; building-stones and slate in vast abundance, fire-clay, beauxite, and other materials used in trade and art are to be found in paying quantities. Gold mines are successfully worked, and there is a vast store of this most precious of metals in the soil of the State. The clays of the State are extremely variable and are suitable for brick and tiles of all kinds; fire-clay occurs in all the great groups or formations described, and some of these are naturally white and form kaolin; others again are tinted. The principal products in 1899 were cement, $9,750; coal (with North Carolina), $268,309; coke, $116,917; gold, $113,000; granite, $411,344; iron ores, long tons, 236,748; manganese ores, $23,377; marble, $742,554; pig iron, long tons (with North Carolina), 17,835; roofing slate, $7,500; and limestone, $29,786.

*Soil, Productions, etc.*—The soils of Georgia may be described as the red and brown loams, gray-gravelly lands, sandy lands and flatwoods of extreme Northwest Georgia; the red-clay lands and gray-sandy lands of Middle and Northeast Georgia; the red-clay lands (marl beds); the sandy lands of Middle and Southern Georgia; and the savannas and palmetto flats of the coast. Along the coast, in the alluvial lands of the river valleys, and in the better parts of the northern section of the State, the soil is fertile. The greater portion of the soil is of medium fertility, but capable of high development. The forest growth is red, white, and Spanish oak, hickory, dogwood, poplar, chestnut, and pine; the agricultural products are corn, oats, wheat, rice, clover, grasses, and long and short staple cotton. The yellow pine furnishes a large proportion of the wealth of the State, the cutting of lumber and the making of turpentine constituting two of the largest and most profitable industries. Savannah and Brunswick are the largest markets for naval stores in the world.

Oranges, lemons, pineapples, bananas, and olives are grown to perfection in the southern part. The growing of peaches, grapes, and watermelons (Georgia being the home of the best varieties of both melons and peaches) has become very profitable. A profit of $100 an acre has not been unusual. Apples are successfully raised in the northern portion, and pears, cherries, plums, quinces, strawberries, and other fruits are grown everywhere. Tobacco, sugar-cane, sorghum, peanuts, and Irish and sweet potatoes are also raised. The principal productions were (1900): corn, 34,119,530 bush.; wheat, 5,011,133 bush.; oats, 7,010,040 bush.; rye, 109,529 bush.; potatoes, 391,816 bush.; hay, 190,237 tons; cotton, 1,345,699 bales. Value of farm animals (1899): horses, $6,001,626; mules, $10,826,032; cattle, $11,052,126; sheep, $518,893.

Of wild animals, etc., may be mentioned the black and brown bear (very scarce); panther and wild cat in Northern Georgia, but very few of either species are left. The raccoon, opossum, rabbit, and squirrel abound everywhere. Alligators are found in waters of the extreme southern portion, and venomous serpents in the southern swamps.

*Climate.*—The climate of Georgia is variable, but exceedingly healthful. Its range embraces quite cold weather, with snow and ice, in the mountainous regions in the northern, and a semi-tropical temperature in the southern portion. Very hot or very cold spells are rare, and the greater part of the State possesses a mild and invigorating climate. The mean for January for the State is about 50°, for July 80°, and for the year about 65°. The rainfall for the State averages about 48 inches, the fall being generally distributed throughout the year; there are neither wet nor dry seasons, the driest part of the year falling in September and October. The winters are usually mild, and the summers, while warm in the south, are never excessively so.

*Divisions.*—For administrative purposes, Georgia is divided into 137 counties, as follows:

| COUNTIES. | * Ref. | Pop. 1890. | Pop. 1900. | COUNTY TOWNS. | Pop. 1900. |
|---|---|---|---|---|---|
| Appling | 6-J | 8,676 | 12,336 | Baxley | 488 |
| Baker | 7-G | 6,144 | 6,704 | Newton | 329 |
| Baldwin | 4-H | 14,608 | 17,768 | Milledgeville | 4,219 |
| Banks | 2-H | 8,562 | 10,545 | Homer | 221 |
| Bartow | 2-F | 20,616 | 20,823 | Cartersville | 3,135 |
| Berrien | 7-H | 10,694 | 19,440 | Nashville | 293 |
| Bibb | 4-H | 42,370 | 50,473 | Macon | 23,272 |
| Brooks | 7-H | 13,979 | 18,606 | Quitman | 2,281 |
| Bryan | 5-K | 5,520 | 6,122 | Clyde | 875 |
| Bulloch | 5-J | 13,712 | 21,377 | Statesboro | 1,197 |
| Burke | 4-J | 28,501 | 30,165 | Waynesboro | 2,030 |
| Butts | 3-G | 10,565 | 12,805 | Jackson | 1,487 |
| Calhoun | 6-F | 8,438 | 9,274 | Morgan | 240 |
| Camden | 7-K | 6,178 | 7,669 | St. Mary's | 529 |
| Campbell | 3-G | 9,115 | 9,518 | Fairburn | 761 |
| Carroll | 3-F | 22,301 | 26,576 | Carrollton | 1,998 |
| Catoosa | 1-F | 5,431 | 5,823 | Ringgold | 437 |
| Charlton | 7-J | 3,335 | 3,592 | Trader's Hill | 497 |
| Chatham | 5-K | 57,740 | 71,239 | Savannah | 54,244 |
| Chattahoochee | 5-F | 4,902 | 5,790 | Cusseta | 301 |
| Chattooga | 2-F | 11,202 | 12,952 | Summerville | 486 |
| Cherokee | 2-G | 15,412 | 15,243 | Canton | 847 |
| Clarke | 2-H | 15,186 | 17,708 | Athens | 10,245 |
| Clay | 6-F | 7,817 | 8,568 | Fort Gaines | 1,305 |
| Clayton | 3-G | 8,295 | 9,598 | Jonesboro | 877 |
| Clinch | 7-I | 6,652 | 8,732 | Homerville | 434 |
| Cobb | 2-G | 22,286 | 24,664 | Marietta | 4,446 |
| Coffee | 6-I | 10,483 | 16,169 | Douglas | 617 |
| Colquitt | 7-H | 4,794 | 13,636 | Moultrie | 2,221 |
| Columbia | 3-I | 11,281 | 10,653 | Appling | 1,561 |
| Coweta | 3-F | 22,354 | 24,980 | Newnan | 3,654 |
| Crawford | 4-G | 9,315 | 10,368 | Knoxville | 300 |
| Dade | 1-E | 5,707 | 4,578 | Trenton | 349 |
| Dawson | 2-G | 5,612 | 5,442 | Dawsonville | 217 |
| Decatur | 7-G | 19,949 | 29,454 | Bainbridge | 2,641 |

* Reference for location of counties, see map of Georgia.

GEORGIA
County Towns
Scale of Miles
0 10 20 30 40 50
TENN.
NORTH CAROLINA
SOUTH CAROLINA
ALABAMA
FLORIDA
ATLANTA
COLUMBIA
TALLAHASSEE
GULF OF MEXICO
ATLANTIC OCEAN
Okefenokee Swamp
Savannah R.
Altamaha
Chattahoochee
Flint R.
Ocmulgee
Oconee
St. Marys R.
Longitude West from Greenwich
L L POATES, ENGR., N.Y.

| COUNTIES. | * Ref. | Pop. 1890. | Pop. 1900. | COUNTY TOWNS. | Pop. 1900. |
|---|---|---|---|---|---|
| Dekalb | 3-G | 17,189 | 21,112 | Decatur | 1,418 |
| Dodge | 5-I | 11,452 | 13,975 | Eastman | 1,235 |
| Dooly | 5-H | 18,146 | 26,567 | Vienna | 1,035 |
| Dougherty | 6-G | 12,206 | 13,679 | Albany | 4,606 |
| Douglas | 3-F | 7,794 | 8,745 | Douglasville | 1,140 |
| Early | 7-F | 9,792 | 14,828 | Blakely | 804 |
| Echols | 8-I | 3,079 | 3,209 | Statenville | 361 |
| Effingham | 5-K | 5,599 | 8,334 | Springfield | .... |
| Elbert | 2-I | 15,376 | 19,729 | Elberton | 3,834 |
| Emanuel | 4-J | 14,703 | 21,279 | Swainsboro | 895 |
| Fannin | 1-G | 8,734 | 11,214 | Blueridge | 1,148 |
| Fayette | 3-G | 8,728 | 10,114 | Fayetteville | 430 |
| Floyd | 2-F | 28,391 | 33,113 | Rome | 7,291 |
| Forsyth | 2-G | 11,155 | 11,550 | Cumming | 239 |
| Franklin | 2-H | 14,670 | 17,700 | Carnesville | 305 |
| Fulton | 3-G | 84,655 | 117,363 | Atlanta | 89,872 |
| Gilmer | 1-G | 9,074 | 10,198 | Ellijay | 581 |
| Glascock | 3-I | 3,720 | 4,516 | Gibson | 293 |
| Glynn | 7-K | 13,420 | 14,317 | Brunswick | 9,081 |
| Gordon | 2-F | 12,758 | 14,119 | Calhoun | 851 |
| Greene | 3-H | 17,051 | 16,542 | Greenesboro | 1,511 |
| Gwinnett | 2-G | 19,899 | 25,585 | Lawrenceville | 853 |
| Habersham | 1-H | 11,573 | 13,604 | Clarkesville | 491 |
| Hall | 2-H | 18,047 | 20,752 | Gainesville | 4,382 |
| Hancock | 3-I | 17,149 | 18,277 | Sparta | 1,150 |
| Haralson | 3-F | 11,316 | 11,922 | Buchanan | 359 |
| Harris | 4-F | 16,797 | 18,009 | Hamilton | 418 |
| Hart | 2-I | 10,887 | 14,492 | Hartwell | 1,672 |
| Heard | 3-F | 9,557 | 11,177 | Franklin | 218 |
| Henry | 3-G | 16,220 | 18,602 | McDonough | 683 |
| Houston | 5-H | 21,613 | 22,641 | Perry | 650 |
| Irwin | 6-H | 6,316 | 13,645 | Irwinville | .... |
| Jackson | 2-H | 19,176 | 24,039 | Jefferson | 726 |
| Jasper | 3-H | 13,879 | 15,033 | Mouticello | 1,106 |
| Jefferson | 4-J | 17,213 | 18,212 | Louisville | 1,009 |
| Johnson | 4-I | 6,129 | 11,409 | Wrightsville | 1,127 |
| Jones | 4-H | 12,709 | 13,358 | Clinton | 658 |
| Laurens | 5-I | 13,747 | 25,908 | Dublin | 2,987 |
| Lee | 6-G | 9,074 | 10,344 | Leesburg | 413 |
| Liberty | 6-K | 12,887 | 13,093 | Hinesville | .... |
| Lincoln | 3-I | 6,146 | 7,156 | Lincolnton | 221 |
| Lowndes | 7-H | 15,102 | 20,036 | Valdosta | 5,613 |
| Lumpkin | 2-G | 6,867 | 7,433 | Dahlonega | 1,255 |
| McDuffie | 3-I | 8,789 | 9,804 | Thomson | 1,154 |
| McIntosh | 6-K | 6,470 | 6,537 | Darien | 1,739 |
| Macon | 5-G | 13,183 | 14,093 | Oglethorpe | 545 |
| Madison | 2-H | 11,024 | 13,224 | Danielsville | 194 |
| Marion | 5-G | 7,728 | 10,080 | Buena Vista | 1,161 |
| Meriwether | 4-F | 20,740 | 23,339 | Greeneville | 815 |
| Miller | 7-F | 4,275 | 6,319 | Colquitt | 320 |
| Milton | 2-G | 6,208 | 6,763 | Alpharetta | 310 |
| Mitchell | 7-G | 10,906 | 14,767 | Camilla | 1,051 |
| Monroe | 4-G | 19,137 | 20,682 | Forsyth | 1,172 |
| Montgomery | 5-I | 9,248 | 16,359 | Mt. Vernon | 573 |
| Morgan | 3-H | 16,041 | 15,813 | Madison | 1,992 |
| Murray | 1-F | 8,461 | 8,623 | Spring Place | 213 |
| Muscogee | 5-F | 27,761 | 29,836 | Columbus | 17,614 |
| Newton | 3-H | 14,310 | 16,734 | Covington | 2,062 |
| Oconee | 3-H | 7,713 | 8,602 | Watkinsville | 351 |
| Oglethorpe | 2-H | 16,951 | 17,881 | Lexington | 635 |
| Paulding | 2-F | 11,948 | 12,969 | Dallas | 644 |
| Pickens | 2-G | 8,182 | 8,641 | Jasper | 379 |
| Pierce | 7-J | 6,379 | 8,100 | Blackshear | 876 |
| Pike | 4-G | 16,300 | 18,761 | Zebulon | 361 |
| Polk | 2-F | 14,945 | 17,856 | Cedartown | 2,823 |
| Pulaski | 5-H | 16,559 | 18,489 | Hawkinsville | 2,103 |
| Putnam | 3-H | 14,842 | 13,436 | Eatonton | 1,823 |
| Quitman | 6-F | 4,471 | 4,701 | Georgetown | 348 |
| Rabun | 1-H | 5,606 | 6,285 | Clayton | 199 |
| Randolph | 6-F | 15,267 | 16,847 | Cuthbert | 2,641 |
| Richmond | 3-J | 45,194 | 53,735 | Augusta | 39,441 |
| Rockdale | 3-G | 6,813 | 7,515 | Conyers | 1,605 |
| Schley | 5-G | 5,443 | 5,499 | Ellaville | 474 |
| Screven | 4-K | 14,424 | 19,252 | Sylvania | 545 |
| Spalding | 4-G | 13,117 | 17,619 | Griffin | 6,857 |
| Stewart | 5-F | 15,682 | 15,856 | Lumpkin | 1,470 |
| Sumter | 5-G | 22,107 | 26,212 | Americus | 7,674 |
| Talbot | 4-F | 13,258 | 12,197 | Talbotton | 1,131 |
| Taliaferro | 3-I | 7,291 | 7,912 | Crawfordville | 597 |
| Tattnall | 5-J | 10,253 | 20,419 | Reidsville | 257 |
| Taylor | 5-G | 8,666 | 9,846 | Butler | 707 |
| Telfair | 6-I | 5,477 | 10,083 | McRae | 1,020 |
| Terrell | 6-G | 14,503 | 19,023 | Dawson | 2,926 |
| Thomas | 7-G | 26,154 | 31,076 | Thomasville | 5,322 |
| Towns | 1-G | 4,064 | 4,748 | Hiwassee | .... |
| Troup | 4-F | 20,723 | 24,002 | La Grange | 4,274 |
| Twiggs | 4-H | 8,195 | 8,716 | Jeffersonville | 1,181 |
| Union | 1-G | 7,749 | 8,481 | Blairsville | 141 |
| Upson | 4-G | 12,188 | 13,670 | Thomaston | 1,714 |
| Walker | 1-E | 13,282 | 15,661 | La Fayette | 491 |
| Walton | 2-H | 17,467 | 20,942 | Monroe | 1,846 |
| Ware | 7-I | 8,811 | 13,761 | Waycross | 5,919 |
| Warren | 3-I | 10,957 | 11,463 | Warrenton | 1,113 |
| Washington | 4-I | 25,237 | 28,227 | Sandersville | 2,023 |
| Wayne | 7-J | 7,485 | 9,449 | Jesup | 805 |
| Webster | 5-G | 5,695 | 6,618 | Preston | 146 |
| White | 2-H | 6,151 | 5,912 | Cleveland | .... |
| Whitfield | 1-F | 12,916 | 14,509 | Dalton | 4,315 |
| Wilcox | 6-H | 7,980 | 11,097 | Abbeville | 1,152 |
| Wilkes | 3-I | 18,081 | 20,866 | Washington | 3,300 |
| Wilkinson | 4-H | 10,781 | 11,440 | Irwinton | 227 |
| Worth | 6-H | 10,048 | 18,664 | Isabella | .... |
| Totals | ..... | 1,837,353 | 2,216,331 | | |

* Reference for location of counties, see map of Georgia.

*Principal Cities and Towns.*—Atlanta (capital), 89,872; Savannah, 54,244; Augusta, 39,441; Macon, 23,272; Columbus, 17,614; Athens, 10,245; Brunswick, 9,081; Americus, 7,674; Rome, 7,291; Griffin, 6,857; Waycross, 5,919; Valdosta, 5,613; Thomasville, 5,322; Albany, 4,606; Marietta, 4,446; Gainesville, 4,382; Dalton, 4,315; La Grange, 4,274; Milledgeville, 4,219; Elberton, 3,834; Newnan, 3,654; Cordele, 3,473; Washington, 3,300; Summerville, 3,245; Cartersville, 3,135; Barnesville, 3,036.

*Population.*—In 1860 Georgia had 1,057,286 inhabitants; in 1870, 1,184,109; in 1880, 1,542,180; in 1890, 1,837,353 (white, 978,357; colored, 858,815; Chinese, Japanese, and civilized Indians, 181); in 1900, 2,216,331.

*Industries and Business Interests.*—The development of manufacturing in Georgia was more rapid in the ten years 1880–90 than during any other decennial period. In 1880 the entire South had only 667,854 spindles. Georgia having 198,656. Georgia had in 1890 524,244 spindles. In 1900 there were 86 mills (53 in 1890), keeping in operation 969,364 spindles, and using 159,151,000 lb. of cotton. There were 41 new mills in 1900—28 completed, and 13 under construction. In 1880 she used 33,757,199 lb. of cotton in manufacturing; in 1890 she used 69,139,410 lb. The cost per pound in manufacture in Georgia is 9·64 cents, as against 10·74 in the New England States, according to the latest census. The value of products in cotton manufacture increased from $6,481,894 in 1880 to $12,035,629 in 1890, or 85·68 per cent. Besides cotton, the leading manufacturing industries are woolen goods, iron and steel, lumber, and other forest products. Value of woolen products in 1890, $100,705; iron and steel, $519,093; lumber and mill products, $6,216,585; tar and turpentine, $4,242,255. Shad-fisheries and oyster-raising are growing industries.

*Banks.*—Sept. 5, 1900, there were 29 national banks, with a paid-up capital of $4,306,000; surplus and undivided profits, $2,483,707.68; deposits, $10,864,848.52. There were 144 chartered State banks; capital stock, $8,735,328; surplus and profits, $3,145,564; deposits, $22,009,064. There were 9 private banks: capital, $702,088; surplus and profits, $102,956; deposits, $251,171.

In insurance there were 72 fire and marine companies doing business in the State; $140,826,192 in risks was written; premiums and assessments paid, $1,706,650; losses paid, $1,372,703; proportion losses paid to premiums, 80 per cent. In 1892 there were 58 fire-insurance companies doing business in the State, with risks in the State of $147,393,355; 24 old line life-insurance companies, with risks of $62,748,056; and 16 accident, indemnity, and marine insurance companies, with risks of $19,734,903.

*Commerce and Navigation.*—The total imports for the seven months ending Jan., 1901, of the customs districts of Atlanta, Brunswick, and Savannah were valued at $550,000; total exports, $36,202,423. A large portion of the exports are made through Charleston, S. C., Fernandina, Pensacola, and Appalachicola, Fla., and Mobile, Ala., so that the above figures do not give the exact and full amount of Georgia's foreign commerce. The exports are mainly cotton, raw or manufactured, lumber, and naval stores. The internal commerce of the State is large and profitable.

*Finance.*—In 1880 the assessed valuation of real and personal property was $239,472,599; in 1890, $377,366,784; and in 1900, $436,000,000. The State debt in 1899 was $7,031,500. The State Treasurer reported Sept. 30, 1900; Balance, Oct. 1, 1899, $438,776.66; receipts, $3,542,069.69; expenditures, $3,564,700.05.

*Means of Communication.*—In 1880 there were 2,459 miles of railway in Georgia; in 1890, 4,263; and in 1899, 5,629.24 miles. The total valuation of the railways of the State amounted in 1880 to $55,517,342; and in 1890 to $128,768,178. There are six navigable rivers, which, with the nearly 500 miles of coast indented by estuaries and sounds, give several thousand miles of waterway. Two canals have been projected—one to connect the Flint and Ocmulgee rivers, which would open a way across the State from the Atlantic to the Gulf, the other to connect the Ocmulgee with the Tennessee. The country roads are poor. The railroads are active in assisting colonies to settle in districts especially favorable to manufacture or farm industry, and have done much to develop the State.

*Churches and Schools.*—The churches in 1880 numbered about 3,250, with a membership of about 320,000. In 1890 there were 6,899 church organizations, having 7,008 churches, about 700,000 members, and church property valued at $8,228,060. The Baptists have 3,966 churches, valued at

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$3,109,390; the Methodists have 2,406 churches, valued at $2,783,267; the Presbyterians have 201 churches, valued at $776,025; the Catholics have 64 churches, valued at $485,123; the Protestant Episcopalians have 46 churches, valued at $492,300; the Congregationalists have 73 churches, valued at $75,350; the Disciples of Christ have 64 churches, valued at $197,925; Jewish congregations have 9 churches, valued at $159,000; Lutherans have 18 churches, valued at $124,150; Christians, 2 churches; Christian Scientists, 2 churches; Spiritualists, 2 churches; Universalists, 15 churches.

The last public school enumeration (1898) showed that there were 66,870 children of school age, which is six to eighteen. The enrollment for 1899 was 423,467; the average attendance 253,193. The total school fund for 1900 was $1,440,642. There are 7,547 schools under the common school system, and 384 under local systems. There were in 1898 9,217 teachers receiving an average of $181.62 annually. The average expense for each child enrolled was in 1899 $6.31, and the length of the school term five months. There are 22 colleges, having about 4,500 pupils; the State University at Athens embraces four branch colleges. A normal school has been started at Athens under State control. A girls' normal and industrial college and an industrial college for colored students have been established by the State. A school of technology has been established at Atlanta as a branch of the State university. These institutions are admirably conducted, are well equipped, and are growing. There are six colleges for colored students (included in the above total). Percentage of illiteracy (1893) is 11 white and 27 colored; average, 18.

*Charitable and Penal Institutions.*—Of charitable institutions, Georgia has an asylum for lunatics, with about 1,500 inmates, under control of a board of trustees and directly managed by a superintendent, and is, in common with all State institutions, inspected by the Legislature at every session; an institute for the deaf and dumb, with about 100 inmates, and an institute for the blind, with about 90 inmates, both under management similar to that of the asylum. All are supported by yearly appropriations by the Legislature. The convicts of the State were formerly not confined in the penitentiary, but were leased out to companies formed for the purpose. In Dec., 1897, the old lease-contract system was abolished, and a new system established under which the State resumed control of the convicts. In 1899 there were in the chain gang 37 boys under sixteen and 117 women, 1 of each being white, besides 132 white men and 2,135 colored men. Of the 2,201 remaining in the Penitentiary at the end of the year, 1,080 were wholly illiterate, 250 could read only, and 871 could read and write.

*History.*—Georgia was one of the thirteen original States, but was settled much later than the others; patent for it granted to Oglethorpe, Whitefield, the Wesleys, *et al.*, June 9, 1732; first colony (120 persons) came in 1733; objects of the colony, to establish a barrier between the Spanish and Indians on the S. and South Carolina and North Carolina on the N., and to provide a refuge for the needy and destitute, and especially poor debtors, orphans, and friendless children and youth; the latter object was Whitefield's. Savannah founded in 1733; the colony was at first military and the colonists received their lands on condition of military service; this occasioned discontent, and the colonists deserted to North Carolina; the policy was changed, and 50 acres of land offered free to settlers, and many Scotch and German emigrants came in. War between Great Britain and Spain 1739–43; Oglethorpe attacked Spaniards in Florida in 1739, but the expedition was a failure; Spaniards attacked Savannah in 1742, but were alarmed by Oglethorpe's stratagems, and returned to Florida; after the peace Georgians demanded slaves, which had been prohibited to them; in 1752 the trustees surrendered the colony to the crown, and Negro slavery was permitted: progress of the colony rapid for next twenty years; in 1736 the commerce of the colony amounted to $741,615, and in 1775 to $1,086,270. It was at this time that Georgia, not itself suffering from British oppression, from sympathy for the other colonies made common lot with them in the Revolutionary war. During that war Georgia suffered severely; was overrun by British troops; Savannah captured in 1778, Augusta and Sudbury in 1779; Savannah held by British till close of the war, despite the efforts of the Americans and French to retake it. Georgia formed first constitution in 1777, second in 1785, the third, which with some amendments lasted till 1861, in 1798, and another in 1877; U. S. Constitution ratified in Jan., 1788. There was some difficulty with Creeks and Cherokees 1783–90, but treaties of peace with them were concluded in 1790 and 1791, and in 1802 the Creeks ceded to the U. S. what now constitutes the finest counties of Southwestern Georgia; these lands were subsequently assigned to Georgia, and the State in turn relinquished to the U. S. all its claims W. of the Chattahoochee—i. e. Alabama and Mississippi. In 1860 Georgia followed the lead of South Carolina, and seceded in Jan., 1861, though with a large minority in opposition; took an active part in the civil war; from the battle of Chickamauga in Sept., 1863, to the winter of 1864–65 it was almost constantly the scene of conflict; Sherman's march to Atlanta and his march to the sea were both almost entirely in its territory; Savannah captured Dec., 1864. Georgia repealed the act of secession Oct. 30, 1865; a new constitution was adopted, and the Thirteenth Amendment to the Constitution of the U. S. ratified, but Congress was dissatisfied with Georgia's constitution, the State was put under military rule, and a new constitutional convention was ordered, which formed the present constitution, ratified in 1868. The State was restored to the Union on its ratification of the Fourteenth Amendment in 1868–69, but on its refusal to ratify the Fifteenth Amendment was again put under military rule; on compliance with this demand it was reinstated. The great National Exposition of cotton and other Southern products at Atlanta in the autumn of 1881 gave its agricultural and manufacturing interests a very wonderful impulse. The following list embraces all the Governors of Georgia since the adoption of the U. S. Constitution:

| | | | |
|---|---|---|---|
| George Walton | 1789–90 | Howell Cobb | 1851–53 |
| Edward Telfair | 1790–93 | Herschel V. Johnson | 1853–57 |
| George Matthews | 1793–96 | Joseph E. Brown | 1857–65 |
| Jared Irwin | 1796–98 | Jas. Johnson (prov.) | 1865 |
| James Jackson | 1798–1801 | Charles J. Jenkins | 1865–67 |
| David Emanuel (acting) | 1801 | Gen. T. H. Ruger (prov.) | 1867–68 |
| Josiah Tatnall | 1801–02 | Rufus B. Bullock | 1868–72 |
| John Milledge | 1802–06 | Benjamin Conley (acting) | 1871 |
| Jared Irwin | 1806–09 | James Milton Smith | 1872–77 |
| David B. Mitchell | 1809–13 | Alfred H. Colquitt | 1877–82 |
| Peter Early | 1813–15 | Alex. H. Stephens | 1882–83 |
| David B. Mitchell | 1815–17 | J. S. Boynton (acting) | 1883 |
| William Rabun | 1817–19 | Henry D. McDaniel | 1883–86 |
| Matthew Talbot (acting) | 1819 | John B. Gordon | 1886–90 |
| John Clarke | 1819–23 | William J. Northen | 1890–94 |
| George M. Troup | 1823–27 | William Y. Atkinson | 1894–98 |
| John Forsyth | 1827–29 | Allen D. Candler | 1898– |
| George R. Gilmer | 1829–31 | | |
| Wilson Lumpkin | 1831–35 | | |
| William Schley | 1835–37 | | |
| George R. Gilmer | 1837–39 | | |
| Charles J. McDonald | 1839–43 | | |
| George W. Crawford | 1843–47 | | |
| George W. Towns | 1847–51 | | |

WILLIAM J. NORTHEN.

**Georgia, Gulf of:** the body of water between the mainland of British Columbia and Vancouver island. It may be regarded as a northward extension of Puget Sound. The Strait of San Juan de Fuca is the southern entrance to the gulf and to Puget Sound. Queen Charlotte's Sound is the northern entrance. The Gulf of Georgia is a sound or channel, rather than a gulf, is 100 miles long, and in some places 20 miles broad.

**Georgian Bay:** the easternmost portion of Lake Huron lying within the province of Ontario, Canada, and separated from the rest of the lake by the Great Manitoulin island and by a peninsula (Cabot's Head) which extends N. from Bruce County, Ontario. The bay was formerly called Lake Manitoulin. Length, 120 miles; breadth, 50 miles.

**Georgian Language and Literature:** the speech and literature of a branch of the Caucasian family, and with the Mingrelian, Lasian, and Suanian, it constitutes the southern group of the family. The language is spread over a considerable extent of territory, occupying the greater part of Transcaucasia, and has a number of subdivisions or dialects. The tongue is somewhat rugged and harsh, but is interesting to the philologist.

On the authority of Anton Schiefner and P. V. Uslar (*Académie Impériale des Sciences de St. Pétersbourg*, 1859, *seq.*), the Georgian, with the other Caucasian languages, is best classified as distinct from the Indo-European family. The speech presents certain similarities to the Basque in structure, but none in vocabulary. Some of its characteristics are of the agglutinative type; but, on the other hand, with its simple declension, the same for noun, adjective, and pronoun, it presents an inflectional stage that approaches but is earlier than that found in the Indo-European family.

The alphabet is based on the Armenian, and, like the lat-

ter, its characters are claimed to be the invention of Mesrob (A. D. fifth century). Two kinds of script are used—the ecclesiastical or square, and the common or round. The writing runs from left to right. The old alphabet of fifty letters is giving place to the Russian.

The Georgian has a fairly rich literature, which dates back to the eighth century. The Bible is its oldest monument and belongs to this period. The first printed edition of this monument, however, did not appear until 1743, in Moscow, but it has since that time been widely spread by the Bible Society of St. Petersburg. Beside the Scriptures and some ecclesiastical writings, the Georgian literature comprises histories, pseudo-histories, chronicles, poetry, and romances. The golden age of Georgian letters was the seventeenth and eighteenth centuries, but in 1807 the Russians carried to St. Petersburg an important part of the literature of the country, and a process of Russianization is now going on in the schools of Transcaucasia.

Reference may be made to Brosset, *Éléments de la langue Géorgienne* (Paris, 1837); Klaproth, *Vocabulaire géorgien-français et français-géorgien* (Paris, 1827); Tchubinow, *Dictionnaire géorgien-russe-française* (St. Petersburg, 1840); Zagarelli, *Examen de la littérature relative à la grammaire géorgienne* (St. Petersburg, 1873); Müller, *Grundriss der Sprachwissenschaft*, vol. iii. (Vienna, 1885); von Thielmann, *Journey to the Caucasus, Persia, and Turkey in Asia*, translated by Dr. Charles Hemeage (London, 1875); Leist, *Georgische Dichter, verdeutscht* (Leipzig, 1887); and Leist, *Der Mann in Tigerfelle, von Schota Rustaweli, aus dem Georgischen übersetzt* (Dresden and Leipzig, 1890).

Revised by A. V. Williams Jackson.

**Georgia, University of**: a non-sectarian institution of learning at Athens, Ga.; chartered in 1785 and opened in 1801; comprising, besides a college of liberal arts (Franklin College), a school of medicine at Augusta, a school of technology at Atlanta, a school of law, and State agricultural colleges in Dahlonega, Thomasville, Milledgeville, and Hamilton, and a normal and industrial college for young women. Tuition is free except in the schools of law and medicine, and the courses in the agricultural colleges are open to women. The university has a general library of 30,000 volumes and special department libraries; biological, chemical, physical, and physiological laboratories; a natural history museum; scientific apparatus valued at nearly $75,000; grounds and buildings worth nearly $500,000; and productive funds amounting to $373,000.

**Geotropism**: See Physiology (*Vegetable*).

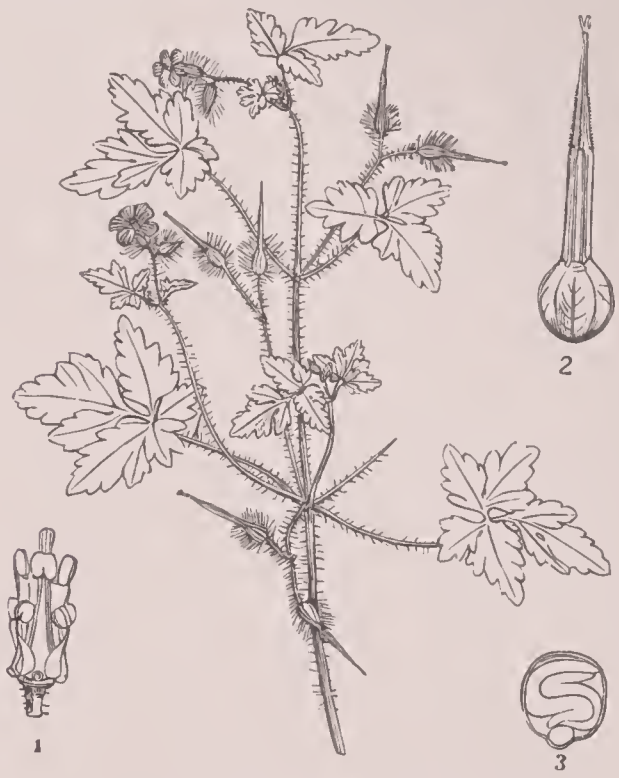
**Gephyræ'a** [Mod. Lat., from Gr. γέφυρα, a dam, a bridge]: a name formerly in vogue for the *Echiuridæ* and the *Sipunculaceæ*, cylindrical worms without jointed bodies. At one time they were regarded as closely related to the Echinodermata, but now the group is regarded as unnatural, the *Echiuridæ* being degenerate Chætopod annelids, the *Sipunculaceæ* as a distinct group. J. S. K.

**Gera**, gā'rāă: town of Germany; capital of principality of Reuss, younger line Reuss, on the White Elster (see map of German Empire, ref. 5–F). It is neatly built and thriving, with considerable manufactures of woolen goods, harmonicas, etc. Pop. (1895) 43,544.

**Gerald de Barri**: See Giraldus Cambrensis.

**Gérando**, zhā'rāăṅ'dō', Joseph Marie, Baron de: author and educator; b. at Lyons, France, Feb. 29, 1772; studied for the priesthood, but served in the army and the civil service; made a baron and governor of Catalonia in 1812; Professor of Public Law in the faculty at Paris 1828–42; and made a peer in 1837. Author of *Des signes et de l'art de penser* (4 vols., 1800), which was written while he was in the army, and gained the prize of the Institute; *Génération des connaissances* (1802); *Histoire comparée des systèmes de philosophie* (3 vols., 1803; 4th vol., 1847); *Du perfectionnement moral et l'éducation de soi-même* (1830); *Visiteur du pauvre* (1821); *De l'éducation des sourds-muets* (1827); *Institutes du droit administratif* (1829); *Cours normal des institutions judiciaires* (1839); *De la bienfaisance publique* (4 vols., 1839); and many other works upon philosophy, education, social questions, law, etc. D. in Paris, Nov. 11, 1842.

**Gera'nium** [Mod. Lat., from Lat. *gera'nium* = Gr. γεράνιον, cranesbill, geranium, deriv. of γέρανος, crane : Eng. *crane*]: the typical genus of the family *Geraniaceæ*. It has ten stamens with perfect anthers. Five are longer than the others, and have glands at the base alternate with the petals. The persistent sepals are imbricated, and the petals usually convolute in the bud, while the stamens are slightly monadelphous. The receptacle has a very long extension, which gives the name of "cranesbill" to the genus. The five carpels and the styles are adnate to this. When ripe and dry, the pods are torn off and carried away by the styles, which curve elastically and throw out the seeds. The wild *Geranium maculatum* of the U. S. well exhibits the characteristics of the genus. It flowers in April or May. The geraniums are herbaceous, with rose-colored, purplish, or white flowers, sometimes variegated. They generally have a strong odor—often agreeable, but sometimes offensive, as in *Geranium robertianum*. They contain tannin, often in large quantities, and from the astringency which this imparts are used in medicine. *Geranium maculatum* contains very large quantities of it, and is often called *alum-root*.




*Geranium robertianum*: 1, the stamens; 2, the ovary; 3, section of seed, showing the curved embryo.

It is used as a remedy for dysentery. The true geraniums are not much used in cultivation, the plants from the Cape of Good Hope generally known by the name belonging to the kindred genus *Pelargonium*. Of these there are very many—some valued for their rich scarlet, pink, or white blossoms, and some for the fragrance and markings of their leaves. There are no plants better known in floriculture, or more sought after for in-door or garden ornamentation. As they cross easily, many hybrids have been formed, and it is now often difficult to determine the parentage of an individual. The pelargoniums are mostly shrubby when growing wild, but they are treated as herbs under cultivation. While the flowers of the geraniums usually are purple or some related color, a species exists in the south of Europe (the *Geranium chrysanthum*) which has yellow flowers. Those used in cultivation are easily propagated by cuttings. The genus contains about 500 species, unequally distributed over the world. Revised by L. H. Bailey.

**Geranium Family**: the *Geraniaceæ*, a group of about 1,000 mostly herbaceous species of dicotyledonous flowering plants, with superior compound ovary, few ovules, and distinct petals. The species are found mainly in temperate and sub-tropical climates. *Geranium* with 110 species, and *Oxalis* with 205 species have a world-wide distribution. *Pelargonium*, which includes the "geraniums" of the greenhouses, is a South African and Australian genus of nearly 200 species. Charles E. Bessey.

**Geranomor'phæ** [Mod. Lat., from Gr. γέρανος, crane + μορφή, form]: in Huxley's classification, a group of schizognathous birds comprising the cranes and rails. Nearly synonymous with *Alectorides*, *Paludicolæ*, or *Gruioideæ*.

**Gérard**, zhā'raar', Étienne Maurice, Count: soldier; b. at Damvillers, France, Apr. 4, 1773; enlisted in the army 1791; attained a colonelcy 1800; distinguished himself in many of Napoleon's principal battles; was made a general of division in 1812 after the battle of Borodino, and in the

following year, after the victory of Bautzen, was named by Napoleon a count of the empire; commanded the army of the Moselle 1815, and was with Grouchy in that campaign; returned to France 1817; was made War Minister and marshal 1830; reduced Antwerp 1832; became a peer of France 1832, Prime Minister 1834; commander of the national guard 1838; senator 1852. D. at Paris, Apr. 17, 1852.

**Gérard**, FRANÇOIS PASCAL, Baron: historical and portrait painter; b. of French parents in Rome, Mar. 14, 1770. Pupil of the sculptor Pajou, of Brenet, and David; second Prix de Rome 1789; executed important works for Napoleon, who appointed him official portrait-painter; member of the Institute 1812; was patronized by Louis XVIII. and Charles X.; created baron 1819. Several large canvases, including *The Battle of Austerlitz* (1810) and a number of portraits, are in the Versailles Museum. D. in Paris, Jan. 11, 1837. W. A. C.

**Gérard de Nerval**, zhā'raar'de-nār'vaal': the pseudonym of GÉRARD LABRUNIE; author; b. in Paris, May 21, 1808. He made his literary *début* with a series of poems which he called *élégies nationales*, and which attracted some attention on account of their controversial character. But his first great literary success was his translation of Goethe's *Faust*, which the old poet himself pronounced a marvel of style, and from which Berlioz borrowed some of the choruses in his *Damnation of Faust*. He also wrote some original dramas, and was a steady contributor to the *Presse* and the *Revue des Deux Mondes*; but toward the close of his life he became insane, and he finally committed suicide in Paris, Jan. 25, 1855. A collected edition of his *Works* appeared in Paris in 1868, in five volumes.

**Gera'sa** (Arabic, *Jerash*): a ruined city 20 miles E. of the Jordan; in a shallow valley about 5 miles N. of the Zerka (ancient *Jabbok*), and about the same distance N. E. of Dibbîn, or Dhibân, where the Moabite Stone was found in 1868. This place is not spoken of in the Bible. It is first mentioned by Josephus (*Jew. War*, 1, 4, 8) as captured by Alexander Jannæus (105–78 B. C.) about 85 B. C. It was one of the ten cities of *Decapolis*. Having been twice destroyed, it was rebuilt with great splendor in the time of the Antonines (138–180 A. D.). Its ruins are the most extensive and beautiful E. of the Jordan. Its walls, in places of the original height, with three of the ancient gateways nearly perfect, inclose a square of about a mile. Inside are ruins of a forum, and of baths, theaters, and temples. Among the ruins are the remains of a Christian church. A bishop of Gerasa attended the Council of Seleucia in 359, another that of Chalcedon in 451. Revised by S. M. JACKSON.

**Gerber**, KARL F. W.: See the Appendix.

**Gerberon**, zhārb'rōṅ', GABRIEL: theologian; b. at St.-Calais, in the department of Sarthe, Aug. 12, 1628. He entered the Benedictine congregation of St. Maur in 1649, and taught philosophy in various schools of the order, but espoused Jansenism so openly in his *Miroir de la piété chrétienne* (Brussels, 1676) that the fury of the Jesuits was aroused, and he had to flee for his life. For twenty-five years he lived in various cities in the Netherlands, and published a great number of books (of which the best known is his *Histoire générale du Jansenisme*, Amsterdam, 1700), but was in 1703 arrested in Brussels at the instance of the Archbishop of Malines and kept in prison until he recanted. Shortly before his death, however, he recalled his recantation. D. at St.-Denis, Mar. 29, 1711.

**Ger'bil** [from Mod. Lat. *gerbillus*, dimin. of *gerbua* (or *jerboa*), from Arab. *yarbū*, gerbil, jerboa]: a name applied to various members of the sub-family *Gerbillinæ*, a group of rat-like rodents, found mostly in Asia, Africa, and Eastern Europe. They have long bushy tails, long hind limbs, and large auditory bullæ. They are active in their movements, and are usually of a delicate shade of brown or fawn color, but frequently possess an offensive odor. These animals are nocturnal in habit and dwell in burrows, where they store up considerable quantities of grain. F. A. L.

**Gerboa**: See JERBOA.

**Gerfalcon**, jêr'faw-k'n, or **Gyr'falcon**: the *Falco gyrfalco* of Iceland, Scandinavia, Asia, and North America, one of the most highly esteemed of the noble falcons used in hawking; was trained with great difficulty, and commanded a very high price. It is about 2 feet long, and has mostly white plumage, especially when full grown. There are several closely related species, among them *Falco islandus* and *Falco candicans*. See FALCON.

**Gerhard**, gār'haart, EDUARD: Greek and Roman archæologist; b. at Posen, Prussia, Nov. 29, 1795. Studied in Breslau and in Berlin under Boeckh; privat docent in Breslau in 1816. After 1819 he traveled repeatedly to Italy. In 1829 he founded the Roman Archæological Institute. In 1844 he was appointed archæologist of the Berlin Museum, to the organization of which he largely contributed, and professor at the university. He is noted as the author of *Antike Bildwerke* (Stuttgart, 1827–44, with 140 copper-plates); *Griechische Vasenbilder* (4 vols., with 330 plates, 1839–58); *Etruscan Mirrors* (4 vols., 360 plates, 1843–68); *Greek Mythology* (2 vols., 1885). His many original contributions have now only an historical interest. D. May 12, 1867. See O. Jahn, *Eduard Gerhard* (Berlin, 1868). ALFRED GUDEMAN.

**Gerhard**, JOHANN: theologian; b. at Quedlinburg, Saxony, where his father was burgomaster or mayor, Oct. 17, 1582; John Arndt was the pastor of his boyhood; studied theology in Wittenberg, Jena, and Marburg; was superintendent, and subsequently superintendent-general, of Saxe-Coburg 1606–16; returned then to Jena as Professor of Theology. D. there Aug. 17, 1637. His *Loci Communes Theologici* (1610–21) is the fullest exposition of Lutheran theology ever published, characterized by erudite thoroughness, transparent clearness, and comprehensiveness. He combines sound judgment, devout spirit, and enormous industry. His *Meditationes Sacræ* (1606) is a devotional work, collecting the choicest sentences from patristic and mediæval writers. He wrote a very extensive controversial work against Roman Catholicism entitled *Confessio Catholica*, and completed the *Harmony of the Gospels*, begun by Chemnitz and continued by Lyser.

Revised by HENRY E. JACOBS.

**Gerhardt**, CHARLES FRÉDÉRIC; chemist; b. in Strassburg, then belonging to France, Aug. 18, 1816; studied chemistry under Liebig; professor at Montpellier 1844–48; pursued chemical investigations in Paris, and was Professor of Chemistry and Pharmacy at Strassburg 1855–56. His *Traité de chimie organique* (1853–56) is a work of great value. Gerhardt's immortality rests upon the reform in chemical notation inaugurated by him, but his early death left the work incomplete. D. in Strassburg, Aug. 19, 1856.

**Gerhardt**, KARL: See the Appendix.

**Gerhardt**, PAUL: German hymn-writer; b. at Gräfenhainichen, Saxony, Mar. 12, 1607. He studied theology at Wittenberg, and was appointed pastor at Mittenswalde in 1651 and at the Church of St. Nicolai in Berlin in 1657. As he refused to subscribe to the edicts of June 2, 1662, and Sept. 16, 1664, which he considered as attempts to unite the Lutheran and Reformed Churches, he was dismissed in 1666, but was in the following year made archdeacon of Lübben. A critical collection of his 131 hymns has been made by Dr. J. F. Baehmann (1866); there are other editions by Wackernagel, Gödeke, and Gerok. Many of his hymns have been translated into English (by Rev. John Wesley, Miss C. Winckworth, Rev. Dr. J. W. Alexander, and Rev. John Kelly) and incorporated with collections of hymns, as, for instance, *O Sacred Head, now Wounded*; *Oh, how shall I Receive Thee?*; *Give to the Winds thy Fears*, etc. There is also a complete translation by John Kelly, *Paul Gerhardt's Spiritual Songs* (London, 1867). "He went back," says Gervinus, "to Luther's most genuine type of hymn as no one else had done, only so far modified as the requirements of his times demanded." The *Life* of Gerhardt was written by Wildenhahn (Basel, 1844; translated into English, Philadelphia, 1881); also by Beeker (Leipzig, 1880); and Wangemann (Berlin, 1884). D. at Lübben, June 7, 1676.

Revised by HENRY E. JACOBS.

**Gerhart**, EMANUEL VOGEL, D. D., LL. D.: a minister and author in the Reformed (German) Church in the U. S.; b. in Freeburg, Pa., June 13, 1817; graduated from Marshall College (1838) and the Mercersburg Theological Seminary (1841). After several years of pastoral and missionary work in Pennsylvania and Ohio, he became in 1851 president of Heidelberg College, and Professor of Systematic and Practical Theology in the Theological Seminary at Tiffin, O. Here he served till 1855. He was president of Franklin and Marshall College, and Professor of Mental and Moral Philosophy there 1855–66, and remained there as professor two years longer. Since 1868 he has been Professor of Systematic and Practical Theology in the Mercersburg Theological Seminary (removed to Lancaster in 1871). Besides many addresses, pamphlets, and articles, he published *Philosophy and Logic* (Philadelphia, 1858); a monograph on

*The Reformed Church* (1863); edited Rauch's *Inner Life*; published a little book on *Franklin and Marshall College*; *Child's Heidelberg Catechism* (1882); *Institutes of the Christian Religion* (vol. i., New York, 1891).

WILLIS J. BEECHER.

**Géricault**, *zhā'rĕĕ'kō'*, JEAN LOUIS ANDRÉ THÉODORE: figure and animal painter; b. at Rouen, France, Sept. 26, 1791. Pupil of Carle Vernet and Guérin; went to Italy and studied in Rome and Florence 1817–19; exhibited his famous picture *The Raft of the Medusa* (now in the Louvre) in Paris in 1819. It stirred up a storm of adverse criticism from the followers of David and the Classicists, but its great merits were finally recognized. Géricault painted horses with wonderful knowledge, and his studies are especially fine in tone. His work in general is sober and honest, and marked by great truthfulness to nature. His influence on his contemporaries was very great, but he did not live to take part in the struggle between the Romanticists and Classicists which was precipitated by the exhibition of his work and that of Delacroix. D. in Paris, Jan. 18, 1824.

**Gericke**, WILLIAM: See the Appendix.

**Gerizim**, *ger'i-zim* [Heb., mountain of the barren places], and **E'bal** [Heb., mountain of stone (?)]: mountains of Western Palestine, about halfway between Jerusalem and Nazareth. They face each other (Deut. xi. 30) across a narrow and exceedingly fertile valley, in which stands the town of Nablous, the ancient *Shechem* or *Sychar*. Gerizim, on the south side of the valley, is 2,849 feet above the sea; Ebal, on the north side, 3,077. Jacob's well and Joseph's tomb are just at the mouth or east end of the valley. Here was Abraham's first encampment W. of the Jordan (Gen. xii. 6). Here the Law was solemnly read in the hearing of the twelve tribes (Josh. viii. 30–35). Gerizim is the sacred mountain of the Samaritans, where the handful that survive (less than 130 in all) still observe the three great festivals of the Mosaic ritual. The temple built there, by permission obtained of Alexander the Great in 330 B.C., was destroyed by John Hyrcanus (135–106 B. C.) about 129 B. C. The spot where it stood is now a platform of naked rock surrounded by slight traces of former walls. The massive ruins near by are probably the ruins of Justinian's fortress built there about 529 A. D. See Robinson's *Biblical Researches*; also his *Physical Geography of the Holy Land* (1865). Revised by S. M. JACKSON.

**Germ**: See EMBRYOLOGY (in plants).

**Germa** (in Gr. ἡ Γέρμα): a city in that part of Phrygia which afterward became GALATIA (*q. v.*). It was a Roman colony, called in Roman times Colonia Julia Augusta Felix, and Latin inscriptions bearing this name prove that Masutkieui on the lower Tembris occupies the site of Germa. (See Ramsay, *Historical Geography of Asia Minor*, pp. 224 and 238.) Justinian visited Germa for the sake of the baths, and built a magnificent palace and public bath-houses. Germa was the seat of a bishop in Byzantine times. J. R. S. S.

**German**, EDWARD: See the Appendix.

**German Catholics**: a sect in Germany which in 1844 seceded from the Roman Catholic Church in consequence of the exhibition of "the holy coat" at Treves. Two elements entered into the composition of the sect. The dominant element was rationalistic, represented by Johannes Ronge, a deposed Roman Catholic Silesian priest, then living in retirement, whose letter of Oct. 1, 1844, to Bishop Arnoldi of Treves inaugurated the whole movement. The weaker evangelical element was represented by Johann Czerski, another Roman Catholic priest of Posen, who had left the Church (Aug. 22) some five or six weeks before the appearance of Ronge's letter. These men came together. The first congregation was that organized in 1844 by Czerski himself at Schneidemühl, under the name of "Christian Catholic." The first creed put forth was the *Confession of Schneidemühl*, drawn up by Czerski. It appealed to Scripture and accepted the Nicene Creed, rejecting indulgences, purgatory, invocation of saints, the Latin mass, communion in one kind, auricular confession, clerical celibacy, the papal supremacy, and some other points. The *Confession of Breslau*, drawn up by Ronge, was less conservative and orthodox. The creed adopted by the council which met at Leipzig Mar. 22, 1845, was substantially Ronge's *Confession of Breslau*. At this time there were more than 100 congregations, and by the end of the year nearly 300. Meanwhile another sect, called "Free Congregations" (*Freie Gemeinden*), composed of rankly rationalistic seceders from Protestant churches, and dating from 1841, had been making considerable headway in Germany. Both of these sects were strengthened by the revolution of 1848, and weakened by the reaction that followed. They came together at Gotha in 1859, under the name of *Bund freireligiöser Gemeinden*, but the vitality of the movement was even then nearly spent. Since then, disintegration and decay have gone steadily on. In 1890 they only numbered in the German empire 5,714 adherents. Governmental hostility (from the start), internal divisions, and, more recently, Old Catholicism, have worked together against a movement which will stand in history as one of very great promise and of very small performance. See F. F. Kampe's *Geschichte der religiösen Bewegungen der neuern Zeit* (4 vols., Leipzig, 1852–60; vol. iv. is a history of German Catholicism). Revised by S. M. JACKSON.

**German East Africa**: the largest of the German colonies; containing approximately 380,000 sq. miles. In 1884 Dr. Carl Peters, Count Pfeil, and Dr. Juhlke, representing the German Colonization Society, secured territorial rights by treaties with native chiefs in the mountain and highland regions behind the Zanzibar coast. Soon after Germany declared a protectorate over these regions. In Mar., 1885, the rights thus secured passed to the German East Africa Company, which took immediate steps to extend its territory. By treaty with the Sultan of Zanzibar (1890) it secured the narrow coast strip claimed by the sultan on payment of 4,000,000 marks. By treaty (1886 and 1890) Germany and England defined their respective spheres of influence. The entire territory thus secured for Germany is under the management of the German East Africa Company, which is largely dependent upon imperial grants for support. It is responsible to the empire, which is represented in the colony by an imperial governor. The seacoast extends from the mouth of the Rovuma river on the S. to Wanga on the N. The boundary then extends inland N. W. to Victoria Nyanza at 1° S. lat., thence due W. to the Congo Independent State. Curiously, the treaty of 1890 provided that the boundary W. of Victoria Nyanza should be deflected so as to include Mt. Mfumbiro in British territory, but it has since been discovered (Stuhlmann, 1892) that the mountain is in the Congo State. The western boundary extends with the Congo State to the north end of Lake Tanganyika, follows the entire east coast of that lake, thence S. E. to Lake Nyassa. The southern boundary follows the Rovuma river to its Msinje affluent, thence due W. to Lake Nyassa and N. to the head of the lake. The chief seaports are Mikandani, Lindi, Kiloa, Dar es Salaam, Bagamoyo, Saadani, Pangani, and Tanga. The company has introduced various cultures with success, particularly at its stations in the highlands of Usambara. Its coffee brings a high price in Europe; its cotton, first exported in 1892, is of excellent quality, and experiments with tobacco are succeeding. In 1892 the building of the first railway from Tanga to the Usambara plantations was begun. This line is projected to Karagwe, W. of Lake Victoria. The broad, geographical features are a low, malarial coast-strip extending inland 60 to 100 miles and farther in the southern portion; further W. is the mountain area, comparatively salubrious and fertile, and 100 miles or more in breadth; semi-arid steppes W. of the highlands embrace nearly a fourth of the total area; and, finally, the extensive elevated and fertile plateaus in the region of the lakes. No part of the territory seems adapted for white colonization, though selected men may live there for years in charge of European enterprises. The natives, mostly of pure Bantu stock, have in places been taught to work for hire on the plantations. The company has 1,200 miles of coast-line on the three largest lakes of Central Africa. The greatest impediments are the hostile influences of the Arabs and the trying climate of most of the country. Fortified military stations are maintained along the caravan routes from the sea to the lakes. Estimated population of the colony (1891) 1,900,000.

The best harbor of German East Africa is Dar es Salaam (Haven of Peace), about 50 miles S. of Zanzibar. It offers good anchorage for vessels of medium tonnage and is important as a transfer point for goods going to or coming from the interior. The harbor is not very easy to enter on account of the long, narrow channel bordered by coral reefs. It is the only port on the east coast N. of Lourenço Marques where the building of a wagon road to the interior has been considerably advanced. The town is built upon a cliff, once a coral reef, and contains about 10,000 people, coast natives, Arab and Indian traders, and Europeans.

See *Travels* of Burton, Speke, Cameron, Stanley, Thomson, and Elton; Baumann's *Usambara und seine Nachbargebiete*

(Berlin, 1891); Meyer's *Across East African Glaciers* (translated, London); Westphal's *Sanzibar und das deutsche Ostafrika*; Reichard's *Deutsch-Ostafrika* (Leipzig, 1892); and the *Deutsche Kolonialzeitung*. C. C. ADAMS.

**German Empire, The**: the empire established in 1871 by the union of the German states of Central Europe under the leadership of Prussia. It is bounded N. by the North Sea, Denmark (Jutland), and the Baltic; E. by Russian Poland and Galicia; S. by Austria from the Vistula to the Lake of Constance, and by Switzerland; and W. by France, Luxembourg, Belgium, and the Netherlands. It lies between lats. 47° 16′ and 55° 53′ N. and lons. 5° 25′ and 22° 25′ E. of Greenwich, and a diagonal line drawn across it from S. W. to N. E. measures 862 English miles. Area, 208,670 English square miles. Population (1890) 49,428,470; (1895) 52,279,901; Dec. 1, 1900:

| STATES. | Area, Eng. sq. m. | Population, Dec. 1, 1900. | Inhabitants to 1 sq. m. |
|---|---|---|---|
| Prussia | 134,463 | 34,463,377 | 256·0 |
| Bavaria | 29,282 | 6,175,153 | 210·9 |
| Würtemberg | 7,528 | 2,165,765 | 287·7 |
| Baden | 5,821 | 1,866,584 | 320·6 |
| Saxony | 5,787 | 4,199,758 | 725·7 |
| Mecklenburg-Schwerin | 5,135 | 607,835 | 118·3 |
| Hesse | 2,965 | 1,120,426 | 377·8 |
| Oldenburg | 2,479 | 398,499 | 160·7 |
| Brunswick | 1,424 | 464,251 | 326·0 |
| Saxe-Weimar | 1,388 | 362,018 | 260·8 |
| Mecklenburg-Strelitz | 1,131 | 102,628 | 90.7 |
| Saxe-Meiningen | 953 | 250,683 | 263·0 |
| Anhalt | 906 | 316,027 | 348·8 |
| Saxe-Coburg-Gotha | 755 | 229,567 | 304·0 |
| Saxe-Altenburg | 511 | 194,273 | 380·1 |
| Lippe | 469 | 139,238 | 296·8 |
| Waldeck | 433 | 57,913 | 133·9 |
| Schwarzburg-Rudolstadt | 363 | 92,657 | 255·2 |
| Schwarzburg-Sondershausen | 333 | 80,678 | 242·3 |
| Reuss-Schleiz | 319 | 138,993 | 435·7 |
| Schaumburg-Lippe | 131 | 43,132 | 329·3 |
| Reuss-Greiz | 122 | 68,287 | 559·7 |
| Hamburg | 158 | 768,349 | 4,862·9 |
| Lübeck | 115 | 96,775 | 841·5 |
| Bremen | 99 | 224,697 | 2,269·6 |
| Alsace-Lorraine | 5,600 | 1,717,451 | 306·7 |
| Totals | 208,830 | 56,345,014 | 269·3 |

*Surface.*—With respect to its surface, Germany consists of three different regions—the alpine region along the southern frontier, the mountain region of Central Germany, and the North German lowland. Of the Alps, only some of the less elevated northern ranges belong to the empire—those which extend from the Lake of Constance eastward to the vicinity of Salzburg on the Salzach. The westernmost of these ranges are known as the Algauer Alps. These are grandest near the sources of the Stillach and the Trettach, which form the Iller; here the Bavarian territory stretches far into Tyrol, and on the frontier rise the Mädeler Gabel (8,670 feet) and Hoch Vogel (8,494 feet). The Bavarian Alps extend from the Lech eastward to the Inn; the Zug Spitze is the highest peak of the empire (9,515 feet). The Salzburger Alps, E. of the Inn, and within the boundaries of the empire (Bavaria), are most remarkable at Reichenhall and Berchtesgaden, two places in the vicinity of Salzburg, among magnificent alpine surroundings. To the S. of Berchtesgaden, which lies 1,900 feet above the level of the sea, is situated the King's Lake, the most beautiful lake of the empire, 1,980 feet above the sea, in the center of a magnificent landscape, in which arise to the W. the Watzmann (8,900 feet) and to the S., but within the Austrian frontier, the Stone Sea (8,950 feet), and the mountain of Hochkönig (9,312 feet).

Along the northern terminations of the Alps the Swabian-Bavarian plateau extends; to the S. W. it stretches beyond the boundaries of the empire into Switzerland, as far as the Lake of Geneva, and to the E., in Austria, it connects with the plain of the March and the Hungarian lowlands. A fine hilly landscape spreads along the foot of the Alps, dotted with beautiful lakes (Ammer, Würm, and Chiem in Bavaria): to the S. of the Ammer Lake the Hohe Peissenberg (3,185 feet) offers a splendid prospect. Otherwise the plateau is uniform, and even more monotonous than many parts of the North German lowland. Large, partly uncultivated swamps are found in several places: those below Munich (1,700 feet above the sea) include the Dachau Moss on the left and the Erdinger Moss on the right bank of the Isar, and between Ulm and Ingolstadt the intricate Danube swamps. The fertility of the plateau is very slight in the center, around Munich, where large forests abound, but very great between the Inn and the Danube, especially at Straubing, the granary of Bavaria. Those parts of the plateau which belong to Würtemberg are more varied with hills and vales, but even there the fertility of the soil is not great. The climate is generally rough, and vine-cultivation succeeds only on the opposite side of the plateau, at the Lake of Constance.

The mountains of Central Germany are separated from the Alps by the Swabian-Bavarian plateau, but connected with the Carpathian Mountains between the sources of the Oder and the Vistula. They consist of three systems: the Rhenish-Westphalian slate mountains, or the Batavian system; the Rhenish system; and the Hercynian or Sudetic system. (1) The Rhenish-Westphalian, or the Batavian system, is of no considerable height, but is cleft by many deep river-valleys. It occupies parts of Rhenish Prussia, Westphalia, and Hesse-Nassau, and is traversed by the Rhine, which between Bingen and Bonn forms a deep and often very narrow valley. To the W. of the Rhine the Moselle forms in the slate mountains a deep and very winding valley between Trier and Coblenz, separating the Hunsrück from the Eifel. The southern boundaries of the system are designated by the coal-hills of Saarbrück, at the southernmost point of Rhenish Prussia, and the beautiful group of the Donners Berg (2,267 feet) in Rhenish Bavaria. N. of the Moselle, the Eifel forms a plateau, the highest point of which is the Hohe Acht (2,493 feet). The northwestern part of Eifel, the Hohe Venn (2,280 feet), situated S. of Aix-la-Chapelle, is entirely bare, and constitutes the most inhospitable region of the empire. On the eastern side of the Rhine the hill-ranges of the Hunsrück are continued by those of Taunus. They are rich in forests and mineral springs, slope rather abruptly to the S., toward the lowland of the upper Rhine, and to the E., toward the Wetterau, but rise in Feldberg to the height of 2,890 feet, and are celebrated for their magnificent vineyards, especially along the foot of the western part of them, the so-called Rhinegau, at Rüdesheim, Johannisberg, and Assmannshausen. (2) The Rhenish system follows the course of the Rhine from Basel to Mainz, whence it continues in the same direction, but to the E. of the slate mountains, to the Weser. With its two highest branches, the Vosges and the Black Forest, it incloses the low plain of the upper Rhine, which stretches on both sides of this river from Basel to Mainz, and which must be considered as the finest region of Germany, on account of the fertility of the soil, the mild climate, the excellent fruit, and the superior wine. Although the Vosges in Alsace-Lorraine and France, and the Black Forest in Baden and Würtemberg, are separated by the low plain of the upper Rhine, they show many similarities; the same height—Sulzer Belchen in the Vosges is 4,680 feet, Feldberg in the Black Forest 4,900 feet; the same abrupt descent toward the plain in the regions of the older formation, and the same gentle declivity in those of the later; the same construction—granite, gneiss, and Devonian strata in the higher parts, though the latter are more prominent in the Black Forest, the former in the Vosges. Also the beauties of nature, the traditions, and the ruins are similar, though they certainly are much richer in the Vosges. But while the Black Forest entirely disappears between Carlsruhe and Pforzheim, the Vosges reach to the latitude of Strassburg in their full height, and continue then through lower formations of red sandstone into Rhenish Bavaria, where at Kaiserslautern a connection takes place with the slate mountains. To the E. of the low plain a small range of hills connects the Black Forest with Odenwald, which, chiefly extending between the Neckar and the Main, encircles Heidelberg, and is separated from the Spessart by the Main. Odenwald and Spessart are also very similar, being of the same height (about 2,000 feet) and same formation, sandstone prevailing, with granite and gneiss on the western side. E. of the sandstone formation follows, from Heidelberg to Nuremberg, a formation of shell-limestone and red sandstone, the Swabian-Franconian terraces. This region of terraces extends as far as the Jura Mountains, which rise very abruptly from it, while on the other side they slope gently down toward the Swabian-Bavarian plateau. The German Jura is a continuation of the Swiss Jura, but differs very much from it. It has not those parallel ridges which characterize the Swiss Jura; it rises in elevated flats, traversed by valleys. At some elevations there is a general scarcity of water, as the water sinks very rapidly through the Jurassic limestone, and forms copious springs at the foot of the mountains and in the deep valleys. Numerous caves are found, especially in Würtemberg and Franconia, among

GERMAN EMPIRE
Scale of Eng. Miles
0 50 100
Longitude
Longitude East
NORTH SEA
DENMARK
SCHLESWIG
HOLSTEIN
HAMBURG
LUBECK
MECKLENBURG
BREMEN
HANOVER
BRUNSWICK
HOLLAND
AMSTERDAM
ROTTERDAM
BELGIUM
BRUSSELS
ANTWERP
BRUGES
GHENT
LILLE
RHENISH PRUSSIA
COLOGNE
DUSSELDORF
COBLENZ
TREVES
WESTPHALIA
MUNSTER
DETMOLD
CASSEL
FRANCE
PARIS
METZ
NANCY
STRASBURG
MANNHEIM
DARMSTADT
FRANKFORT
WURZBURG
BAVARIA
MUNICH
STUTTGART
CARLSRUHE
SWITZERLAND
BERNE
GENEVA
LYONS
DIJON
BESANCON
TROYES
AUXERRE
CHALONS-SUR-MARNE
MEZIERES
LAON
AMIENS
ARRAS
MONS
LIEGE
AIX-LA-CHAPELLE
INNSPRUCK
ITALY
Milan
Lake Maggiore
Lake of Como
Lake of Garda
Lake Neuchatel
Lake Geneva
Mont Blanc
Mt. Cenis
Simplon Pass
St. Gothard
Rhine
Elbe
Danube
Moselle
Meuse
Seine
Rhone
Saone
Loire
Marne
Aisne
Oise
Somme
Scheldt
Ems
Weser
Inn
Adige
Po
Mouths of the Meuse
Mouths of the Scheldt
Helgoland
Heligoland
Frederica
Copenhagen
Zuyder Zee
Dunkirk
Calais
Boulogne
Ostend
Antwerp
Cambrai
Maubeuge
Charleroi
Namur
Verviers
Malmedy
Bonn
Coblenz
Mayence
Wiesbaden
Frankfort
Hanau
Darmstadt
Mannheim
Heidelberg
Carlsruhe
Stuttgart
Strasbourg
Colmar
Mulhausen
Schaffhausen
Constance
Zurich
Lucerne
Glarus
Chur
Lausanne
Vevay
Thonon
Chambery
Annecy
Bourg-en-Bresse
Chalon-sur-Saone
Macon
Lons-le-Saulnier
Besancon
Vesoul
Belfort
Epinal
Chaumont
Troyes
Sens
Joigny
Auxerre
Dijon
Beaune
Autun
Nevers
Moulins
Clermont
Limoges
Bordeaux
Toulouse
Marseille
Nice
Genoa
Turin
Venice
Verona
Mantua
Bologna
Florence
Pisa
Leghorn
Rome
Naples
Palermo
Messina
Catania
Malta
Corsica
Sardinia
Sicily
Cape Bonifacio
Cape Spartivento
Cape Passero
Cape Trapani
Cape Corse
Cape Creus
Cape Finisterre
Cape Ortegal
Cape Bayonne
Cape Gris Nez
Cape Grisnez
Cape Wrath
Cape Clear
Cape Lizard
Cape Ushant
Cape Frehel
Cape Hague
Cape Barfleur
Cape Antifer
Cape Cornwall
Cape Finisterre
Cape Ortegal
Cape Bayonne
Cape Gris Nez
Cape Grisnez
Cape Wrath
Cape Clear
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Cape Ushant
Cape Frehel
Cape Hague
Cape Barfleur
Cape Antifer
Cape Cornwall

Landskrona
from G 14 Greenwich H16 I 18 J20 K 22
SWEDEN
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Dirschau
Rummelsburg
Belgard
Schievelbein
Politz
Gollnow
STETTIN
Stargard
POMERANIA
Soldin
Friedberg
BROMBERG
Landsberg
R. Warta
Rogasen
Gnesen
POSEN
Kustrin
Schwerin
BERLIN
Drossen
Frankfort on the Oder
BRANDENBURG
Zullichau
Kosten
Lubben
Guben
Gruneberg
Lissa
Sommerfeld
Cottbus
Fraustadt
Glogau
Rawitsch
Spremberg
Sagan
LIEGNITZ
Bautzen
Liegnitz
DRESDEN
CHEMNITZ
Gorlitz
Freiburg
Schweidnitz
Bielau
Frankenstein
SUDETIC MTS.
Leitmeritz
Jung Bunzlau
Koniggratz
Kolin
Rakonitz
PRAGUE
Kuttenberg
BOHEMIA
Pilsen
Klattau
Pisek
Budweis
BOHMER WALD
BAVARIA
Alten Otting
Memel
R. Russ
Niemen or Memel R.
Tilsit
R. Gilge
Schirwind
GULF OF DANTZIC
KONIGSBERG
R. Pregel
Insterburg
Gumbinnen
Wehlau
Eylau
EAST PRUSSIA
Braunsberg
Elbing
Marienburg
Allenstein
Snirding L.
Augustowo
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MARIENWERDER
Neuenburg
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Inowrachw
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Lomza
R. Narew
Ostrolenka
Pultusk
R. Bug
Plock
RIVER VISTULA
WARSAW
Praga
R. Warta
Siedlce
POLAND
Pleschen
Kalisz
Ostrowo
Lodz
R. Pilica
Piotrkow
Radom
Lublin
Kempen
Kielce
Sandomirz
Kreuzberg
BRESLAU
Brieg
OPPELN
Oppeln
Gross Strelitz
Beuthen
Kosel
Ratibor
R. Vistula
CRACOW
Wieliczka
GALICIA
Jagerndorf
Troppau
Oderberg
Teschen
Sternberg
Zwittau
Weisskirchen
Neutitschein
Olmütz
Prerau
MORAVIA
Kremsir
BRUNN
Trebitsch
Austerlitz
Nikolsburg
CARPATHIAN MTS.
Teplicz
R. Waag
Eperies
Kaschau
Schemnitz
R. Gran
Miskolcz
Tokay
DANUBE
LINTZ
Steyer
VIENNA
Presburg
Baden
AUSTRIA
Neustadt
Lake of Neusiedl
Oedenburg
Comorn
Gran
Waitzen
HUNGARY
Theiss
Debreczyn
BUDAPEST
Raab
Salzburg
Hallein
R. Enns
Bruck
STYRIA
Judenburg
GRATZ
River Raab
Balaton Lake
Stuhlweissenburg
CANAL
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CARINTHIA
Villach
Klagenfurth
Marburg
Szegedin
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which that at Muggendorf is famous for the remains it contains of extinct animals. (3) The Hercynian or Sudetic system comprises the northeastern part of the mountains of Central Germany, and has a general direction from S. E. to N. W. It consists of two well-marked mountain-lines. The southern contains the Bohemian forest, the Fichtel range, the Thuringian forest, and the Teutoburger forest; the northern, the mountains of Silesia, the Harz, and the Weser Mountains. The Bohemian forest forms the boundary between Bohemia and Bavaria. The highest points are the Great Arber (4,767 feet) and the Great Rachel (4,747 feet). The Fichtel range forms the center of the German mountains, those of German Austria included, and is about 280 English miles from the beginning of the delta of the Rhine, the mouths of the Weser and Oder, and the cities of Pressburg, Trent, Basel, and Strassburg. From it the Eger flows eastward, and the Saale northward, both to the Elbe; the Main westward to the Rhine, and the Naab southward to the Danube. The highest points are the Schnee Berg (3,460 feet) and the Ochsen Kopf (3,330 feet). The Fichtel Gebirge are connected with the Thüringer Wald. The Thüringer Wald, so important as the boundary which separates the Franconians in the S. from the Thuringians in the N. forms to the S. E. a broad plateau, but to the N. W. a real edge, terminating in a cone at Eisenach on the Werra. The highest points are the Great Beerberg (3,225 feet) and the Schneekopf (3,210 feet), both situated on the Schmücke; farther to the N. W., the Inselsberg (3,035 feet), and at Eisenach the celebrated Wartburg. To the N. of the Thüringer Wald the Thuringian terraces extend to the Harz, the plateau of Eichsfeld forming the watershed between the Weser and the Elbe. The Harz is an isolated group of mountains, 56 English miles long, situated between the Leine and Saale, and sloping abruptly to the N. toward the lowland. Its most beautiful points are found along its northern border, the Selke valley, the Bode valley, Viktors Höhe, Ilse valley, and the Brocken, the highest point (3,742 feet), from which the plateau of the upper Harz stretches to the W. and that of the lower Harz to the E. From the Fichtel range the Erz Mountains stretch to the N. E., forming the boundary between Saxony and Bohemia. They are steep toward the valley of the Eger, but slope gently toward the low plain in the north along the Mulde. Keil Berg (4,060 feet) and Fichtel Berg (3,950 feet) are the highest points. At the Elbe above Pirna are the sandstone mountains of the Elbe, which, under the name of Saxon Switzerland, have acquired a fame not quite deserved. In the basin of the upper Bober rise the Riesen Mountains, on the boundary between Silesia and Bohemia. This group contains the highest mountains of Central Germany, well-marked ridges, covered with forests. The highest point is Schneekoppe (5,252 feet).

The North German lowland is only a small part of the great European lowland, which occupies almost the whole of Eastern Europe, and to the W. reaches as far as the Strait of Dover. In Germany that part of the lowland which lies to the W. of the Elbe differs very much from that which lies to the E. Fertile "marshes" extend along the North Sea, also on the eastern side of the Elbe along the whole western coast of Schleswig-Holstein. They generally lie so low that they must be protected against the sea and the rivers by dikes. Here, in the western part of the German lowland, large swamps alternate with sandfields, and real hill-ranges do not appear to any extent, except in the vicinity of the Elbe. In the eastern part, on the contrary, hill-ranges appear, and stretch eastward to the Ural Mountains. Of special interest is the Baltic-Uralic "lake plateau" which begins in Jutland, curves around the Baltic through Schleswig, Holstein, Mecklenburg, Brandenburg, Pomerania, and Prussia, is traversed by the Oder and the Vistula, and forms in Russia a most important watershed. It consists of broad, undulating uplands, rich in lakes, and rises in Prussia to a height of 1,040 feet. A similar upland traverses the southern part of Brandenburg and Northern Silesia, and merges in the east with the hills of Poland. Between these two uplands extend broad lowlands, especially in Brandenburg, along the Havel, the Spree, and the Oder, and these lowlands have made it easy to establish communication by canals between the Elbe, Oder, and Vistula.

*Hydrography.*—The empire borders on two seas, the North Sea and the Baltic. In the North Sea the usual tide rises 10 feet, the highest spring-flood 26 feet. A number of low islands lie off the Friesland coast, to the W. of the Weser, and off Schleswig, known collectively as Frisian islands, while Heligoland, ceded by Great Britain, lies in the open sea off the month of the Elbe. The sea between these islands and the mainland is shallow and abounds in sandbanks (*Watten*). The Gulfs of Dollart and Jade cut deeply into the mainland; and gulfs or bays are formed by the widening of the Weser, Elbe, and Eider at their mouths. The Baltic has no tides. A remarkable feature are the Haffs, large fresh-water lakes or estuaries of rivers—the Pomeranian Haff, the Frische Haff, the Kurische Haff, etc. Germany owns parts of seven large river-basins and three large coast-streams. Of the latter, the Pregel flows to the Baltic, and the Eider and Ems to the North Sea; of the former, the Memel, Vistula, and Oder flow to the Baltic, the Elbe, Weser, and Rhine to the North Sea, and the Danube to the Black Sea. Of all these rivers, the Weser is the only one which belongs entirely to the empire—of the Elbe, the Oder, and the Rhine, the larger half. The principal of these rivers are described in separate articles.

*Climate.*—The empire is situated in the temperate zone. Only a few peaks of the Alps on the southern boundary of Bavaria rise into the snow-region. In the other mountains there are also a few points where the snow may last into the summer, and sometimes the whole year round. Rain falls in every month, but is more abundant in summer (July). The annual average for the whole of Germany is 28 inches (North German lowlands, 24 inches; mountain region of Central Germany, 28 inches; Southern Germany, 33 inches). It is least in Mecklenburg and the Rhine valley between the Vosges and the Black Forest, and more considerable in the mountain districts (summit of Brocken, 70 inches). The mean annual temperature, apart from the mountainous districts, varies between 44° F. (Königsberg, Memel) and 51° F. (Mannheim), the mean temperature of July between 63° F. (Memel) and 68° (Mannheim), that of January between 25° F. (Königsberg) and 35° F. (Cologne). The most favored region, as far as climate is concerned, is the broad plain of the Rhine, which stretches from Frankfort to Basel, and is bounded on all sides by mountains (the Taunus in the north, the Vosges and Black Forest to the W. and E.). Here the summers are warm, the winters not too severe, the rainfall sufficient. The ice lies generally 26 days on the Rhine, 30 on the Weser, 62 on the Elbe, 70 on the Oder, 86 on the Vistula, and 116 on the Memel. Storms are more numerous and violent in the south than in the north. Heavy earthquakes, such as occur in Southern Europe, have never been observed.

*The flora* and *fauna* are those of Central Europe generally, but western, northern, and eastern types are discovered by the botanist to have penetrated far inland. Luxuriant meadows and dense forests of conifers or deciduous trees form the leading features of the landscape, and forests cover all the mountain-slopes, only the highest summits reaching above them. The chestnut has its northernmost boundary between Coblenz and Cologne, but it is found at Wernigerode in the Harz; the red beech stops a little S. of Königsberg; the peach ripens in the open air in Rhenish Prussia and farther S.; but the walnut succeeds even in Eastern Prussia. The vine is cultivated to the S. of a line extending from Bonn on the Rhine to Naumburg on the Saale and Grünberg on the Oder, and table grapes are produced even farther N. in favorable localities. The flowering of fruit-trees takes place in Memel eight days later than at Königsberg, three weeks later than at Berlin, and four weeks later than on the Rhine.

Many wild animals, which were common in former times, have disappeared. Elk are found only in a few preserves in Eastern Prussia; the aurochs became extinct in 1755; the last bear was killed in 1835; the wolf still haunts the large forests of Prussia; the lynx and wild cat have become scarce, while the wild boar would have become extinct long since were it not protected for the sake of sport. The beaver, which was of old an inhabitant of all the German rivers, is seen only in the Danube and its southern tributaries, and in the Elbe near Dessau. The tortoise is confined to the Havel.

*Population.*—The total population increased from 30,608,700 in 1834 to 56,345,014 in 1900. This increase up to the year 1840 was nearly uniform in all parts of the empire, and showed nearly the same proportions in city and country. But the building of railways and the general increase of manufacturing industry effected a change. Large numbers of the inhabitants left the agricultural districts, especially in the flat lowlands, and gathered in cities or districts favorably situated for manufacturing business. This movement was apparent even before 1867, and after that time

it became still more striking. In 1867 the number of large towns of over 100,000 inhabitants was only 7, with a total population of 1,657,517 souls. In 1895 there were 27 such towns with 7,159,807 inhabitants. The largest of these were Berlin (1,677,304); Hamburg (625,552); Munich (407,174); Leipzig (398,448); Breslau (373,206); Dresden (334,066); Cologne (321,431); and Frankfort-on-Main (229,299). (See the Appendix.) On an average there are (1900) 270 inhabitants to a square mile. The population is most dense in the kingdom of Saxony and the manufacturing districts on the lower Rhine. The birth-rate is 40 to 1,000 inhabitants, the death-rate 28, and the annual excess of births over deaths averaged 846,871 in 1898, but, owing to a very active emigration, this is far in excess of the actual increase of the population. This emigration has fluctuated considerably in different years, for while in 1862 it only embraced 27,529 individuals, it rose in 1881 to 220,902. The number of emigrants, 1887–92, was 644,271 persons, of whom 601,897 embarked for the U. S. Between 1820 and 1892 the emigration to the U. S. numbered nearly 5,000,000 individuals. In addition to this emigration, which is directed to countries outside Europe, Germany annually sends many emigrants to European countries, including more especially France and Southeastern Europe. There are about 104 females to every 100 males.

*Language.*—German is the mother-tongue of the bulk of the population, and is spoken in a number of dialects, namely, Frisian, Low German, and Upper German, the language of culture being known as High German (*Hochdeutsch*). The leading German "tribes" are the Frieslanders, Saxons, Franks, Swabians, Alemannes, and Bavarians, including Austrians. The non-German speaking inhabitants of the empire are about 7 per cent. of the total population. They include Poles (2,513,000), in Prussia proper, Posen, and Silesia; Lithuanians (150,000), to the E. of the river Memel; a few hundred Kures, the kinsmen of the now extinct Prussians, around Memel; Czechians and Wends (180,000), in Brandenburg, Saxony, and Silesia; Danes (140,000), in Northern Schleswig; Walloons (9,600), at Malmedy, on the Belgian frontier; and French (220,000), in Alsace-Lorraine.

*Religion.*—In 1890 the population included 31,026,810 Protestants (62·8 per cent.); 17,674,921 Roman Catholics; 145,540 Christian sectarians; 567,884 Jews. Roman Catholics were in a majority in Alsace-Lorraine (78 per cent.), Rhenish Prussia, Bavaria, Posen, Baden, Silesia, and Westphalia. The relations between Church and state are intimate, and the ministers of Roman Catholic as well as of Protestant congregations are in receipt of salaries and other subsidies from the government. In the Protestant states the sovereign is, as a rule, head of the Church, while the Roman Catholics are placed under 5 archbishops and 20 bishops.

*Education* is compulsory throughout Germany. Education is more backward in the eastern provinces of Prussia, with their Polish population, most advanced in Würtemberg, Baden, the old free towns, and some of the minor states. Most of the elementary schools are denominational. There are about 58,300 of these schools, with 8,120,000 pupils and 120,000 teachers, all of whom must hold certificates, and whose training is attended to in 256 seminaries. The number of secondary schools (*Bürgerschulen*) is very large, while of high schools there are 1,192, including 427 *Gymnasia*, or classical schools. The number of technical and industrial schools is very large. They include 9 polytechnic high schools, 31 agricultural colleges, 9 schools of forestry, 23 of art and art-industries, 7 music conservatories, a naval college at Kiel, military academies at Berlin and Munich, 49 navigation schools, and many others. Of universities there are 21, with (in 1900) 2,777 professors and 34,089 students. The universities having the largest number of students are Berlin (5,105), Leipzig (3,269), and Munich (4,391). See SCHOOLS.

*Agriculture.*—The country is mainly an agricultural one. In 1895–96 the yield (in tons of 2,200 lb.) was as follows: Wheat, 2,807,557; rye, 6,595,758; barley, 2,411,731; oats, 5,252,590; potatoes, 31,786,621; hay, 21,001,621; sugar beet-root, 11,196,390; beets for fodder, 9,265,607; and hops, 30,181. In the same year 44,256,014 gal. of wine were produced.

Notwithstanding her own very considerable production, Germany is dependent upon foreign countries (the U. S. and Russia) to satisfy her ever-increasing demand for food-products. Rye is the principal cereal cultivated for food. Maize grows only along the Rhine and the Neckar. The potato yields the raw material for (1898–99) 60,926 distilleries, which produced 83,942,518 gal. of alcohol; while the beet is made into sugar (in 1898–99 the yield was 1,627,072 metric tons of raw sugar and 305,869 tons of molasses). The cultivation of flax and hemp, which thrive in hilly regions, has been decreasing, as has also that of oil-seeds, in consequence of the large importation of petroleum from the U. S. The principal dyestuffs produced are madder, safflower, and wood.

Erfurt is famous among German towns for its horticultural produce. Fruit-trees are grown throughout Germany, but especially in the southwestern part, where even almonds, figs, and Spanish chestnuts succeed in favorable localities. The vine yields her choicest juice on the slopes of the Taunus in the Rheingau. Hops succeed best in Franconia, and Bavaria produces the best beer (total (1898–99) for all Germany, 1,491,556,000 gal.). The tobacco cultivation is carried on more especially in the Palatinate, Baden, and Alsace, and yielded (in 1894–95) 38,317 tons.

*Domestic Animals.*—Horses are bred more especially in East Prussia, Schleswig-Holstein, Oldenburg, in the north, Alsace, Würtemberg, and Bavaria, in the south. Cattle-breeding is most successfully practiced in the "marshes" along the North Sea (Friesland, Oldenburg, Schleswig-Holstein), and in the mountainous districts of the south (Algäu). The genuine merino sheep of the Escorial breed was introduced into Germany in the latter part of the eighteenth century; later on, another breed, also Spanish, the Negretti, spread into Silesia from Bohemia and Moravia; and in 1820 a crossing of these two breeds was effected, and resulted in the improved Escorial-Negretti, which was introduced generally. The great wool-markets are Berlin and Breslau. Westphalia is famous for its hams; Brunswick for its sausages. Bees are most extensively kept in Hanover (Lüneburg Heath). Germany exports sheep and cattle, but imports pigs and horses.

*Mining.*—The produce of the mines and salt-works was valued, in 1899, at $250,138,000. This included 101,621,900 tons of coal, 34,202,400 tons of lignite, 17,989,700 tons of iron ores, 3,361,400 tons of salt, and 1,871,700 tons of other products. The metals of all kinds produced in 1898 had a value of 584,424,315 marks ($139,092,986). They included 7,312,766 tons of pig iron, 154,867 tons of zinc, 706,400 tons of zinc ore, 132,742 tons of lead, 161,600 tons of lead ore, 30,695 tons of copper, 633,400 tons of copper ore, 481 tons of silver, 993 tons of tin, and gold to the value of 7,913,410 marks. There are about 350,000 miners besides 47,000 men employed in smelting-works. The iron industry, as a whole, employs 260,807 men. There are seven layer coal-fields, viz., those of Upper Silesia (540 sq. miles); Lower Silesia, the Ruhr (340 sq. miles); Aix-la-Chapelle, the Saar (Saarbrücken), Dresden (Pottschappel), and Chemnitz. The deposits of lignite are still more extensive. Peat is found in the moorlands of North Germany and on the Bavarian plateau. Various kinds of bituminous shale are utilized for the manufacture of mineral oils; asphalt is found near Hanover; amber on the coast of the Baltic.

The richest deposits of iron ore are found in Westphalia, in Nassau, and in Lorraine the largest of all. Iron in smaller quantities, but sometimes of superior quality, is also found in the Fichtel Mountains and elsewhere. The most important iron works are those of Upper Silesia (Beuthen), of Bochum, Dortmund, Siegen, and Essen on the lower Rhine, of Saarbrücken, and Northern Lorraine.

Zinc is the most important metal next to iron. It is obtained in Upper Silesia (Beuthen) and in Rhenish Prussia (Aix-la-Chapelle, Arnsberg). Other metals of some importance are copper, lead (Bleiberg near Aix-la-Chapelle), antimony, cobalt, nickel, manganese, and mercury. Silver has been mined near Freiberg in Saxony since 1168.

The production of salt increases every year. Many of the salines, however, have ceased to be worked since the discovery of the large strata of rock-salt. Among these, that in the Alps of Salzburg has been in operation for a long time. In 1816 the rock-salt layers were reached in Würtemberg by boring, in 1853 those at Stassfurt in the province of Saxony, and since that time many others in different places around the Thüringer Wald and the Harz. In the North German lowland rock-salt layers of immense depth were discovered by boring, in 1867 at Sperenberg in Brandenburg, in 1868 at Segeberg in Schleswig-Holstein, and in 1871 at Inowrazlaw in Posen. The average annual production of rock-salt amounts to more than 800,000 tons. Germany is very rich in mineral springs. The most important are Baden-Baden in Baden; Kissingen in Bavaria; Wiesbaden, Homburg, Ems, and Nieder-Selters in Hesse-Nassau; Aix-la-Chapelle in Rhenish Prussia; and Pyrmont in Waldeck.

*Manufactures.*—The manufacturing industry of Germany has been subject to immense fluctuations. It was influenced by the civil war in the U. S.; and after the close of the war against France it rose at once to a height which none had ever expected, but from which it fell in 1873, partly in consequence of fraudulent operations, from which, however, it has since revived. The chief manufacturing centers are in the provinces of Rhenish Prussia, Westphalia, Brandenburg, Silesia, and Saxony; in the kingdoms of Saxony, Würtemberg, Alsace-Lorraine, and parts of Bavaria, Thuringia, and Baden. (1) The manufacture of woolens employs about 250,000 hands. The raw material is partly imported from other countries, especially from Australia. To provide the cloth-factories with yarn, about 2,600,000 spindles are in operation in different spinning-factories, situated mostly in the cloth-manufacturing districts, but also in Upper Alsace and in the kingdom of Saxony. The cloth-manufacturing industry has its principal centers in Rhenish Prussia, Southern Brandenburg, Lusatia, Western Saxony, and Alsace. In Apolda hosiery is made; in Gera, fine woolens. Carpets and shawls in Berlin; Turkish carpets in Schmiedeberg in Silesia. (2) The flax and hemp industry is increasing, but as yet demands a considerable importation of raw material from Russia, and of yarn from Great Britain and Belgium. The center of this industry is Bielefeld in Westphalia and its vicinity, where, besides the spinning and weaving factories, 4,000 hands are employed in the manufacture of home-made linen. Other centers are at Zittau in Lusatia and in the Silesian mountains. In the whole empire there are about 60 linen-factories, with 300,000 spindles and about 250,000 looms for the manufacture of linen. (3) Cotton manufacture has its chief seats at Mülhausen (Alsace) and Zwickau (Saxony), but is also carried on at Augsburg, Kaiserslautern, Esslingen, and other places. There are 7,000,000 spindles and 300,000 power-looms. (4) The silk and velvet manufactures have their centers at Crefeld, Elberfeld, Barmen, and Viersen, all in Rhenish Prussia. Crefeld alone produces annually goods valued at $17,000,000. (5) The manufacture of metal goods is the chief industrial pursuit in large parts of Westphalia, Rhenish Prussia, and Lorraine. Essen, Bochum, and Witten are noted for their steel-works; Solingen for swords and bayonets; Remscheid for cutlery; Altona for wire; Aix-la-Chapelle and Burtscheid for pens, pins, and needles; Suhl, Amberg, and Sömmerda for firearms; Berlin for iron-castings and electro-plated ware; Pforzheim and Hanau for jewelry. The largest establishment for the manufacture of cast steel, and generally the largest industrial establishment of the empire, is that of Krupp at Essen in Rhenish Prussia, which employs 12,000 men and is famous for its cannon. (6) The first steam-engine in Germany was put in operation Apr. 4, 1788, at Friedrichshütte, near Tarnowitz, in Upper Silesia. In 1860 most of the locomotives and machines were imported from foreign countries, but since that time the machine-works have improved so much that they are capable not only of satisfying all domestic wants, but even of exporting. Since 1867 the exportation of machinery from the Zollverein has exceeded the importation. In the whole empire there are 750 machine-works, employing 90,000 hands. The most prominent places are Berlin (locomotives and sewing-machines), employing more than 15,000 hands; Chemnitz, with more than 10,000 workmen; Mülhausen in Alsace; and various towns in the kingdom of Saxony. (7) Among more than 100 porcelain-factories that of Meissen in Saxony is the most famous. It was established in 1710, is the oldest in Europe, and supplies so-called Dresden china. Other famous factories are those of Berlin, Waldenburg, Nympfenburg, and Bamberg. Of glass-works there are about 300, the more important in the coal districts of Silesia and Rhenish Prussia. (8) There are nearly 700 factories for the manufacture of chemicals and dyestuffs, some of the more important of the former being situated near the great salt-works of Stassfurt in Prussian Saxony and Leopoldshall in Anhalt. The manufacture of colors has been carried to high perfection. Among articles of perfumery, eau de Cologne has a world-wide reputation. (9) There are 1,240 paper-mills, the more important near Düren and Jülich in Rhenish Prussia, and on both banks of the Leine in Westphalia. Nuremberg is famous for its lead-pencils, which are made of Siberian graphite. (10) Excellent leather of all sorts is brought into the market by Mainz and Worms. Leather goods of the finer qualities are produced mainly in Southern Germany; Würtemberg is known for its gloves; while Offenbach, Nuremberg, and Berlin have a reputation for fancy goods.

*Commerce.*—The Zollverein, established in 1833 by the acceptance by Bavaria and Würtemberg of the commercial agreements existing between Prussia and the Hessian countries, and since 1888 composed of all the German states, has exercised a large and beneficial influence on the commerce of the empire by abrogating injurious restraints and destroying many unnatural barriers. Hamburg and Bremen were the last states to join the Zollverein. The grand duchy of Luxembourg and an Austrian parish to the S. of Kempten in Bavaria belong to it also. Until 1879 Germany pursued a free-trade policy, but in that year protective duties were introduced, and they have since then been considerably increased. All transit duties were abolished in 1861, and export duties in 1865. The imports and exports for some years were as follows, in thousands of dollars:

| YEAR. | Imports. | Exports. |
|---|---|---|
| 1872 | 770,773 | 553,693 |
| 1884 | 729,984 | 726,533 |
| 1890 | 944,935 | 757,685 |
| 1899 | 1,376,503 | 1,039,681 |

Foremost among the exports were woolen goods, cotton goods and silks, drugs and colors, earthenware and glass, iron, machinery, and instruments. The imports (1899) included cereals and other agricultural produce, $366,992,192. Of the imports, about 15 per cent. came from the United Kingdom, 13 per cent. from Austria, 12 per cent. from Russia, and 11 per cent. from the U. S. Of the exports, 21 per cent. went to Great Britain, 11 per cent. to the U. S., 10 per cent. to Austria, 8 per cent. to the Netherlands, and only 7 per cent. to Russia.

The commercial marine (1900) consisted of 2,466 sailing vessels, of 587,639 tons, and 1,293 steamers, of 1,150,159 tons. Of these steamers, about one-half belonged to the ports of Hamburg and Bremen, which mainly carry on the trade with Great Britain and transoccanic countries, and are the chief outlets for emigrants. The tonnage of foreign and German ships entering German ports is very nearly equal, the German flag having only a slight advantage. The inland navigable waterways have a length of 8,804 miles, and are navigated by over 20,000 boats, of a burden of 2,150,000 tons. The railways (1898) have a length of 30,950 miles, with receipts of 1,849,094,000 marks, and yield a profit of 5.94 per cent. on the capital invested. The postal and telegraphic service of the empire employs 206,945 persons, and keeps open 36,464 post and 23,729 telegraph offices. In 1899, 4,775,037,756 articles were forwarded through the post, and 44,558,742 messages by telegraph. There were 77,910 miles of telegraph lines in operation. These services yielded a net profit (1899) of 48,552,246 marks.

*Constitution.*—The constitution of the empire dates from Apr. 16, 1871, and has since been modified in several respects. The empire is a federal state and not a federation like the defunct Bund. The imperial dignity is hereditary in the house of Hohenzollern. The emperor merely enjoys an executive authority, which he exercises in the name of the empire or of the confederate governments. Laws are enacted by the Bundesrath and the Reichstag, and the emperor has no veto. The emperor appoints all imperial officials, including the chancellor, who is the only responsible minister of the empire and presides over the Bundesrath; he convokes, opens, and prorogues Bundesrath and Reichstag, and the latter can not be dissolved without his consent. The emperor also represents the empire internationally, appoints and receives ambassadors and consular officials, and can declare war with the consent of the Bundesrath. He is commander-in-chief of the army (of the Bavarian contingent, however, only in time of war) and of the navy. The laws promulgated by the emperor override all local laws. All matters of trade and commerce, military defense, criminal and civil law, and, in fact, all matters not strictly of a local nature, may be dealt with by the Bundesrath and Reichstag. The Bundesrath, or Federal council, numbers 58 members (17 for Prussia), who are appointed by the governments of the individual states, and vote according to instructions. The Reichstag numbers 397 members, who are elected by universal suffrage, all males of twenty-five years of age having votes, except soldiers with the colors. Its members are not paid. The legislative period is five years.

*The Judiciary.*—Judicature acts of 1877 and 1878 regulate the administration of justice throughout the empire. The *Reichsgericht*, the judges of which are appointed by the emperor, is the supreme court of justice and of appeal

for the whole of the empire. All other courts are state courts, but the appointment of the judges, as well as their practice, must conform to imperial legislation. Small civil cases, up to about $100, are decided by a single judge in the *Amtsgericht*; above this there is the *Landesgericht*, and finally the *Oberlandesgericht*, the highest of all the state courts. Commercial cases may be dealt with by arbitrators or experts, presided over by a judge. The same courts or judges deal with misdemeanor or crime. Minor offenses are dealt with by a *Schöppengericht*, that is a court presided over by one judge and two *Schöppen*, or assessors, elected by the ratepayers. Serious crimes are adjudged by a jury. Altogether there are 2,129 courts of justice, presided over by 7,789 judges. In 1898 as many as 477,807 persons were convicted of misdemeanors or crimes.

*Revenue.*—The revenue is derived from customs and excise duties, stamps, posts and telegraphs, railways (in Alsace), and the "matricular" contributions of the individual states, which are intended to make up any deficit in proportion to population. In 1898–99 the revenue amounted to $442,112,926, of which $201,653,592 were derived from customs, excise duties, and stamps. In the same year the army and navy cost $181,823,194. The matricular contributions are assessed according to population at a rate per head which is fixed annually in the imperial budget. The estimate for 1900–01 was $125,583,556. The national debt, including outstanding treasury bills, amounted in 1899 to $557,622,267. A war treasury of about $28,000,000 in gold is kept in the fortress of Spandau.

*Army and Navy.*—See ARMY and SHIPS OF WAR.

*Colonies.*—In 1884 Germany sent Dr. Nachtigal in a gunboat along the west coast of Africa, and took possession of various territories there which had not yet been appropriated by other European states. In the following year a footing was obtained next to the Sultan of Zanzibar's dominions, and in New Guinea. The various foreign possessions include Togoland, on the Slave Coast (16,000 sq. miles, 500,000 inhabitants); Cameroons in the Gulf of Guinea (130,000 sq. miles, 2,600,000 inhabitants); Damara and Nama lands in Southwest Africa (300,000 sq. miles, 250,000 inhabitants); German East Africa (380,000 sq. miles, 1,900,000 inhabitants); Northern New Guinea or Kaiser Wilhelmsland, the Bismarck Archipelago, several of the Solomon islands and the Marshall islands in the Pacific (99,066 sq. miles, 402,000 inhabitants). The total for these dependencies is thus 925,066 sq. miles, with 8,652,000 inhabitants. None of these possessions, except Southwestern Africa, is suited for the permanent settlement of Europeans.

## HISTORY.

*Germany in the Dark Ages.*—The history of the empire begins with the treaty of Verdun, 843. (For the relations between Germany and the Roman empire, see GERMANIA; for the relations between Germany and the Frankish empire, see FRANKS.) By the treaty of Verdun, Germany (Eastern Franconia) became separated forever from France (Western Franconia), and Lorraine (Middle Franconia) was thrown between them as the apple of discord. Ludwig the Child, the last Carolingian in Germany, died in 911. At this time the Germans were threatened by the Norsemen from the north, by the Wends on the Elbe and the Havel, and especially by the Hungarians in the east, while in the interior a sort of national or tribal division became more prominent; so that at the extinction of the Carolingian house Germany was divided into five large dukedoms—Saxony (with Thuringia), Franconia, Swabia (formerly Alemannia), Bavaria, and Lorraine. The Franks elected their own duke, Conrad, King of Germany, and he was acknowledged by the other tribes, with the exception of Lorraine, which fell to Western Franconia (France). Conrad, however, did not succeed in consolidating the empire internally or strengthening it outwardly, but after his death the Franks and the Saxons chose the mighty Saxon duke Henry for king. Henry I. (912–936) is the founder of the empire. He vindicated the royal authority against the dukes; he acquired Lorraine for Germany; he fought with success against his foreign enemies, the Wends on the Havel and the Hungarians, whom he defeated at Merseburg in 933. In the interior he improved military affairs by developing a new system of cavalry; built numerous towns, and laid the foundation of the kingdoms of Saxony and Prussia by establishing against the Wends the margraviates of North Saxony and Meissen. Of still greater consequence was the reign of his son, Otho I. the Great (936–973). He crushed the rising opposition of the princely aristocracy; gave the dukedoms to friends and relatives; acquired the crown of the Lombards in 951; defeated the Hungarians at Augsburg on the Lech in 955; and assumed in 962—not to the advantage of Germany—the imperial title, which from that time, and up to 1806, remained with the German kings. After him followed three emperors of the Saxon house, Otho II., Otho III., and Henry II. But under them the royal authorities lost very much; the princes and the ecclesiastical dignitaries became very bold; and the popes, hitherto always submitting to the strong emperor, began now to aspire to the empire of the world. With Conrad II. (1024–39) begins the Franconian or Salic dynasty, under which the royal power culminated in Germany; so that if Henry III. (1039–56) had lived longer, not only would the imperial dignity have become hereditary in his family, but an end would have been put to the injurious interference of the pope in German affairs. His government in the interior was severe but just, and it was respected in foreign countries; in papal affairs he was generally referred to as arbiter. But he died when only thirty-nine years old, and all the fruits of his policy were lost for centuries under his son Henry IV. (1056–1106). Henry was gifted by nature, but having been educated by priests he suffered very much from their influence. Under him the feudatory princes, the Church, and the Saxons, took back what they had lost under his father, and the pope compelled him to humiliate himself at Canossa (1077), by which he in a manner acknowledged the supremacy of the Church over the crown. Henry, however, supported by the burghers, continued to struggle against the Church with various fortune. At one time he even expelled the pope, Gregory VII., from Rome. But his last days were much embittered by his own son, Henry V. (1106–25), who was won over to the papal party and rose against him. As soon, however, as Henry V. came to power he followed the example of his ancestors, but was compelled by the papal party to conclude the concordat of Worms in 1122; with him the Franconian dynasty became extinct. The Saxon Lothaire followed (1125–37); he yielded to the princes and the Church, and by marrying his daughter to Henry the Proud, Duke of Bavaria, he left his possessions to the house of the Guelphs.

*Later Mediæval Period.*—On his death the powerful house of Hohenstauffen ascended the German throne (1138–1254). Conrad III. (1138–52) confined himself to German affairs, but his successor, Frederick I. Barbarossa (1152–90), tried to extend his power beyond the boundaries of the empire. In Italy he was not successful against the Lombard cities and the pope; but when his son married the heiress of the Norman empire in Lower Italy, he gained new influence, while in Germany he succeeded in curbing Henry the Lion of the powerful house of the Guelphs. He died in Asia on a crusade. His son, Henry VI. (1190–97), ruled with vigor and severity, but died very early; and on his death a contest began between Philip of Swabia, of the house of Hohenstauffen, and Otho, of the house of the Guelphs. The latter was supported by the pope, Innocent III., and Philip was killed; but when Otho IV. became sole emperor he could not satisfy the papal demands, and a son of Henry VI., Frederick II. (1212–50), was elected king by the papal party in opposition to him. Frederick gained the superiority, but as the popes soon became his most inveterate enemies, and were supported by the Lombard cities, he had to fight against the Church during his whole life; and although his adversaries did not succeed in placing another king of any power against him in Germany, still the empire suffered frightfully. During his reign the Germans succeeded in breaking the power of the Danes in the battle of Bornhöved (1227), and in 1230 the Teutonic Order conquered the country of Prussia to the E. of the Vistula. But after his death the house of Hohenstauffen declined rapidly. Conrad IV. died in 1254, and his son, Conradin, the last of the family, was beheaded at Naples in 1268 while trying to reconquer his heritage in Lower Italy from the invader, Charles of Anjou. William of Holland reigned in Germany to 1256, but then followed an interregnum to 1273. Neither of the two foreign princes who were elected German emperors had any authority at all. On the election of Rodolph I. the house of Habsburg ascended the German throne. Rodolph restored general tranquillity to the empire, which during the interregnum had fallen under club-law, and by the battle on the March in 1278, in which Othokar II. of Bohemia was killed, he acquired the duchy of Austria, and laid the foundation of the Austrian state. After Adolph of Nassau (1292–98) came Rodolph's son, Albert I. (1298–1308),

under whose reign the Swiss Confederation was formed, which later was vindicated so gloriously against Austrian pretensions in the battles of Morgarten (1315) and Sempach (1386). With Henry VII. (1308–13) the house of Luxembourg acquired the German crown; its members held Bohemia, Moravia, and Silesia in their possession. After him, Ludwig of Bavaria (1314–47) and Frederick of Austria contended for the German crown. The former was victorious in the battle of Mühldorf (1322), and by the establishment of the electoral body of the empire in 1338 he made the election of the emperor independent of the papal confirmation. With Charles IV. (1347–78) of the house of Luxembourg Bohemia reached its point of culmination. He founded the University of Prague in 1348—the first university in Germany—and in 1356 published the Golden Bull, by which the election of the German king by seven electors (four secular and three ecclesiastical) became finally settled. To the early part of his reign belongs the invention of gunpowder by Berthold Schwartz. His son, Wenceslaus (1378–1400), was too weak for the difficult circumstances. The mischief of club-law increased; associations of princes and lords originated; the Fehmic Court extended its authority beyond Westphalia; the Hanseatic League, founded in 1241 by the maritime cities, acquired the dominion over the northern seas. Wenceslaus was deposed, and Ruprecht of the Palatinate was elected (1400–10). Then followed Wenceslaus's brother, Sigismund (1410–37), under whose reign the Councils of Constance (1414–18) and Basel (1431–43) were held, in order to effect a reformation of the Church, which, however, did not take place. On the contrary, the result of the Council of Constance was the burning of Huss, and that of the Council of Basel a compromise which ended the war of the Hussites. During the reign of Sigismund the house of Hohenzollern first came to Brandenburg in 1411. With Albert II. (1438–39) the house of Austria once more ascended the German throne, which it afterward held till 1806, with a short interruption. Frederick III. (1440–93) was a feeble ruler. In his time Gutenberg invented the art of printing (1450), which exercised an immense influence on European civilization. Bohemia and Hungary were at this time governed by the celebrated kings George Podiebrad and Matthias Corvinus.

*The Period of the Reformation.*—Frederick III.'s son, Maximilian I. (1493–1519), brought the period of club-law to an end by the declaration of the public peace of the country in 1495, and by the establishment of a supreme court of the empire. By marriage he acquired Burgundy, to which the Netherlands belonged, and he witnessed the beginning of the Reformation by Martin Luther in Wittenberg (Oct. 31, 1517). The reign of his grandson, Charles V. (1519–56), was one of the most remarkable periods in the history of Germany, especially on account of the rapid development of the Reformation. At the Diet of Worms (1521) Luther defended himself with undaunted courage; at that of Speyer (1529) his adherents formally protested against decisions which were unfavorable to them; and at that of Augsburg (June 25, 1530) they publicly set forth their creed. Other remarkable events of his reign are the peasants' war (1524–25); the appearance of the Anabaptists at Münster (1535); the Schmalcaldian war (1546–47); the Agreement of Passau (1552); the Peace of Augsburg (1555); his several wars with France; and the counter-Reformation which took place within the Roman Catholic Church, partly through the establishment of the Society of Jesus, partly through the Council of Trent (1545–63), whose decisions have since ruled the Roman Catholic Church. The empire of Charles V. comprised Germany, Austria-Hungary, the Netherlands, Belgium, Spain, and large portions of Italy. In 1556 he abdicated, leaving Spain and the Netherlands to his son Philip, and Germany and Austria to his brother, Ferdinand I. (1556–64). Maximilian II. (1564–76) was rather indifferent with respect to religious matters, but under his son, Rudolph II. (1576–1612), the confusion increased, and under Matthias (1612–19) the Thirty Years' war broke out (1618–48). In the beginning the Roman Catholics gained such great advantage, through the emperor, Ferdinand II. (1619–37), the duke (later elector), Maximilian of Bavaria, and the generals Tilly and Wallenstein, that about 1630 it seemed as if the total fall of the Protestant cause was at hand. But the courageous interference of the Swedish king, Gustavus Adolphus, saved Protestant freedom in Germany; Tilly and Wallenstein died in 1632 and 1634, and the intermeddling of France after 1635 changed the whole character of the war, and transformed it from a religious to a merely political contest. By the Peace of Westphalia (1648) the Lutherans and the Reformed (adherents of the Swiss Reformers, Zwingli and Calvin) were granted the free exercise of their religion, but large provinces were lost to France and Sweden, the power of the emperors was much curtailed, and Switzerland and the Netherlands were acknowledged as independent states.

*Decline of Imperial Power: Rise of Prussia.*—After Ferdinand III. (1637–57) followed the slow and hesitating Leopold I. (1657–75), under whom Germany sank to the lowest stage of degradation. Louis XIV. of France pursued at that time a policy of aggrandizement. In the midst of peace he took (1687) the free imperial city of Strassburg, and with unheard-of cruelty devastated (1689) by fire and sword the Palatinate, the most beautiful part of Germany. And yet the Germans did not rise to resistance. At the diet, which from 1663 to 1806 was always held at Regensburg (Ratisbon), the princes were represented only by deputies. The most important business was delayed and procrastinated, while personal interests were pursued with great eagerness. The immorality and prodigality of the French court were imitated by every petty court in Germany; the French language was adopted in court circles; and German princes allied themselves with France against the emperor and the empire. And it was of very little comfort to the national feeling that the Turks, who in 1683 laid siege to Vienna, were thrown back by the Hungarians and vanquished by Prince Eugène of Savoy. Neither was the victory which the Elector of Brandenburg, Frederick William, gained over the Swedes at Fehrbellin (June 28, 1675) so very impressive, though thereby he became the founder of the Prussian state. His country did not assume the name of Prussia, however, until Jan. 18, 1701, when Frederick I. was crowned king. At the same time as Prussia grew into a kingdom two great wars devastated Europe. The one, the Northern war, which raised Russia at the expense of Sweden, and introduced her among European states, touched the German empire only on its northeastern boundary; while the other, the war of the Spanish succession (1701–14), was fought chiefly in Germany. As the English and the Germans, allied against France and led by Marlborough and Prince Eugène, won victory after victory (Hochstädt 1704, Turin 1706, Malplaquet 1709), it seemed as if Germany would rise again under the reign of Joseph I. (1705–11) and reconquer a large part of the territory which she had lost to France. But with the fall of Marlborough (1711) a reverse of fortune took place, and under the Emperor Charles VI. (1711) she was compelled to make an unfavorable peace with France. While, at this time, the prodigality of most German courts had reached an unexampled height, and while Saxony had lost her prominent position among the Protestant states of Germany by the conversion of the dynasty to the Roman Catholic confession in 1697—in order to get possession of the crown of Poland—the King of Prussia, Frederick William I. (1713–40), laid a solid foundation by parsimony, careful administration, and the establishment of an excellent army; and on this foundation his son, Frederick the Great (1740–86), built up a state which soon ranked among the great powers. When, in 1740, the male line of the house of Habsburg became extinct, Frederick II. laid claim to some parts of Silesia. By the first Silesian war (1740–42) he took them; by the second (1744–45) he kept them. Bavaria, whose elector was Emperor of Germany, under the name of Charles VII., from 1742 to 1745, likewise demanded certain territories of the Austrian countries. Bavaria was supported by France, and the war of the Austrian succession began (1740–48). But Bavaria soon retired from the war; Saxony and the maritime powers allied themselves with Maria Theresa; and in 1747 the first Russian army, also in aid of Austria, reached the Rhine. By the Peace of Aix-la-Chapelle (1748) France gave up all her conquests in the Netherlands. Three years earlier the husband of Maria Theresa, Francis I. of Lorraine, had been elected Emperor of Germany (1745–65). Meanwhile Frederick the Great of Prussia had used the eleven years of peace to prepare himself for the Seven Years' war (1756–63), in which Austria, allied with Russia, France, Sweden, and most of the smaller German states, tried to humiliate Prussia, whose only ally was Great Britain, and make her an insignificant state. But Frederick proved himself superior in the field to all his enemies, and although he lost many battles, and more than once brought Prussia to the very verge of ruin, yet he was not to be crushed. The defeat at Kollin (June 18, 1757) was fol-

lowed by the victories at Rossbach (Nov. 5, 1757) and at Leuthen (Dec. 5, 1757); the defeat at Kunersdorf (Aug. 12, 1759) was followed by a series of operations which quite neutralized the advantages the enemy had gained over him. Russia, Sweden, and France retired from the field, one after the other, and at last Austria herself was compelled to make peace at Hubertsburg (Feb. 15, 1763). From that moment there existed in Germany a pernicious dualism, until in 1866 Prussia acquired a decided superiority.

*The Period of the French Revolution.*—The emperor, Joseph II. (1765–90), a son of Maria Theresa, tried by education, religious freedom, and political reforms to bring his people up to the standard of the age. But he was less successful in this respect than the Prussian king had been, partly because he introduced his reforms with some violence, partly because he was thwarted by the Roman Catholic clergy, but more especially because in Austria no preparations had been made by his ancestors. Nevertheless, his reforms were of great importance to Austria, and in spite of a violent reaction they still form the foundation of Austrian life. Both Frederick the Great and Joseph II. took part in the first division of Poland (1772), in which, however, as in the two following (1793 and 1795), Russia received the lion's share. But the attempts of Joseph II. to annex Bavaria to Austria were frustrated by Frederick the Great. In Prussia the weak Frederick William II. (1786–97) followed Frederick the Great, but, although the country was much enlarged by the division of Poland, yet it was brought near to ruin by internal mismanagement, by prodigality, intolerance, and false administrative measures. After the short reign of the Emperor Leopold II. (1790–92), Austria, under the Emperor Francis II. (1792–1835), and Prussia united into a war against France when the Revolution of 1789 had brought all the states of Europe into fermentation. Royalty, which was in danger in France, and which was to be helped by the allies, was finally overthrown after the first slight successes of the Prussian arms, which served only to exasperate the French against their king. A republic was declared, and Louis XVI. was beheaded. In the field fortune changed. The Prussians had to leave France, the Austrians Belgium, and the jealousy between them prevented any energetic action. Meanwhile the Reign of Terror in France had passed away, and Prussia made peace with the French republic, while Austria and Great Britain continued the war. But after the victories of Napoleon in Italy in 1796, which opened the way for him into Styria, Austria concluded peace at Campo Formio in 1797, and gave up Lombardy, for which it received Venice. In 1799, however, Austria again began war against France, this time in connection with Russia and Great Britain. The French were repeatedly defeated both in Italy and Germany, but, on account of a quarrel between Austria and Russia, the Russian troops under Suwaroff were withdrawn, and soon after Napoleon Bonaparte returned from Egypt and became first consul.

*French Ascendency in Germany.*—By the battle of Marengo (June 14, 1800) Austria lost Italy, and after the disaster at Hohenlinden (Dec. 3, 1800) she was compelled to conclude the peace of Lunéville (1801), by which the Rhine became the boundary of France. Several German princes lost their possessions on the left side of the Rhine, but they received ample indemnification on the right—together with some former Italian princes—by the mediatization of the ecclesiastical states and the imperial cities. In 1804 Napoleon became Emperor of France. A third coalition against France was dissolved by the defeat of Russia and Austria at Austerlitz (Dec. 2, 1805), and Austria lost large territories by the Peace of Pressburg; Bavaria and Würtemberg were made kingdoms. In 1806 Napoleon united all that remained of Germany, with the sole exception of a much-curtailed Prussia and Austria, into a Rhenish Confederation, under his own protectorate. Numerous mediatizations of minor states took place, and (Aug. 6, 1806) the Emperor Francis abdicated his dignity as chief of the empire and assumed the title of Emperor of Austria. With this event the so-called Holy Roman Empire of the German empire, dating from Charlemagne's coronation in 800 A. D., came to an end. Prussia, under Frederick William III. (1797–1840), had hitherto lived in peace with France —not to her own advantage—but in 1806 she felt compelled to declare war, and before the Russians could come to her support she was completely defeated at Jena and Auerstädt (Oct. 14, 1806), and thoroughly subdued, owing to the unexampled cowardice and treachery of many of her generals. After the battles of Eylau and Friedland (Feb. 8 and June 14, 1807) peace was concluded at Tilsit, by which Prussia lost half of her possessions, and kept the other half only on very hard conditions. After the peace, however, Baron von Stein effected a thorough regeneration of social and political life in Prussia, and Scharnhorst, supported by Blücher and Gneisenau, became the founder of a new military system. In 1809 Austria ventured once more on a war with France. The Archduke Charles won the battle of Aspern (May 21, 1809), but at Wagram he was defeated (July 5, 1809), and by the Peace of Schönbrunn Austria lost other territories and became totally excluded from the sea. In 1810 Napoleon incorporated the Hanseatic cities of Bremen, Hamburg, and Lübeck into his empire, but on the retreat from Russia, after the burning of Moscow, in 1812, he lost his whole army.

*The War of Liberation.*—In the beginning, Prussia and Russia fought alone against Napoleon, and they were not successful. They lost the battles at Grossgörschen (May 2, 1813) and Bautzen (May 20, 1813), and Davoust maintained himself in Hamburg up to 1814. But during the armistice from June to Aug., 1813, Austria and Sweden joined the coalition of the three armies—the chief army, under the Austrian Schwarzenberg in Bohemia; the army of the North, under the Swedish crown prince, the former French marshal, Bernadotte; and the Silesian army, under Blücher in Silesia—the last, though the smallest, turned the fortune of the war. Silesia was delivered by the battle on the Katzbach (Aug. 26). The French force, pushed toward Berlin, was defeated by Bülow and Tauenzien at Grossbeeren (Aug. 23) and Dennewitz (Sept. 6), and on Oct. 3 Blücher crossed the Elbe at Wartenberg, following the movements of the army of the North, while the main army, after the defeat at Dresden (Aug. 26) and the victory of Kulm (Aug. 29), pushed forward from Bohemia toward Leipzig. The battle of Leipzig, commonly called the Battle of the Nations (Oct. 16–19, 1813), decided the destiny of Germany and Napoleon. The allies followed the fleeing emperor into France, and after entering Paris (Mar. 31, 1814) they compelled him to abdicate the crown of France and retire to the island of Elba. By the Treaty of Paris the Bourbons returned to France, and German affairs were regulated, under the more immediate influence of Metternich, by the Congress of Vienna (1814–15).

*The Period of Reaction.*—From 1815 to 1848, the influence of Metternich, the Austrian minister, was predominant in Europe. The German Confederation developed no life. The diet, sitting at Frankfort-on-the-Main, suppressed every free movement. The promised constitutions were rarely given. By the establishment, however, of the Zollverein, in 1833, Prussia laid the foundation of a united Germany, at least with respect to commercial matters. Ferdinand I. ruled in Austria from 1835 to 1848. In Prussia, Frederick William IV. inaugurated a powerful ecclesiastical reaction, which, after the transient success of the revolution of 1848, extended also to political affairs, and placed Prussia under the influence of Russia and the Ultramontanes. The Revolution of 1848 had no permanent results. A constitution was proclaimed by the German Parliament at Frankfort in Mar., 1849, but the pusillanimous King of Prussia declined to receive the imperial crown at the hands of a sovereign people. Revolutionary risings in Baden, the Palatinate, Dresden, and elsewhere, were suppressed by Prussian bayonets, and the old Bundestag met once more at Frankfort on Sept. 2, 1850. Prussia, which had endeavored to bring about a union of all German states, to the exclusion of Austria, was weak enough to sign the humiliating convention of Olmütz (Nov. 29, 1850), the result of which was that the inhabitants of Schleswig-Holstein were surrendered unconditionally to the Danes. Reaction was everywhere triumphant, but the seed sown by the eminent representatives of the German people who met at Frankfort in 1848 was yet to bear fruit.

*Prussian Ascendency.*—In Prussia, William I. governed from 1857 as prince-regent instead of his brother—from 1861 as king. He first tried constitutional methods, but when the Landtag refused to sanction an increase of the army (1862), he placed Bismarck at the head of affairs, whose violence and arbitrariness estranged all liberal elements of the population. He was forgiven, however, when the results seemed to justify the unconstitutional means he had employed. In 1863 Bismarck found an opportunity of showing his foreign policy. When the Danish dynasty became extinct he disputed, together with Austria, the claims of Denmark on the duchies of Schleswig and Holstein, and by the war of 1864 he acquired these two countries for Germany. Then there arose a quarrel between Prussia and Austria, as Prussia

wished to annex the two duchies, while Austria favored the claims of a collateral branch of the Danish dynasty (Augustenburg). In June, 1866, the war broke out, and after routing the Austrian army under Benedek at Königgrätz or Sadowa (July 3), the Prussian armies appeared before Vienna. By the Peace of Prague (Aug. 23, 1866) Austria retired altogether from the German Confederation, and acknowledged the changes and annexations which Prussia had made in Germany. Prussia now established the North German Confederation, whose constitution later was extended, with some modification, to the whole empire, and concluded treaties with the South German states.

*The Empire.*—This progress toward unity, however, excited the jealousy of France, which culminated, July 19, 1870, in a declaration of war. (See FRANCO-GERMAN WAR.) But the remarkable successes of the German arms brought about the very result which France had intended to prevent, namely the unity of Germany (although to the exclusion of the Austrian provinces). The South German states joined the North German Confederation; a deputation of the Reichstag, headed by Dr. Simon, who twenty-one years before had approached Frederick William IV. on a similar mission, proceeded to Versailles, and on Jan. 17, 1871, King William assumed the imperial dignity under the title of *Deutscher Kaiser*—German Emperor, not Emperor of Germany. Since this great war Germany has had no conflict with any foreign powers, and the treaties of alliance concluded with Austria-Hungary in 1879 and with Italy in 1883 (see TRIPLE ALLIANCE) appear to guarantee peace for many years to come. The first German colony was secured in 1884 (see *supra*, Colonies). The Society of Jesus was expelled in 1872, together with all its members of foreign origin, but the Ultramontane party has nevertheless forced several concessions from a reluctant government, and only an absolute separation of Church and state seems to promise a settlement of these vexed questions. A repressive socialist law, consequent upon two attempts to assassinate the emperor, was passed in 1878, but Prince Bismarck's successor wisely repealed it. Among measures specially designed to improve the social condition of the working-classes are a law for compulsory insurance in case of sickness (1883); a similar law against accidents (1884); and one providing an annuity for old age, or in case of incapacity for further work (1889). See GERMAN EMPIRE in the Appendix.

William I. died on Mar. 3, 1888, and was succeeded by his popular son, Frederick III., who reigned, however, only ninety-nine days, and was succeeded June 15, 1888, by William II. Prince Bismarck was dismissed in 1890, and Count G. von Caprivi, then appointed in his stead, was succeeded by Prince Hohenlohe Oct. 29, 1894.

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Revised by E. G. RAVENSTEIN.

**Germa'nia** [= Lat. *Germa'nia*, the country of the Germans, deriv. of *Germa'nus*, German]: the common name used by the Romans for the vast but half-unknown regions extending between the Rhine and the Vistula, and from the Danube to the North Sea and the Baltic. They made their first real acquaintance with the inhabitants of this territory through Cæsar's campaign in Gaul. Several Germanic tribes had at that time crossed the Rhine and settled between that river and the Vosges Mountains, while the Marcomanni, Tencteri, and Usipetes tribes pushed forth through Belgium. Cæsar subdued the former, together with the Gauls, and the latter he drove back on the other side of the Rhine. The Usipetes, however, soon returned, followed from the E. by the Catti and Cherusci, and from the N. by the Frisii, Batavi, and Chauci. A new series of campaigns, directed solely against the Germanic tribes, was then undertaken by Drusus (from 16 to 9 B. C.), and the result was that the Roman conquests in Germania were extended N. to the Elbe and E. to the Taunus Mountains. Forts were erected, canals dug, roads constructed, bridges built, and Roman civilization began to make great strides into Germania; but when, a few years later, Varus tried to subject the inhabitants of these newly conquered regions to the forms of Roman provincial administration, they rose at once in irresistible rebellion. Arminius, the chief of the Cherusci, defeated Varus and his legions in the Teutoburger forests, and the whole northern portion of the Roman possessions in Germania, from the Elbe to the Weser, made itself independent. The Germanic tribes began to associate, and the Marcomanni and Quadi of the second century, the Alemanni and Franks of the third, the Vandals, Suevi, and Heruli of the fourth, and the Goths and Longobards of the fifth, were not small tribes, but large nations. Meanwhile large numbers of Germans accepted protection in the Roman empire, and entered into domestic or military service. When the northern invasions finally took place it was found that the Roman army contained large numbers of German soldiers, who were called upon to fight against their own countrymen. When the Germanic tribes, pressed from the east by the Slavi and the Huns, went westward and southward, the Romans were incapable of withstanding them. Knowledge of the early Germans is derived chiefly from Tacitus and Cæsar. Tacitus noted that they erected no temples and had no idols, but believed in a future life and in eternal justice—that they built no cities, and had no manufactures or trade, but held their women and households in deep respect.

**German'icus**, CÆSAR: b. in 15 B. C.; a son of Claudius Drusus Nero, the brother of Tiberius, and Antonia; was adopted in 4 A. D. by Tiberius, and accompanied him in his campaigns in Pannonia and Dalmatia (7–10 A. D.) and in Germany (11). In 14 he was made commander-in-chief of the legions on the Rhine, and gained greater victories than had been achieved by the Romau arms for many years. But Tiberius became afraid of his popularity, and recalled him in 17, before he could perfectly consolidate his conquests and make them useful to the empire. He was then sent to the East against the Parthians and Armenians, and died, probably poisoned, at Epidaphne, near Antioch, Oct. 9, 19. By his wife, Agrippina the Elder, he had nine children, six of whom survived him; the two most famous of them were Caligula, the emperor, and Agrippina the Younger, mother of Nero. Germanicus was also an orator and poet, and his translation of the *Phænomena of Aratus* is still extant (see ed. cum Scholiis, A. Breysig, Berlin, 1867).

Revised by M. WARREN.

**Germanium**: one of the chemical elements. It was discovered by C. Winkler in 1886 in a mineral known as argyrodite, which occurs near Freiberg in Germany. It has since been found in small quantity in the mineral euxenite. Germanium is one of the elements the properties of which were foretold by Mendeléeff. (See CHEMISTRY.) In his memoir on the Periodic Law, which appeared sixteen years before germanium was discovered, this author described an element which he called ekasilicium, that should appear in his table between ekaaluminium, the then unknown element gallium, and arsenic. His description was found to agree with the facts as established by Winkler sixteen years later. Germanium belongs to the same family as carbon and silicium, forming compounds resembling those formed by the elements named. Its atomic weight is 72·32, and its symbol is Ge.

IRA REMSEN.

**German Language**: the official and literary language of the whole German empire, of 26 per cent. of the inhabitants of Austria-Hungary, and of 71 per cent. of the inhabitants of Switzerland. But among the 52,000,000 subjects of the German empire there are over 3,500,000 of non-Germans who do not speak German dialects—viz., nearly 3,000,000 Poles in Eastern Prussia, 145,000 Lithuanians in Northeastern Prussia, 140,000 Wends in the provinces of Brandenburg and Silesia, 150,000 Danes in the extreme north of Schleswig-Holstein, 240,000 Frenchmen in Alsace-Lorraine, 54,000 Czechs in Silesia, and perhaps 12,000 Frisians on the coasts of Oldenburg and of Northwest Schleswig. There are small German-speaking colonies in Russia and Northern Italy. In the Russian provinces of Kurland, Livland, and Esthland on the Baltic about 200,000 Germans, mostly of the educated classes, use their mother-tongue. (See the great work of Nabert, *Karte der Verbreitung der Deutschen in Europa*; also the smaller and more convenient *Völker- und Sprachenkarte von Deutschland und den Nachbarländern*,

by Kiepert.) German is a member of the west (Germanic) branch of the Teutonic group of languages. (See TEUTONIC LANGUAGES.) German and its dialects stand apart from the rest of the group in their consonants on account of the second or (High) German shifting. (See GRIMM'S LAW and VERNER'S LAW.) All the Teutonic languages shifted certain consonants once, German shifted once more, but this second shifting was not so uniform or so thorough. Some German dialects shifted more, some less. Upon the extent of the shifting a classification of the dialects can be based. This is done here, and a few other characteristics are added. Beginning with the south where the shifting started, there are: 1. South or Upper German dialects (*Oberdeutsch*). They shifted almost completely. In strictly South German every voiced explosive (*b*, *d*, *g*) became the corresponding voiceless explosive (*p*, *t*, *k*); every voiceless explosive became the corresponding fricative or spirant (*pf*, *f*: *z* (*ts*), *s*; *kch*, *ch*). Of the spirants, only *th* shifted and became the voiced explosive *d*. Their vowel-system still preserves the old diphthongs *ie*, *uo*, *üe*. These dialects are grouped as Alemanic and Bavarian. The Alemanic is subdivided into Alemanic proper, spoken in the larger part of Baden and in German Switzerland, and into Suabian in most of Würtemberg and Suabian Bavaria. The Bavarian covers the larger part of Bavaria and German Austria, but the German of Transylvania is Middle Frankish. 2. The Middle, or better the Midland, dialects which excepted from the southern shifting *b*, *g*, and initial *k*. They contracted the old diphthongs *ie*, *uo*, *üe* into the single long vowels *i*, *u*, *ü*, and shortened long vowels before more than one consonant. They are grouped as follows: Frankish, Thuringian, Upper Saxon, and Silesian. Frankish is variously subdivided. Important are Middle Frankish (Prussian Rhine province with the city of Cologne), South Frankish and Hessian, East or High Frankish (Fulda); but Low Frankish, the modern Dutch, is Low German. These dialects cover the midlands between South and North Germany, and hence their name. The term High German (*Hochdeutsch*) is used to embrace both South and Midland dialects. 3. The Low German dialects. They shifted only *th* into *d*. The other consonants are preserved almost as they were in general Teutonic. Strictly speaking, neither Frisian nor Old English are Low German, because they preserved even the Teutonic *th*. In the Low German dialects started the lengthening of short accented vowels in an open syllable, now a feature of standard German. But they never diphthongized the long vowels *i*, *u*, *ü* (*iu*), a movement which started in Bavarian and then became a feature of the written language. The chief divisions are Low Saxon and Low Frankish. The first is called Plattdeutsch or Platt, which embraces numerous smaller dialects, like the Mecklenburg, Schleswig-Holstein, Westphalian, Bremen, Hamburg. The terms Low, Platt, refer to the lowlands of Northern Germany, just as High, Upper (*Ober*, *Hoch*), refer to the mountainous southern and central regions of Germany. The cradle of all Saxons was the country between the Weser and the Elbe. Low Frankish is the only Low German dialect that has become a literary language—viz., Dutch. (See DUTCH LANGUAGE.) References: Wenker's *Sprachatlas von Nord und Mitteldeutschland*; Bernhardi's *Sprachkarte von Deutschland*; Piper's *Die Verbreitung der deutschen Dialekte bis' um das Jahr 1300*; Behaghel's and Kauffmann's articles in Paul's *Grundriss der germanischen Philologie*, i.; Brandt's *German Grammar*, §§ 480–83; and the general maps mentioned above.

To understand the relation of the dialects to the standard literary language (*Schriftsprache*), the origin and history of the latter must be studied. The history of German is usually divided into three great periods—viz., Old High German as far as 1100, Middle High German as far as 1500, New High German since then. But these dates are almost arbitrary. There are no sharp and sudden divisions between the periods. In Old High German the unaccented and inflectional vowels, *a*, *o*, *u*, *iu*, are still intact; in Middle High German they are worn down to *e*. The umlaut (the modification of *a*, *o*, *u* into *ä*, *ö*, *ü*), which had begun with *a*, spread over the other vowels. References: Braune's *Althochdeutsches Lesebuch* (Old High German Reader); Wright's Old High German *Primer*; Schade's *Altdeutsches Wörterbuch*. The differences between Middle and New High German are as follows: 1. The long vowels *i*, *u*, *iu* (= *ü*) were diphthongized. 2. The diphthongs *ie*, *uo*, *üe* were made single long vowels (a Middle German feature). 3. The short accented vowels in an open syllable were lengthened, while the long vowels before more than one consonant were shortened. The first started in Low German; the second in Middle German. 4. *s* before *l*, *m*, *n*, *w*, *p*, and *t* passed into *sch*. This started in South German and spread over Midland and even over Eastern Low German dialects. 5. *ch* became palatal after palatal vowels and after consonants, but became *k* before *s*—a Low and Middle German change that has become classical. 6. Final *m* became *n*; *mb* became *mm*. 7. The difference between the stem-vowel of the preterit singular and of the preterit plural disappeared in the seventeenth century—e. g. *ich fand*, *wir funden* became *ich fand*, *wir fanden*. 8. The umlaut spread by analogy, e. g. as a means of forming the plural, *Boden*, *Böden*. References: The grammars of Weinhold and Paul; Wright's *M. H. G. Primer*; Lexer's *Mhd. Wörterbuch* (in 3 vols.).

In the Old High German period the dialects reigned supreme; in the Middle High German are found the beginnings of a common written language; in the New High German the same becomes fully established. There are several official or state languages (*Kanzlersprachen*) in the latter half of the fourteenth and in the fifteenth centuries—e. g. the Imperial, the Austrian, the Bohemian, the Upper Saxon. Of these the Imperial, being less local than the others and reaching all parts of the country, had the greatest influence. The local chancelries throughout the country imitated this and one another not a little. Then several factors made themselves felt in the evolution of a standard language—viz.: 1. The Reformation and its literature. 2. Luther with his strong personality. 3. The invention of printing. 4. The public school with its primers and spellers. Luther says in his *Table Talk*: "I have no fixed especial language of my own in German, but use the common German language so that both highlanders and lowlanders may understand me. I speak according to the Saxon chancelry which all princes and kings in Germany follow. All the imperial cities and the courts of princes write according to the Saxon chancelry; therefore it is the most common German language. Emperor Maximilian and Elector Frederic, Duke of Saxony, have thus drawn into one fixed language the German languages of the Roman empire." The statement as to the universality and fixity of the one language must be taken *cum grano salis*. Not until the middle of the eighteenth century, i. e. the beginning of the classical literature, was the standard language fully established. Humanism advocating and using Latin, the confessional prejudice of the Reformed Swiss and of the Catholic South, together with local prejudice, opposed any common language, but especially Luther's. But the very spirit of the Reformation, its hearth at the very center of Germany, the fact that the common language was strongly Midland, a compromise as it were between North and South dialects, the efforts of the *Sprachgesellschaften* (language societies), and of the authors of the seventeenth and early eighteenth centuries at last brought about a full recognition. References: Rückert, *Geschichte der nhd. Schriftsprache*; Pietsch, *Martin Luther und die hd. Schriftsprache*; Socin, *Schriftsprache und Dialekte im Deutschen*; Behaghel's article in Paul's *Grundriss* and his separate work *Die Deutsche Sprache*, which has been published in English as "an historical grammar of the German language"; also the concise account in Brandt's *Grammar*, §§ 485–91.

The German word-stock is almost purely German, consisting of words inherited from the old Teutonic stock, and of such as have been formed upon and from these. German has a remarkable power of building up and compounding home words, but it lacks the power that English has of assimilating and naturalizing foreign words. The first greater influx of foreign words occurred through Roman civilization and through Christianity. The crusades and chivalry, humanism and the Thirty Years' war, brought in some more. During the last 200 years German has drawn upon Latin and Greek for scientific terms. But all modern foreign words are quite strictly relegated to a dictionary of foreign words and excluded from the regular German dictionary.

While all Germans readily accept their common literary language, they are not so ready to recognize a standard spoken language. Only the theater and the small class of the highly cultured aspire to a dialect-free pronunciation. The reasons why a standard of pronunciation is not set up and followed by more are as follows: 1. German has no such authorities as French has in the Academy and in the predominant city of Paris, or English in its great dictionaries and in London. German dictionaries never even allude to pronunciation. 2. The spirit of provincialism in

life and manners, of particularism in politics, is very strong in Germany. 3. The speakers of German are distributed among three distinct nationalities—viz., Germans proper, Austrians, and Swiss. The following may be considered characteristic German sounds and peculiarities of speech: 1. Every initial vowel is preceded by a glottal stop (’), while in English and French vowels the voicing—i. e. the vibration of the vocal chords—begins immediately; e. g. *’ach*, *’auch*, *’Ochse*, *’ich*. A vowel is treated as initial in the second parts of compounds, not so strictly, however, if the first part is unaccented; e. g. *Ob’acht*, *Ab’art*, but *herein*, *ereignen*, *Verein*. Also in enclitics the ’ is absent; e. g. *will ich*, *muss es*. 2. The umlaut vowels *ö* and *ü* similar to the French *eu* and *u*, long in *böse*, *müde*, short and somewhat different in character in *Götze*, *Müller*. 3. The frequency of the full, pure *a*-sound, short in *Land*, *Macht*, long in *fahren*, *graben*. 4. The frequency of *sch* which does not occur in English before *l*, *m*, *n*, *w*, *p*, *t*, as in *erschlagen*, “slay”; *schmeissen*, “smite”; *Schnee*, “snow”; *Schweiss*, “sweat”; *Spiess*, “spit”; *Stein*, “stone.” 5. The sounds of *ch* which is either back (guttural), as in *wach*, *Loch*, or front (palatal), as in *Wicht*, *euch*, *Mädchen*. 6. *w* represents a mild English *v*. 7. *r* should be pronounced with the vibrating tip of the tongue. It is not the American “rolled” *r*. The uvular North German *r* is not worthy of imitation. 8. The short *o* should not be confounded with the English low-back-narrow-round. Compare *Stock*, *Rock* with *stock*, *rock*. 9. German has no sound like the English *th*. The digraph *th* occurs, but it is nothing but *t* to which the useless diacritic *h* has been added. References: Vietor’s *German Pronunciation*; Vietor’s *Aussprache des Schriftdeutschen* (a convenient little book with a very useful word-list); Sweet’s *Handbook of Phonetics*; Laura Soames’s *Introduction to Phonetics*.

In comparison with English, German is a strongly inflectional language. The articles and pronouns are fully inflected. The adjective has preserved the double inflection characteristic of the Teutonic languages. (See the articles on these languages.) There are still two case-endings in the substantive declension—viz., *(e)s* in the genitive singular and *(e)n* in the dative plural. (However, the dative singular may have *e*.) The formation of the plural has still abundant means at its disposal in the umlaut of the stem-vowel and in the suffixes *e* and *er*. The weak or *n*-declension is still flourishing. Compare the rare English remnants in *oxen*, *children*, *kine*. The compound or periphrastic tenses are made up with the use of *haben*, *sein*, and *werden*. In one respect the German word-order is peculiar—viz., the verb proper stands at the end of a dependent clause, *der Mann*, *welcher dieses Buch kaufte*, but *der Mann kaufte dieses Buch*. References: The school grammars of Wilmanns, Krause, and Heyse (revised by Lyon); the new historical grammar of Wilmanns, including Gothic, Old, Middle, and New High German; the dictionaries of Kluge (etymological, translated into English); of Sanders, in three volumes with a supplementary one; of the brothers Grimm, not yet complete; of Flügel, German-English and English-German (the latter especially valuable).

In Germany the so-called “Gothic” letters are still in vogue. They are the modified Roman letters angulated through the influence of Gothic architecture. But nearly all the scientific books and periodicals—Bauer’s, Krause’s, Wilmanns’s, and Grimm’s grammars, and Grimm’s dictionary—are printed in Roman type. The German script now in use was fixed in the sixteenth century with the advice of Dürer. German spelling is much more phonetic than English spelling. The official spelling was fixed for Prussia by the Orthographical Conference of 1876, held in Berlin. The South German, Saxon, and Austrian regulations vary slightly from the Prussian. See *Regeln und Wörterverzeichnis für die deutsche Rechtschreibung in den preussischen Schulen* (a very small convenient book) and Duden’s *Orthographisches Wörterbuch*.

H. C. G. Brandt.

**German Literature**: those works in the German language which are in form and contents products of the creative activity of the mind.

*First Period* (to 1050).—Concerning the character of the oldest Germanic poetry—which has not itself been transmitted—we have the testimony of Tacitus, according to whom it must have been in part religious and in part heroic. Echoes of this oldest poetry, which reaches back into the prehistoric Indo-Germanic time, probably lie in the few magical incantations (the *Incantations of Merseburg*, etc.) which were, however, not recorded until a later period; but the German nations emerge first into the bright daylight of history with the migration of the tribes. Not until then were they brought into contact with the entire ancient civilization and with Christianity. From the wars of the migration was born the German hero-song which crystallizes round separate tribe-heroes. The real literary activity of single tribes—as far as it has been fixed in writing—begins only with the introduction of Christianity. Thus the conversion of the Goths resulted in the Bible translation of Ulphilas (311–383), the oldest monument of German literature; thus, too, the first literary documents of the Old High German and Old Saxon languages come from the years immediately following the introduction of Christianity. The contents of these first compositions show the influence of the new idealistic religion, as the *Wessobrunner Gebet*, *Muspilli*, *Heliand*, and Otfried’s *Harmony of the Gospels* testify. At the same time, in addition to the Old Germanic metrical form of alliteration, we find the appearance of rhyme borrowed from the Middle Latin.

During the next centuries the chief protectors of literature were naturally the clergy, and it is surely only by chance that from this earliest time a fragment of the Old Germanic hero-song has come down in the *Hildebrandslied*. For as the clergy bring into German literature the contrast between *Kunstpoesie* and *Volkspoesie*, so they also begin the warfare against the German folk-song which lasts through centuries, and is only apparently sileneed when the monk Eckehart I. (925), in his epic *Waltharius*, chooses for his theme the German hero-song.

*Second Period* (1050–1300).—This clerical poetry offered little of importance to the history of German literature up to the twelfth century. It needed the great event of the crusades and all the tendencies connected therewith in order to bring the German literature into new channels and new hands. Following its French model, the German nobility begins to cultivate letters, and gradually to assume the leadership in them. The clergy, indeed, attempt at first to bring themselves into harmony with the new tone, and thus arises a number of compositions such as the *Alexanderlied*, *Rolandslied*, and *Kaiserchronik*, in which the clerical learning and the awakening taste for the miraculous are curiously mingled. But soon the clergy, together with their old enemies, the wandering minstrels, step into the background, for the nobles take exclusive possession of the art of poetry. In lyric and in epic they seek to present the ideal which floats before them as equally capable of realization in life. Thus the Minnesong arises which, in Austria starting originally from a popular *motif*, soon follows only the French model, and reaches its zenith with *Reinmar der Alte* at the court of Vienna. In opposition to him appeared Walther von der Vogelweide, the greatest lyric poet of the Middle Ages, who gave again to the artificial Minnesong a popular *motif*, and who also, by means of the political and religious contents of his didactic lyrics, the *Sprüche*, powerfully influenced the spirit of his time.

With the rise of the lyric the development of the court epic keeps pace. Here, too, may be seen the effects of the French model. All the great epic poets, as Heinrich von Veldeke, Hartmann von der Aue, Wolfram von Eschenbach, and Gottfried von Strassburg, conform to French models, which they endeavor—each according to his talents—to elevate with German fervor and loftiness of thought. Only once since has German poetry voiced such high ideals or attained such perfection of language and form. Poetry and life seemed for a time at least to join hands. The old hero-songs, too, were included in the subject-matter of the court poetry, and in the *Nibelungenlied* and *Gudrun* the old heroic characters appear in knightly guise. But the *Blüthezeit* of court poetry was not to last long. Both Minnesong and epic bore in themselves the germs of decay. If the *Minnepoesie* rested on the unnatural relations between man and woman, the fairy-like fanciful world of the epic was too far removed from reality long to fascinate. The strife of the clergy against the worldly character of this court poetry co-operates with political and economical causes to bring about its final overthrow. Abstract *Minnepoesie* changes to its sensual opposite (Neidhart von Reuenthal, 1220, Tannhäuser, etc.), and the court epic degenerates into commonplace or sanctimonious prating (Rudolf von Ems, Konrad von Würzburg).

*Third Period* (1300–1624).—But German literature not only assumes for a time a clerical aspect, it also adopts a didactic tone which clings to it from now on through cen-

turies, and for a long time precludes purely æsthetical enjoyment. As the citizen class in the rich towns outrivaled the nobility in pecuniary affairs, so it now assumes the literary leadership. Meistersong takes the place of Minnesong, and the need for entertainment which was met by the court epic is satisfied by means of novelettes and nonsense-tales (*Schwänke*). But with the stern honesty of the *Meistersinger* there appears among the learned *schwank* poets a tendency toward the coarse and vulgar. At the same time may be perceived the germs of new literary forms. Starting from the sermon there is a gradual development of German prose which was destined to play so great a *rôle* in the spiritual conflicts of the sixteenth century. In order to meet the awakening historical interest numerous chronicles are written, among which the *Limburger Chronik* tells of the slowly reawakening folk-song which was now to reach its zenith. In addition to the historical lays and love-songs we find songs which represent the most different circles of folk-life, and make it clear that spiritually the German nation still presents an undivided unity, that the contrasts between *Volkspoesie* and *Kunstpoesie*, between the learned class and the unlearned, are not yet sharply defined. The rise of the modern drama also dates from this time. While it is true that the Old Germanic dramatic plays had, in spite of the opposition of the Church, been preserved up to the late Middle Ages, of the real development of the drama in Germany we can not speak until the Church itself began to make use of the dramatic form for its own ends. Then in quick succession appear the Christmas carnival, Passion and Easter plays, in which there is indeed little dramatic art, but which show how susceptible were the people's minds to this art-form.

Among the rich cities whose citizens devoted themselves especially to the study of poetry Nuremberg must be mentioned particularly. Here Hans Folz (1480) founds a new and more vigorous school of Meistersong, and here, too, the popular drama finds its most important center under Hans Rosenblut (1450), the forerunner of Hans Sachs.

The zenith of this period is reached in the sixteenth century. This century is ushered in with Sebastian Brant's *Narrenschiff*, a work which, by its combination of popular feeling with didactic learning, may be taken as a model for the coming age. The satirical tone with which it prepares the way for the great spiritual revolution of the Reformation is afterward continued by the still more talented and witty Thomas Murner. Brant and Murner received their stimulus from the older school of humanists in Southern Germany, which reflected the first influences of the Italian Renaissance in Germany. Soon the humanistic tendency spread further, and created in various places, especially at Erfurt, literary centers where poetry in the Latin language was cultivated. Of this younger band of humanists, Reuchlin, the teacher of Melanchthon, must be considered as leader. From the circle of poets at Erfurt emanated (1515) the *Epistolæ obscurorum*, one of the finest satires known to the world's literature.

The strongest literary personality of the time is, however, Luther. Although he had been deeply affected by humanism, he was pre-eminently a man of the people and a theologian who did not share the purely æsthetical interests of humanism. To his superior translation of the Bible and his numerous smaller prose writings is due in large measure the ascendency gained by the present German literary language over the many dialects. He deepened the moral consciousness of his people in every walk of life, worked for a more general popular education, interested himself in the drama, was a friend to poetry and music, and through his classical church hymns gave to his people a poetic source of religious edification. In all the domains of literary activity in Germany may be traced the influence which his mighty personality exercised over friend and foe.

In this stirring time—shaken to the foundation by religious, political, and social strife—little room was left for pure delight in the beautiful. One of the most gifted of the humanists himself, Ulrich von Hutten was drawn into the vortex of these conflicts, so that he finally devoted his literary activity entirely to the questions of the day, and turned from the Latin to the German language in order to be sure of reaching the wider circles of his contemporaries. What remains at this time of activity in pure art finds its representative in Hans Sachs, who, although intellectually dependent upon Luther, maintains still, beside this intellectual giant, an independent station. A shoemaker by trade, but a man of poetic talent, open-minded and athirst for knowledge, he began in early youth as a *Meistersinger*, and brought the *Meistersinger* school at Nuremberg into great renown. He also adopted the short rhymed narrative which comes into use as early as the end of the thirteenth century. Soon he turned to the drama, the form of poetry which was best adapted to the life of the sixteenth century, and in which this century showed the greatest creative power. The drama, which had been especially promoted after the pattern of Plautus and Terence by the humanists, had been quickly employed in the service of the Reformation, and in the most widely different regions of Germany, from Switzerland to Lower Germany, we can observe its cultivation. Biblical stories, as well as the pattern of the English *Every Man*, furnish the themes for these dramas, which for the most part reflect the fundamental ideas of the Reformation. With Hans Sachs we find this same compass of material, but enlarged so as to include the German hero-song and general history. Although without real dramatic power, there is still apparent in Hans Sachs the endeavor to treat the questions of the day, and when he handles a subject to which his talent is adequate, we find the people's poet cheerful, full of humor, and of the wisdom of life.

The English comedians who came to Germany at the end of the century brought with them a more highly developed stage-art. The effect of this upon the development of the German drama soon shows itself.

While we can observe in this period of German literature a decadence of the metrical art, which in its essential points had been transmitted from the classical period of the thirteenth century, we can also perceive a rise of prose which visibly increases in flexibility and power of expression. Subjects which had formerly allowed only of verse now began to be treated in prose. The thirst for entertainment, too, is now almost exclusively satisfied with prose. So there appear, partly from earlier sources which reach back into the time of the court poetry, partly from later myths and versions, the *Volksbücher*; *Kaiser Octavian*, *Fortunat*, *Eulenspiegel*, *Dr. Faust*, *The Wandering Jew*, etc. The spirit of the whole stirring time is seen again toward the end of the sixteenth century incarnate in Johann Fischart (1550–1590). In command of language, in power of expression and representation, he can be compared only with Luther.

*Fourth Period* (1624–1748).—The wealth of thought and material of the sixteenth century would surely have also developed a greater perfection of form had not the Thirty Years' war, the most fearful disaster that ever befell a nation, now set in. The prosperity of the nation was destroyed, and the population of Germany decreased by more than half; yet these were but minor evils compared with the fact that the national spirit also entirely disappeared. Only the religious feeling could develop independently in the misery of external circumstances. And so in the beginning of this period we see, partly in opposition to the prevailing one-sided dogmatism of theology, the beginnings of pietism, which was to be an important factor in the literary development of later times.

While the voice of popular poetry gradually becomes mute, from the circles of humanism arises a reform. It was an act of great importance for the future when Martin Opitz undertook, in his book on German poetry (1624), to reform the German verse-structure in accordance with ancient models, without, however, disregarding the difference between the ancient and the German languages. Around Opitz, who looked upon fame and immortality as the poet's highest goal, but was himself possessed of slight poetic talent, was grouped the first Silesian school of poetry, whose most gifted members are Paul Fleming, Simon Dach, and Friedrich von Logau. While these poets stand for the most part under the influence of humanism, the second Silesian school shows in Hofmannswaldau and Lohenstein how the taste of the public is entirely subject to the influence of foreign countries, especially of France, Spain, and Italy. It is in vain that individual men and the German language societies revolt against this. The national feeling has disappeared from the nation, and it must be fought for in the future by individual men with full consciousness. Only the German Protestant Church hymn reached its perfection at this time with Paul Gerhardt; and only in the satire, as employed by Schuppius, Lauremberg, and particularly Moscherosch in the *Wunderliche Gesichte Philanders von Sittenwald*, does there still breathe something of the spirit of the sixteenth century. A faithful mirror of the time appears finally in the writings of Christoph von Grimmelshausen, who produced in his novel *Simplicissimus* the greatest imagi-

native work of the seventeenth century. Next to him must be mentioned Andreas Gryphius (1616–64), who as dramatist is pre-eminent among the poets of his time.

But the bombast and artificiality which ruled in the second Silesian school could only endure for a time. As pietism through its chief representatives, Spener and Francke, asserted the claims of the heart, so the now dawning rationalism asserted the claims of the intellect, and enlisted in its service criticism, which was soon to play so great a *rôle* in literary development. The great philosopher Leibnitz had before praised the strength of the German language, and now the leaders of rationalism, Wolff and Thomasius, turn by preference to their mother-tongue. Thomasius gives the first public lectures in German, and publishes the first scientific journal. Gradually, too, in poetry the tone of true sentiment makes itself felt. In connection with this must be mentioned particularly Brockes, who first showed a fine feeling for the beauties of nature, and Günther, who based his poetry upon the experiences of the heart.

As formerly Opitz, so now Johann Christian Gottsched (1700–66) undertook to reform German literature. Although a man of the best intentions and of a patriotic soul, he yet lacked the creative power to carry out his plans of reformation. He, too, believed it possible to direct German poetry into new channels by means of criticism, but instead of going back directly to antiquity he thought that he saw in classical French poetry the ideal of the poetic art. Thus while he thought to advance German poetry he chained it so much the more firmly to the French model.

A far greater influence over his contemporaries was exerted by Gottsched's colleague at the University of Leipzig, Gellert (1715–69). In his works we can see incorporated all that there was in Germany of intellectual and poetical culture before the classical period. Even to-day he still lives in his church-hymns and fables. The light, smooth tone which pervades these fables is present also in the songs of the so-called Anacreonists, who, imitating Anacreon in their songs, continued to make their influence felt down to Goethe's time. Among the really noteworthy poets of this time are to be mentioned Friedrich von Hagedorn (1708–54) and Albrecht von Haller (1708–77).

But the preparation for the coming classical period of German literature is really effected by the struggle between Gottsched and the Swiss critics Bodmer and Breitinger, which takes place at this time. Schooled by the English poets Thomson, Pope, and especially Milton, the two Swiss critics maintain that pre-eminently necessary for the poet are imagination, passion, and strong prophetic power. This, of course, Gottsched opposed. But soon the youthful poets turned, in the hot battle, to the teachings of the Swiss, and then there needed only a successful illustration to decide the victory for the new teaching, according to which poetry was not to be, as Gottsched had desired, an affair of the understanding, but should rest upon a natural gift which would manifest itself primarily in imagination.

This illustration was afforded by the publication of the first three cantos of the *Messiah* (1748), whose author was the twenty-four year old Klopstock, and which met with extraordinary success. An epic, indeed, as Klopstock intended it to be, the *Messiah* was not. The work was effectual chiefly through the lyrical movement of the language. And as a lyric poet Klopstock attained in his *Oden* his greatest influence over the German literature as well as over the German people. He it was who proclaimed truth as the noblest theme of poetry, and saw in the poet the prophet, the herald of truth, who must become, by virtue of his God-like calling, the moral leader of his fellow men. He deepened not only moral ideas, as, for example, the conception of love, but also the sympathetic feeling for nature, and intensified the national consciousness.

But the vaporous and sentimental patriotism of Klopstock and his disciples found its first real support in the person of Frederick the Great, who, according to Goethe, first gave to German literature the genuine *Lebensgehalt*. This is seen most clearly in the literary work of Lessing (1729–81), the greatest German critic of the eighteenth century. Especially is it apparent in his literary criticism, in which there breathes something of the victorious spirit of the great king. As Klopstock had given to German literature a new and higher content, so Lessing now secured for it adequate form. Basing himself upon a thorough study of the ancients, and filled with a deep enthusiasm for antique art, Lessing, in his *Laokoon* (1766), defined the character of poetry and in particular of the epic. He also, in his *Hamburger Dramaturgie* (1767), destroyed the false classical ideal of the French, and pointed to Shakspeare, whom he placed by the side of the great Greek tragedians. In his own dramas also (*Minna von Barnhelm, Emilia Galotti, Nathan der Weise*) he created models for dramatic composition which retain their value to the present day.

Although Klopstock and Lessing reached so deeply into the spiritual life of their nation, their endeavors were much too serious and in part too learned for the great mass of their contemporaries to be carried away by them. The nobility and the higher classes of society were still preponderately French in taste, and it was reserved for Wieland (1733–1818), through the light tone of his poetry and the elegance of his language, to win over these circles also to German poetry. His greatest work in this respect is probably *Oberon*, to which even Goethe gave great praise. As a translator of ancient writers as well as of Shakspeare, Wieland has also insured himself a place in the history of German literature.

In the spiritual life of the German people a revolution had slowly been preparing which needed only an impetus from without to seize hold upon literature. Long before Rousseau had sounded the cry "Back to nature," in the seventeenth century even, a longing for pure nature had made itself felt among individual German poets. In like manner had the idea that to the true poet belongs a creative spirit, a genius, also appeared before the time which we call *Geniezeit*, or, after Klinger's drama *Sturm und Drang*, the *storm and stress period*. As its critical leader comes Johann Gottfried Herder (1744–1803), who, inspired by Hamann, Rousseau, and English writers, originated the conception of primitive, natural poetry, the product of a naïve soul, but especially of a genius. He was able to point to this primitive poetry not only in Homer, but in the Bible and in the literature of all times and peoples, and thus to awaken an appreciation for folks-poetry in general. At the same time he made the treasures of foreign literature accessible in his delicately wrought translations, of which the most noteworthy are the *Volkslieder* (1778) and *The Cid*. But these endeavors do not show the mere self-satisfaction either of the scholar or of the dilettante. From the poetry of all times and nations Herder sought to learn the nature of man, and on the basis of this knowledge to reform his people, and not only his people but humanity. The final goal of all his striving is the uplifting of humanity. In order to define its nature and at the same time to establish a conception of the course of history, he undertook his greatest work, *Ideas toward the Philosophy of the History of Mankind*, a work of magnificent conception. Not only poetry, but science, too, in nearly all its departments, owes much to Herder.

But the ideas of Herder and of the *Sturm und Drang* period first found really poetical expression in Herder's great disciple Goethe (1749–1832), who, when he met Herder at Strassburg in the year 1770, had, in his lyrics at least, already attempted new strains peculiar to himself. Under the influence of Herder, who directed him to Homer, Shakspeare, and the folk-song, now begins his career as a poet. The most beautiful of his youthful songs fall into this period —the drama *Götz von Berlichingen*, the novel *Sorrows of Werther*, and the beginnings of *Faust*. The other writers of the *Sturm und Drang* period, as Lenz, Klinger, Wagner, Maler Müller, can not compare with Goethe. Only the young Schiller (1759–1805), with his *Robbers*, takes his stand beside the author of *Götz*.

A new epoch begins for Goethe when he goes (1775) to Weimar, which was soon to become the literary center of Germany and to see the classical era of modern German literature. The influence of Frau von Stein, one of the most cultured and noble women of the century, and the responsible official position which he occupied at court, combined to turn Goethe away from the wild and eccentric *Geniezeit*. Primarily for the little circle of souls who understood him in Weimar, he composes the magnificent dramas *Iphigenie* and *Tasso*, being still an apostle of Herder's ideas, whose views of humanity attain in *Iphigenie* especially to the purest poetical expression.

His Italian journey (1786) first makes him entirely independent of Herder, as it also gives him his full maturity as an artist. In Italy the two dramas mentioned received the artistic verse-form which Lessing had first employed in his *Nathan*. But the revolution which had taken place in Goethe's mode of thought and in his style during his Italian sojourn was not understood by his contemporaries. His

ripest works, as *Iphigenie* and *Tasso*, left the public cold, and during the next years Goethe stood alone, finding his satisfaction only in science, which he enriched in the realms of anatomy and botany with some of the most important discoveries. Not until he had formed the bond of friendship with Schiller did he turn again with new love to poetry.

Schiller, too, had gone through a purifying process since his storm and stress period. He had applied himself first to historical investigations and then to the study of Kant's philosophy, but had not, withal, allowed the poetic development of Goethe to escape his notice. A nearer relation to the greatest poet of Germany had long seemed to him the goal of his ambition, and when he at last attained it he stood before Goethe as a mature thinker and critic, who might well boast himself to have developed peculiarly and successfully the æsthetic and ethical views of Kant, the greatest of German philosophers.

Now began for both poets a time of rich poetical productiveness. Goethe in these years wrote *Hermann und Dorothea*, completed the novel *Wilhelm Meister*, and enlarged the first part of *Faust*. Schiller, on the other hand, now wrote his classical dramas, *Wallenstein*, *Maria Stuart*, *Jungfrau von Orleans*, *Tell*, *Braut von Messina*, each of which appears as an attempt of the poet to realize the ideal of a national German drama.

The poetic art now formed the center of the intellectual life of the nation. It had taken as its task the solution of the greatest problems of human life, and, in holding up a new ideal to humanity, sought to influence the education of the nation. Unhappily Schiller died too early to see the fruits of his own and his great friend's works, which were also political in nature, as is seen in the national uprising during the wars for liberation.

While Goethe followed, more and more in solitude after Schiller's death, his artistic and scientific inclinations, there arises, largely incited by himself, a younger literary school which is generally known as the romantic school, whose oldest leaders are to be found in the Schlegel brothers, in Tieck and Novalis. The fact that this school could be formed while Goethe and Schiller held literary sway finds its explanation in certain one-sided tendencies of the classicists. Inasmuch as the romanticists were closely connected with the storm and stress period, and especially with Herder, they awakened, in opposition to Goethe's and Schiller's classical tendencies, a love for the German past, and fought for the justification of the religious feeling in the intellectual life. (Schleiermacher.) While their attempts often degenerated into fantastical nonsense, and while, through a one-sided accentuation of the imagination, they produced no work of art, still they developed historical interest, and brought about an advance in the national feeling. The immense advance in the philological and historical sciences also came from the circle of the romanticists. Franz Bopp, the Grimm brothers, Karl Lachmann, Niebuhr—all drew the inspiration to their great services from romanticism. Even Goethe was not able to withhold himself from their powerful influence, and paid tribute to the new spirit in his later creations—*Waldverwandschaften*, *Wanderjahre*, *Faust*, etc.

In poetry the lyric was especially benefited by romanticism. Aside from the poets of the wars for liberation, as E. M. Arndt, Theodore Körner, Max von Schenkendorf, etc., who are called forth by the political situation, romantic strains are heard in the songs of nearly all the great lyric poets of this period. This is pre-eminently the case with Ludwig Uhland (1787–1862), the author of beautiful ballads and fervent folk-songs; Eduard Mörike (1804–75), the most notable and the deepest lyric poet after Goethe; William Müller (1794–1827); A. von Chamisso (1781–1838); Jos. von Eichendorff (1788–1857); and finally also with Heinrich Heine (1799–1856).

For the drama, on the contrary, the teaching of romanticism proved utterly fruitless. That which was produced in the dramatic field in the period up to Goethe's death was essentially influenced by Schiller, as, for example, the so-called *Schicksals-dramen*. Only the unfortunate Heinrich von Kleist (1776–1811) and the gifted Grillparzer (1791–1871) show original dramatic talent. Even less of a lasting nature, if we except Goethe, was produced during this period in the realm of romance. Only Hölderlin, with his novel *Hyperion*, may be mentioned here, although this poet is really one of the greatest lyrics of the German language, who seems in his best poems to unite the merits of both Goethe and Schiller. Later, under the influence of Walter Scott, Wilhelm Hauff developed, whose novel *Lichtenstein* (1826) has not grown antiquated.

*Sixth Period* (1832 to the Present).—The growth of national feeling during the wars for liberation was followed by a time of reaction and of political lassitude which was indeed favorable to the development of science but not of poetry. Thence it came that gifted poets like Friedrich Rückert (1788–1866) and Platen (1796–1835) turned toward the Orient after Goethe himself had set the example in his *Westöstlicher Diwan* (1819). Shortly before Goethe's death, in consequence of the French July revolution, a change had taken place in the spiritual and political life of Germany. The group of writers who stood in the forefront of this new movement are usually known under the name of the Young Germany. They were a number of young men whose chief talent lay in journalism, and whose greatest service was done by combating romantic extravagances in political, moral, and religious fields. As poets they were all like Ludwig Börne, Heinrich Laube, etc., of a low order of talent. Even Heinrich Heine, the clever imitator of folk-songs, in spite of many successful poems, is not to be exempted from this judgment.

Political interests which are directed toward the unity of Germany fill the nation's life during the ensuing period. The idea of a renewed German empire, which first took shape among romantic circles, is gradually taken up by the opposite party, the Liberals. From the struggle for German unity rises the political lyric in the hands of Herwegh, Dingelstedt, Freiligrath, and others. Among these poets only Emanuel Geibel (1815–84) rose to the height of real art. In addition to these are still to be mentioned R. Reinick, August Kopisch, and the melancholy Nikolaus Lenau (1802–50). In the case of the latter, love for America, which rules so many of the best German poets since the *Sturm und Drang* period, becomes so strong that it leads him to emigrate, only, indeed, to return in a short time disillusioned. In the field of the novel, Karl Immermann (1813–63) is to be mentioned, who gave, through his *Oberhof*, the incitation to the *Dorfgeschichte*, which was taken up by Jeremias Gotthelf, B. Auerbach, M. Meyr, and many others. The most noteworthy dramatist of the time is seen in the person of Friedrich Hebbel (1813–63).

As after the wars for liberation, so after the year 1848, with the failure of the national hopes, a state of lassitude supervenes, in which poetry no longer exercises the chief influence over the life of the nation. This fact is not altered through the circumstance that King Maximilian II. of Bavaria assembles about himself a circle of poets to which belong Geibel, Bodenstedt, Schack, Lingg, Riehl, Paul Heyse, and others. Natural science and social questions advance further and further into the foreground of the intellectual life. Even the great Franco-Prussian war and the re-establishment of the empire, the fulfillment of the patriotic dreams of centuries, brought no new impetus to German literature. Poets like Gustav Freytag, Jos. von Scheffel, Gottfried Keller, and Paul Heyse, who lived to see this great event, belonged to an earlier generation, and received their artistic views from a time still filled with classical and romantic traditions. The youngest generation, the so-called Youngest Germany, is seeking to break with these traditions entirely, and, in imitation of Scandinavian, Russian, and especially French models (Zola), to create a new realistic form of writing. Hitherto it has produced only programmes; we patiently await the promised poetical achievements. However, a real poet of deep humor and high art has recently appeared in Hans Hoffmann, who, by his excellent works, has given proof that German literature is still bearing fresh blossoms.

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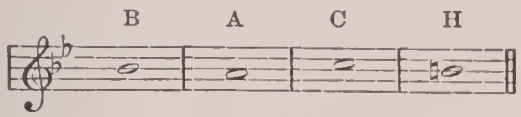
Julius Goebel.

**German Methodist Church**: See Evangelical Association.

**German Ocean**: See North Sea.

**German Reformed Church**: See Reformed Church in the United States.

**German Scale**: the musical scale used by the Germans; represented by the letters A, *H*, C, D, E, F, G, not A, *B*, C, etc. It is customary with them to reserve the letter B for *B*♭, and its place is supplied by substituting the letter H. In German organ-music there are fugues written in honor of the illustrious J. S. Bach, in which the leading theme or subject is formed from the four letters of his surname, the H standing for B♯, thus:




**German Seventh-day Baptists**: a sect founded in 1728 at Ephrata, Pa., by Conrad Beisel, who led a secession from the so-called Dunkers. The members in 1732 entered a conventual life and adopted the Capuchin habit. Their principal settlement is at Snowhill, Franklin co., Pa. They take no monastic vows, hold property in common, keep the seventh day sacred, recommend celibacy, but do not forbid marriage. They number about 200.

**German Silver**: an alloy of variable constitution, designed as an imitation of silver. Eight parts of copper to three or four each of zinc and nickel make a very fair imitation; and the addition of 2 or 3 per cent. of iron renders it whiter, but less malleable. A very malleable sort has 10 parts of copper, 6 of zinc, and 4 of nickel. The Chinese *pakfong* is essentially the same as German silver. As the price of nickel has increased, various cheaper white alloys have to some extent superseded the use of German silver, which is, however, still extensively used in the arts.

**German Southwest Africa**: See the Appendix.

**German Theology**: the theology of the Protestant churches of Germany. In spite of all appearances to the contrary, there is still noticeable a very great family resemblance among those churches which call themselves Protestants. With good reason, therefore, may one speak of the unity of a Protestant or Evangelical Church, the more so as it is the common evangelical principle that the unity of the Church does not consist in the similarity of ceremonies or form of government of the Church, but in the preaching of the pure gospel and the administration of the sacraments in accordance with the principles of their institution. This one Evangelical Church, or Protestantism, has this distinguishing characteristic, that it would have the common features of Christianity apprehended by conscious personal appropriation, in the full sense of the word; that is to say, through the appropriation by the whole soul from center to circumference, and indeed so that through the acceptance of the object of faith in our inmost souls the assurance of salvation is grounded in justification by faith in Christ, whereby immediate access to God is secured and enjoyed. And this assurance of salvation, as it opens up a new idea of God, of His acts, and of the destiny of mankind —thus a new conception of God and the world—contains no less a strong impulse of gratitude in order to the work of sanctification in one's self and for work in one's calling for the kingdom of God. This assurance of salvation is a knowledge which begets a new disposition, a new being, a new regenerate creature—which, recognizing itself, with a loving heart would engage in work. Christianity in Protestantism has advanced to a new stage in its appropriation by mankind, for it is not content either with a purely intellectual appropriation of Christianity, be it in a speculative form or more as a matter of memory, as is chiefly the case in the Greek Church, influenced by the Hellenic mind, or by a mere legal submission of the will to a system of doctrines, or even a practical ecclesiasticism, as in the Roman Catholic Church, influenced by the Jewish mind. Protestantism, on the other hand, as a unit, would be the personal expression of Christianity, above all as the religion of peace and reconciliation, and indeed of light and life from God.

Protestantism, so soon as the preparatory streams of the Middle Ages had worn for themselves deep beds and been combined in one channel, manifested itself in a twin form —the Lutheran, which on the whole prevailed in German Protestantism, and the Reformed. The one took possession of the eastern division of the German races, the other of the western. The difference is that the Reformed confession carried out the evangelical principle more according to its realistic or practical side, or as a principle of the will, while the Lutheran confession, in accordance with the genius of the German people, unfolded it more according to the intellectual side. Thus each has a relative advantage and a relative deficiency. If the present article confines itself to German theology, and lays greater stress upon that which, within Protestantism as a whole, constitutes the peculiar strength of the German Church, it is not to exalt this theology above that of other confessions or to depreciate their superiority in other respects. A prelude or type of German theology appeared in the Middle Ages in the German mysticism of Johann Eckart, Heinrich Suso, Ruysbroeck, Tauler, and the little book with the characteristic title *Ein Deutsche Theologey*, which Luther justly prized so highly. In the Middle Ages, indeed, men of the German race had distinguished themselves as scholastics, such as Albertus Magnus, Gabriel Biel, not to speak of Nicolaus Cusanus or Occam; but the Latin races then led the van in scholasticism. In analysis and the logical treatment of a subject they were in their element. The Teutonic (particularly the German) mind early tended to unite religious feeling or mysticism with speculation, together with a thoroughgoing reconciliation of faith and knowledge. The evangelical principle of faith unites faith and knowledge in the form of religious assurance; and in that it shows itself capable of establishing a Church, the soil is prepared upon which the peculiarity of the German mind may assert itself, and at the same time take up a position at the head of theology.

The evangelical principle ripened to its power of reform by satisfying the longing of the soul for immediate communion with God by the word of reconciliation through Christ and justification by faith; that is to say, in that the deep mystical tendency of the German mind attached itself in faith and faithfulness to historical Christianity, as it has its sources in the Holy Scriptures, thus possessing the truth no more outwardly as a law, but inwardly as an enlightening and quickening power. And so the principle of the Reformation reached its maturity in that faith and the Word, the Word and faith manifested and confirmed themselves in their necessary internal harmony. This is nothing else but what is now called the formal and material sides of the Protestant principle. The history of German theology is only to be understood from the movement of these constitutive factors. In the following sketch are distinguished a *creative* and *formative* period; a *preservative* and *conservative* period; and, finally, a critical or destructive period—that of the eighteenth century. The last, however, was only a purifying process in order to a regeneration which already announces itself in potent tokens.

I. The first *creative* period of the German Church and theology, embracing the period of the Reformation, is evidently characterized by the position which the doctrine of justification assumed in its critical and positive development. The prevailing church doctrine and order were critically measured by the word of God, contained in the Holy Scriptures, apprehended by faith. Faith in the Holy Scriptures was not based upon the authority of the Church, although historical tradition in other respects continued to be recognized. No more was the authority of the Church to decide respecting the canon (as the exclusion of the Apocrypha shows), or the interpretation of the Scriptures. The Holy Scriptures received their regulative place because the apostolic word about Christ, or because that which was recognized as the kernel of the Holy Scriptures, Christ accepted in faith, demonstrated to the soul its animating divine power. And so the real attestation of the Holy Scriptures was found in nothing else than Christ so far as He imparts to the soul through His Holy Spirit the assurance of divine salvation. Accordingly, while faith itself arises through the word of God, whether in the Holy Scriptures or in the preaching regulated by them, it is only through them as the specific means of grace. On the other hand, the Holy Scriptures are authority or norm for faith only through that which certifies them, through Christ their central theme. He is "the emperor over the Scriptures" (*der Kaiser über der Schrift*); a writing that "does not urge Christ" (*Christum nicht treibet*) can not claim canonical authority.

Faith in unison with the Holy Scriptures, and holding them in the hand as norm, now critically revised the whole ecclesiastical system of the Middle Ages, and established new religious views. The doctrinal type which resulted therefrom received its classical expression in the Augsburg Confession (1530), with its Apology (1530–31), and in the

two catechisms of Luther (1529), with the Schmalkald Articles (1537), which are essentially in unison with these writings of Melanchthon. These five symbols present the first formation of the Lutheran doctrine, the most systematic and summary being the *Augsburg Confession*; for justification by faith constitutes the center from which all else is ruled (Art. IV.); its theological, anthropological, and Christological presuppositions are given in the first three articles, while the fourth article contains the union of the free grace of God with the believing soul. It then proceeds to the doctrine of the origin and nature of this faith. Its origin is through the ecclesiastical office, which administers the word of God, and the sacraments, these being accompanied by the agency of the Holy Spirit (Art. V.). Faith grows into new obedience or love (Art. VI.). If this be the nature of evangelical faith in its origin and growth, it of necessity leads to the Church, which partly presupposes faith, partly supports it; therefore the Church is treated of at length in Arts. VII.–XVII. Art. VII. determines the fundamental idea of the Church as an everlasting communion of saints or believers, which is recognized externally by the pure doctrine of the gospel and the proper administration of the sacraments, and which preserves its unity even in the dissimilarity of human tradition. The Church in its realization is to a certain extent inconsistent with its idea, and hence there arises the distinction between the invisible and visible Church, which, however, does not find its expression in the Lutheran symbols. This inconsistency, however, on the side of the subjective factors of the Church does not go so far as to do away with the efficacy of the objective factors, the Word and sacraments. These objective factors, baptism and the Lord's Supper, were now positively stated (Arts. IX.–XII.) with silent polemic toward the Roman Catholic Church, and her apparently fuller doctrines of the sacraments (viz., penance, with confession and ordination); the *opus operatum* was rejected, because contrary to faith (Art. XIII.), and the evangelical idea of ordination was defined as the lawful call to the public administration of the means of grace, as opposed to anarchy as well as hierarchy, so that the balance is restored between church order and evangelical freedom. The principle of faith entirely unites the objective or necessary side with the subjective side, and transfigures both into evangelical freedom. On this very account the evangelical type of teaching is friendly to the state which it acknowledges as a divine institution, and engages to serve with the cheerful obedience of love (Art. XVI.). Finally, Art. XVII. treats of the final destiny of the Church, excluding enthusiastic millenarianism. The remainder, for the most part, refutes misconceptions respecting evangelical doctrines, such as the supposed entire denial of free will and the charging the divine causality with the origin of evil, the supposed despising of good works and the law; and closes with the rejection of the principal ecclesiastical abuses, such as withdrawal of the cup from the laity, the celibacy of the priests, the sacrifice of the mass, oral confession, laws about eating, monastic vows, as well as the unevangelical exaltation of episcopal power over against the laity and the state. That which has just been stated is the substance of the doctrines of the Lutheran Church—that which constituted the official doctrine until 1750. These Lutheran symbols contain in general an harmonious whole, and have shown themselves capable of establishing an evangelical Church and an independent evangelical literature and learning. Several important points, however, were either not discussed in this first confession, or were not clearly decided in harmony with the general evangelical type. Above all, the Holy Scriptures are indeed presupposed as authority, but are mentioned only as a means of grace; no doctrine respecting them as a norm is established, even though they are implicitly understood to be so as a matter of course. There is a marked difference in this respect in the Reformed confessions, since they very early presented the article respecting the Sacred Scriptures as a particular doctrine, some of them with a specification of the particular writings which were to be regarded as canonical. The *Formula Concordiæ* (1577) partly made up the deficiency. But it evidently proves that Luther's clear insight into the relation of faith to the word of God and the Holy Scriptures in the principles briefly mentioned above, as resulting from faith with respect to the canonicity and criticism of the Holy Scriptures, as well as their interpretation, had by no means become the general conviction of the Lutheran Church. The deficiency in the working out of this fundamental principle constitutes the mainspring of the theological movements of the two following centuries, which somewhat differ from the standpoint of the Lutheran Reformation. There are other inequalities or deficiencies, such as the following: While the *opus operatum* is decidedly denied, owing to the fundamental principle that salvation must be apprehended by personal faith, yet regenerative power was ascribed to the baptism of infants, even at the moment of its administration, not indeed by the *Augsburg Confession*, but by the common Lutheran doctrine. And notwithstanding Luther's attempts to escape the difficulty by the supposition that even infants who have been baptized have faith (analogous to Calvin's *fides seminalis*), another inconsistency threatened with the position decidedly taken against enthusiasts, that faith comes only through preaching. Luther hinted at a better solution in his Larger Catechism—namely, that baptism has not merely momentary significance as an act of the eternal God in His adopting grace, but is a revelation of His gracious will, which remains valid and efficient until human unbelief shall have destroyed the baptismal covenant. But this solution was not made use of by the Lutheran theologians.

There is another inequality with reference to the doctrine of predestination. It is indeed true that Luther never lost sight of the universality of the divine gracious will, and would found the consciousness of salvation not on the knowledge of everlasting election working through faith, but, on the contrary, on the gracious will revealed in the word and sacraments and apprehended by faith—maintaining likewise a possibility of a falling away from grace. Nevertheless Melanchthon, in the first edition of his *Loci*, the earliest dogmatical work of the Reformation, as well as Luther's treatise *De servo arbitrio* (1525) against Erasmus, shows that in the beginning the leading men of the Lutheran Church maintained a position similar to that of the founders of the Reformed Church and theology; for, while avoiding absolute predestination with reference to both the elect and the reprobate (the *prædestinatio duplex*), they decidedly held fast to the doctrine of a complete extinction of the free will by means of original sin, and, in connection with this Augustinian rejection of every form of synergism, admitted a sort of eternal predestination with reference to the elect. Such was the standpoint which, in a somewhat mitigated and relaxed form, was maintained not only by Luther in his later writings (after 1530), but also by his disciples and immediate followers, the so-called Gnesio-Lutherans of the second half of the sixteenth century. The concluding Confession of Faith of the Lutheran Church in the epoch of its first formation, the *Formula Concordiæ* (1577), decidedly and clearly expresses the same meaning in its eleventh chapter (*De aet. prædestinatione et electione Dei*), where both the double decree of the Calvinists and the synergism of the later editions of Melanchthon's *Loci* and of his one-sided disciples (the so-called Philippists) are equally rejected. The German evangelical people, however, from the very beginning did not agree with the absolute denial of the freedom of the will, as is clear from the letters of the laity to the Reformers. Absolute *determinism*, even in the Augustinian form, did not please them, and they could not be contented with the mere *liberum arbitrium in civilibus* which the leaders of the Reformation early acknowledged. (*Conf. Aug. XVIII.*; *Form. Conc.*, ch. ii.) This was in the interest of not letting the cause of evil, nor indeed the ruin of the descendants of Adam on account of original sin, fall back upon God. But since even the Reformers had been led by a religious motive to the denial of freedom toward the good—namely, by the doctrine that all good cometh from above—it became a necessary as well as a difficult task to reconcile the apparent conflict in an harmonious, well-adjusted doctrine of sin and grace. The Lutheran theology of the seventeenth century sought the solution by presupposing as necessary for conversion certain inevitable operations of grace, whereby the *liberum arbitrium* was restored, upon the use of which, then, man's final fate depends. But thereby it did not take away all difficulties involved in the problem; for while laying too much stress upon the necessity of certain electing and preordaining acts of God with regard to the human individual, these theologians did not conceive the inevitable effects of grace to be universal, whether in this world or the next: and when in the eighteenth century the universal salvation of the heathen, even without Christ, was frequently acknowledged, nothing was gained thereby. It was not until the nineteenth century that the *universality of the call* by the gospel to faith and salvation was taught also by Lutheran orthodox theologians on the ground of 1 Pet. iii. 18.

With reference to Christology, finally, the *Augsburg Confession* and the other older symbols limited themselves to that which is common to Christianity, only that Christ as a conscious possession was placed in the center, while He had hitherto been pushed into the background, and, as it were, "buried" by the doctrine of the saints and the merit of works. Nor did these symbols establish any doctrine in opposition to the Reformed Church. The germ of the conflict lay in Luther's doctrine of the Lord's Supper and his polemical writings against Zwinglius; yet this doctrine assumed only a subordinate position. Luther was concerned with reference to the Lord's Supper simply with the objectivity of the sacrament independent of faith, which did not make the sacrament, but only received it. To insure this objectivity, he maintained that the body and blood of Christ were the divinely given pledge of the forgiveness of sins, which were imparted in, with, and under the bodily elements, so that whoever receives the elements, even though without faith, would likewise receive that pledge—the glorified body and blood of Christ. It was not clear, however, how far the objectivity of the sacrament depended upon the partaking of the body and blood on the part of unbelievers likewise, or why the equal objective *offer* did not suffice, as Brenz taught in the *Syngramma Suevicum* (1525), which even Luther himself approved. On the other hand, it was not clear in what sense the invisible body and blood of Christ were to be a pledge, together with the visible pledges of bread and wine, of the invisible grace of the forgiveness of sins. It was not until the later Lutheran theology since Hollaz (d. 1713) that an especial significance was ascribed to the partaking of the former, in that, with Calvin and several Reformed confessions, the participation in the virtue of the glorified body of Christ was regarded as a blessing in itself, and no longer merely as a means of the assurance of the forgiveness of sins. It would not have been at all necessary for the Lutheran doctrine of the Lord's Supper to adopt the Lutheran Christology with reference to the *status exaltationis* and all its consequences, which threatened in a Docetic manner the true earthly humanity of Christ, His growth, learning, etc., unless it had already fully extended the *communicatio idiomatum* to the childhood of Jesus, instead of making a deep and real distinction between the state of humiliation and the state of exaltation. This course was considered necessary in order that the first Lord's Supper should become entirely identical with the subsequent ones; for which there was no real necessity, since the visible bodily presence of Christ afforded the disciples a complete compensatory pledge for that which the glorified body of Christ is said to veil behind the visible.

Melanchthon, whose native character was more ethical than religious, was the occasion of the controversies with reference to the relation of justification and santification to the law and good works, which were so decided by the *Formula Concordiæ* as more closely to define the Lutheran doctrine on this subject (*F. Conc.*, ch. iii. and iv.). Since Melanchthon ascribed such essential importance to the law for the origin of faith through repentance and the continuance of faith, George Major (d. 1574) and others of his school asserted that good works were necessary to salvation. This doctrine was assaulted in many points by the Antinomianism of Johann Agricola (d. 1566). The law, he contended, belonged to the court-house, and not to the pulpit, true repentance originating entirely from the contemplation of the love of Christ. And, as Luther had shown that penitence and repentance presuppose a moral norm, he insisted at least that the believer no longer required the law, because the internal impulse of the Spirit works of itself that which is good. The *Formula Concordiæ* rightfully decided that the law was of threefold necessity: (1) To secure civil order (*usus politicus*); (2) to work repentance (*usus elenchticus*); (3) to regulate even the life of the regenerate, who were still struggling with sin (*usus normativus*), whereby it was acknowledged that Christ alone, as the living Law, could lead to saving repentance as well as be the living mirror of holiness (*For. Conc.*, ch. v. and vi.). On the other hand, the necessity of good works to salvation was truly recognized in the sense (contrary to Nicolaus of Amsdorf, Major's extreme and hyperlutheran adversary, d. 1565) that a good tree bringeth forth good fruit; but the opinion was repudiated that good works can in any way merit salvation, which would admit a depreciation of the justifying free grace of God (*For. Conc.*, ch. iv.).

In all these points the ethical spirit of Melanchthon was followed. It was otherwise with the controversy respecting the atonement and justification, which was raised by Andreas Osiander (of Nuremberg, d. at Königsberg, 1552) and Franz Stancarus (of Mantua, for some time professor at Königsberg, d. 1574). The school of Melanchthon had been accustomed to base the atonement exclusively upon the expiatory sufferings of Christ, which led Stancarus to ascribe mediatorial significance *solely to the human nature* of Christ, which alone was able to suffer. Osiander thought it more frosty than ice to limit justification to deliverance from guilt and punishment, from which indeed man had been redeemed by the work of Christ 1,500 years ago. It was rather the communication of the essential righteousness or divine nature of Christ, which is the archetype of humanity, eternally appointed for incarnation, and hence only the *divine nature can come into consideration with reference to salvation.* A *justitia forensis*, consisting merely in imputation, and indeed of the merit of Christ, blotting out guilt and punishment by His suffering, would not be sufficient to satisfy the divine good pleasure; but nothing less than the restitution of the divine image through the indwelling of the divine nature of Christ, which justifies in fact, and not merely in the way of imputation. Osiander in this appears to be ethically superior to Melanchthon; and indeed the Melanchthon type of doctrine did not attain the fervency and depth of the mysticism which, for instance, distinguished Luther's little book about the freedom of the Christian. But, on the other hand, the undervaluing of the atonement by Osiander, and of the blotting out of guilt and punishment, was not inspired by an ethical spirit; he leaps over the step of the appropriation of the forgiveness of sins, which in fact can only take place by a forensic act of God, and not merely on the ground of man's habitual righteousness in faith; and he pays too little regard to the necessity of peace with God in order to sanctification. He would attain holiness immediately through the divine nature of Christ, which he does not conceive as sanctification. Moreover, he stops at *justitia essentialis*, and thus does not overcome an *unethical mysticism.* The *Formula Concordiæ* (ch. iii. and ch. viii.) maintains the unity of the person of Christ in the work of salvation, the co-operation of the divine and human natures of Christ therein, and regards as Christ's work not only His passive suffering, but also His active obedience. And thus the imputation which it maintains against Andreas Osiander is so carried out that man is justified by faith because Christ represents him before God, having blessed him with His active obedience as well as His passive. Thus Luther's doctrine is likewise preserved, that man enters by faith into union with Christ; and this opinion simply is rejected, that he receives forgiveness of sins or justification on account of the *justitia essentialis* which has become his. Personal sanctification is first called forth by the love of God experienced in the forgiveness of sins, and appears in the form of responsive love. A remnant of ideas current before the Reformation pervades this doctrine of the *Formula Concordiæ* when it says that Christ, according to His divine nature, in which the human nature by virtue of the *communicatio idiomatum* participates, is the Lord of the law, and is not therefore obligated to it; and thus His double obedience produces disposable merit, which, by imputation, may be charged by grace to the account of believers. Thus the fact is lost sight of that Christ by His entering into human life subjected Himself (Gal. iv. 4) to its conditions and laws, therefore also to the divine law to which all men are bound. Finally, the internal goodness and necessity of the law is not regarded in this view, which does not admit that it should be conceived as depending for its validity on absolute power or arbitrary will.

II. The period of the Reformation was followed by an epoch of *scholasticism* which more and more fortified the doctrinal system of the symbolical books. In the place of the creative period which built up the doctrines of the Reformation came a period of the *cultivation and preservation of traditional doctrines*; the sublime activity of the Reformation was followed by a period of slackness in spiritual things—the bold and yet well-regulated use of freedom by a kind of barrenness, anxiousness, and narrowness. The bravery and courage of the heroes in the spiritual battle of the sixteenth century remained as a model, but were exchanged for a hateful love of strife, which regarded the little things as great, and only too often the great ones as little. But just as the followers of the apostles in the subsequent generations should not be despised or blamed, however far below their leaders they may have stood, inasmuch as they yet helped to conquer the world for the faith by their faithful testimony unto death, so the followers of the

Reformers in the epoch subsequent to the founding of the Evangelical Church had to exhibit no trifling power of faith in the bloody conflicts which were excited and nourished by the counter-Reformation, especially by the Jesuits. It is enough that they accomplished something in true labor for the task which was laid upon them. The principle of the Reformation, in accordance with its great historical significance for the world, must first secure the firm establishment of Protestantism in the midst of the Old World. It was not of so much importance to bring forth new treasures out of the Holy Scriptures and the chambers of the believing spirit, as to carry out the Reformation's idea of the world through the consideration of the history of the Church. It was necessary to search into the entire sources of the revelation in the Old and New Testaments, to study them in the light of the newly gained knowledge, and thus to take spiritual possession for the new Church of the whole previous world. It was necessary to find confirmation and proof for the truth of the Reformation in the Holy Scriptures and the history of the Church. The whole of theology under these circumstances became the servant of dogmatics—yea, almost became absorbed in it. What had been planted by the Reformation in the heart of the German people was taken possession of in the seventeenth century by the architectonic spirit, in order to build up a systematic structure for offense and defense. A well-organized method, equipped with logical power, endeavored to arm Protestant truth on all sides. The indefatigable diligence and acuteness of the great dogmatic writers of that century surrounded the district of evangelical truth on all sides with fortifications in order to present it as a great invincible citadel. In the beginning of the century, and indeed subsequently, there was no lack of the power of a spiritual life. It resounds with abundance of holy hymns and mighty chorals, and the people were edified by excellent evangelical preaching. But an abatement of spiritual power was soon manifest. The thought of the conquest of the world, Roman Catholic, heathen, and Jewish, was scarcely agitated, nor was there any great effort to carry out the Protestant principle in an ethical direction in the whole life of the Church. Rather with the one-sided effort to preserve that which had been won, the evangelical principle itself, in accordance with an internal law, changed in their very hands. This is shown in the treatment of the principle of the Reformation itself, which was for Luther the living soul and controlling center of the whole, and which the *Augustana* (see above) shows to be fruitful in the production of an entire system of doctrine, as well as in criticism and polemics. But now the principle became a single article of doctrine alongside of others, and in the scholastic treatment to which the doctrine of justification was likewise subjected can be traced, only too clearly, an internal uncertainty respecting important points in the principle itself, as well as in its systematic position.

There was an uncertainty respecting the time of the divine act of justification with reference to the individual; thus whether justification is adjudicated to man only as subsequent to faith, either as coming into existence or confirmed, or whether, on the other hand, the declaration is made known to man by God that He *has* forgiven him for Christ's sake, and justification is thus offered in order that he may believe. Since faith and true repentance were more and more demanded in such a manner as a condition of justification that faith almost gained the significance of a meritorious or efficient cause of justification, the pious began to be doubtful whether they were in possession of true repentance and true faith, or not, as well as to doubt (in the eighteenth century) respecting the true evidences of genuine faith. Finally, these evidences were found in faith working by love, and the assurance of justification was drawn from good works as the evidences of true faith. And thus they had returned by a roundabout way to the boundaries of Rome. So likewise there appeared more and more uncertainty whether faith might be sure of eternal election or only of present grace, as J. Musaeus (of Jena, *v. infr.*) claimed. It was of more importance to theology, however, that justification by faith was no longer treated as a principle, but only the Holy Scriptures. They were now brought forward in such a way that they were treated by the dogmatic writers as the only foundation of Christian truth. The doctrine of the Holy Scriptures was so wrought out that it should be clear that the evidence of the truth consisted solely and sufficiently in the fact that it could be proved to be contained in the sacred books. Accordingly, then, the theory of Philo respecting inspiration previous to the Christian era became almost the model for the Christian theory of inspiration. It was said that the contents and words of Scripture were dictated to their authors, and imparted *non ad sciendum sed ad scribendum*, while, on the other hand, it is the characteristic of the New Testament economy, by which it is essentially distinguished from the time before Christ, that the subject-matter of salvation no longer remained merely external to the spirit, but unites itself with its innermost convictions and knowledge of the truth. While the significance of the gospel, according to Protestantism, consisted above all in the building up of free and conscious individuals, that theory made the pillars of the Church, the teachers of mankind, into mere machines, so that their personal faith and knowledge were not employed as co-operative factors in the preservation and transmission of the gospel. That theory passed rather lightly over the fact of the different individualities of the writers of the Holy Scriptures, as well as the various readings of the original text, the impossibility that believers in general should resort to the original sources, and the imperfections in the style and language of the various compositions. All the differences and lack of harmony in parallel historical statements were balanced, not unfrequently by an overstrained endeavor to harmonize them. Thus there was a recoil from the critical principles of Luther with reference to the canonicity of particular writings, important as they were in religion and theology, as if they were something which was not to be followed, but rather pardoned in him; but they had nothing better to substitute for them than a renewal of the authority of the Church in constituting the canon, as indeed the view of Quenstedt (of Wittenberg, *v. infr.*) was that, granted the Gospel according to Matthew were spurious, it would nevertheless retain its authority if the Church should ascribe canonicity to it. In the same manner the difference between proto and deutero canonical writings of the New Testament, which was still recognized in the editions of the Bible of the sixteenth century, was abolished in the seventeenth. Yet they did not deviate so far from the standpoint of the Reformation as to treat mere historical faith (*fides historica*), or evidence of the same, as a substitute for the proper assurance of faith (*fides divina*). On the contrary, they laid great stress on the fact that a special operation of the Spirit accompanied the reading of the Scriptures to receptive souls, or that the Scriptures were the peculiar channel for the Holy Spirit, the Spirit of truth. This significance of the Scriptures as a means of grace—which characteristic they eternally possessed independent of all criticism—was, however, immediately inverted in the doctrine that the Holy Spirit gives immediately, and not only to true believers, divine assurance respecting their divine origin and the fact of their inspiration. Hence was derived their normal authority. Instead of their being acknowledged as the document and source of the knowledge of the genuine original Christianity, their contents, they were considered as likewise a sufficient attestation of the *truth* of these contents. Furthermore, it was granted that each individual could be enlightened and assured respecting the truth of the contents of the Scriptures through the working of the Holy Spirit in these Scriptures, without the necessity of the operation of the power of the gospel in changing the heart. This decline to the standpoint of intellectualism, with its latent Pelagianism, occurred in the so-called *Theologia irregenitorum*, which led the way to Pelagianism through the magical operation of the Scriptures and the Holy Spirit—a doing away of the difference between nature and grace, and between the regenerate and unregenerate.

Space will not permit the insertion of details with reference to the deviations from the standpoint of the Reformation which are involved in the changes in the fundamental principle already described. However, it must not be supposed that all theologians took this direction of establishing a Protestant tradition as an external assurance of the redemptive power and truth of the gospel. The various universities (each of which had its peculiar type of theology) took up different positions with reference to this matter, and are represented by important theologians, the authors of remarkable dogmatical works. The strict Lutheran orthodoxy was especially represented in Wittenberg and Tübingen, subsequently also in Rostock. A freer tendency was represented by George Calixtus (d. 1656) and his school (called by their opponents, Calov, Hülsemann, etc., *Syncretists*) in Helmstädt, Königsberg, and the Nuremberg University of

Altdorf. Jena assumed an intermediate position, with the great John Gerhard (d. 1637, author of the *Loci theologici* in 9 vols.; in the eighteenth century edited by Cotta—in the nineteenth century by Preuss), who with John Himmel and John Major, likewise Salomon Glassius (*Philologia sacra*, 1636–40), established the flourishing period of Jena, which was afterward continued by the acute and philosophical John Musaeus (d. 1681), and by J. W. Baier (d. 1695, author of a *Compendium theologiæ positivæ*, which since 1686 has gone through almost twenty editions, and even now is used for the instruction of the students of some Lutheran theological schools, for instance, of the Concordia Seminary at St. Louis, Mo.), as well as Buddeus (*Institutiones*). Leipzig also was more moderate in the seventeenth century, where Hoepfner (*De justificatione*), Scherzer (*Systema theologiæ*, in twenty-nine definitions, not a few of which are prosy, 1667–83), and Rechenberg, the friend of Spener, flourished; similarly Strassburg, where after Calvin and his contemporaries, in the sixteenth century (Capito, Bucer, Hedio, P. Martyr), John Schmidt (d. 1658) and Sebastian Schmidt (d. 1696), the teachers of Spener, represented a moderate and mild sort of Lutheranism, until through the influence of Dorsche and Dannhauer the majority of the theologians of this university went over to the stricter Lutheranism. This was likewise the case with Rostock, where after Chytræus (d. 1600) a prevailing practical theological tendency long maintained itself, united to some extent with mysticism. On the other hand, the chief representatives of the stricter Lutheran orthodoxy after Martin Chemnitz (d. 1586, author of the renowned *Examen concilii Tridentini*, 1565–1573) were Ægidius Hunnius, in Marburg, 1576–92 (subsequently in Wittenberg; d. 1603), who became the most influential in building up the Lutheran doctrine of predestination; Leonhard Hutter (d. 1616), who was the chief opponent of the Irenics of Melanchthon; the profound Hülsemann (1629–46 in Wittenberg and in Leipzig; d. 1661); the contentious Abraham Calov (in Königsberg, Rostock, Wittenberg; d. 1686; author of the *Biblia illustrata*, in 4 vols. fol., and the *Systema theologicum*, 12 vols. 4to); his father-in-law, Quenstedt (d. 1688), and his son-in-law, Deutschmann (d. 1706). In Tübingen, after Jacob Andræ, who had been the chief author of the *Formula Concordiæ* (d. 1590), and Heerbrand (d. 1600), flourished Hafenreffer (1502–1619), and Thumm (d. 1630), an advocate of *crypsis* in Christology. In the same university were also Lucas Osiander, called "Arndt's Scourge" (*Arndtomastix*), and John Adam Osiander (d. 1697; author of *Harmonia evangelica*). In Giessen were the advocates of *kenosis*, Balth. Menzer (d. 1627) and Just. Feuerborn (d. 1656).

III. *The Mystic and Pietistic Opposition to Scholasticism.*—More and more complaints were raised against the scholastic bent of theology. On the one side, those of a humanitarian and freer tendency, who had been trained in philosophy, contended against the hostility to all philosophy which had been manifested in the Hofmann controversy. This may be regarded as a revival of the Melanchthon school in the seventeenth century. It is the tendency of the great theologian of Helmstädt, George Calixtus, with his friends and pupils, Hornejus and Titius; in Königsberg of the same spirit were Behm, Dreier, Latermann; and in Altdorf, Hackspan, Sanbert, and Dürr. But it was in vain that they attempted to stem the tide of polemical zeal; as so-called syncretists they only inflamed it the more, and were regarded with distrust on account of Reformed elements in their emphasizing of good works, and on account of Roman Catholic tendencies in their doctrine of the *consensus quinquesæcularis*, and their depreciation of the principle of justification. But still more weighty were the complaints on the part of vital piety in such men as John Arndt, Lütkemann, Valentin Andreä, Grossgebauer, Heinrich Müller, Tarnov, Quistorp, Meyfahrt, and Schuppius, heralds and predecessors of the *pietistic movement of Spener*. Already, previous to these, the mystical element, which in the Reformation ripened into an ecclesiastical form, had again separated itself and taken a position in hostility to the Church in Valentin Weigel, Jacob Boehm, Rathmann in Dantzic and others. But the severest blow against the orthodoxy of the seventeenth century was given by Philip Jacob Spener, of Rappoltsweiler, in Alsatia (b. 1655; d. 1705), through a thorough reform in theological study which he awakened, through a thorough revival of love for the Holy Scriptures, and through the foundation of the so-called *collegia pietatis*, which became *ecclesiolæ in ecclesia*. While the Lutheran clergy, allied with the authority of the princes, held the so-called third class, *status œconomicus*, the laity and the congregation, in general in dependence, and made them into a mere *ecclesia audientium*, Spener again raised the banner of the universal priesthood of Christians, and trained by the study of the ecclesiastic order of the Reformed Church—for example, in Geneva—he demanded an analogous use of the presbyterian element. He would not deviate from orthodoxy in doctrines, but would simply modify the formula of subscription to the symbols. Yet his efforts for conscious faith, for regeneration and sanctification, were little in harmony with the prevailing spirit of the so-called orthodox, who persecuted him and his school in a conflict of more than thirty years. The orthodox, however, lost the confidence of the German people, by nothing so much as through their hostility to the school of Spener and its principles, by their boasting of a *theologia irregenitorum*, as well as the especial grace of the ecclesiastical office. As Calixtus, for instance, had permanently established the independence of ethics, so Spener on the practical side carried over the evangelical principle of faith into the ethical sphere; first of all, as was the case in the ancient Church, in the form that the idea of the Church of the future was fixed, and the way was paved to heathen missions; and thus the innermost vital impulses of the Evangelical Church were awakened, and these from the center were set in motion in an ethical direction. Moreover, Spener, by his ideas of church organization, exhibited a lively interest in the Church of his times. Yet the ethics of the Pietists were still much too negative, exaggerating the contrast between the Church and the world, and confining themselves for the most part to the sphere of personal and religious ethics. The North German pietism suffered likewise from a depreciation of the importance of scholarship, while on the other hand the South German branch, in the great theologian, critic, and exegete, John Albert Bengel (d. 1752, author of the *Gnomon Novi Testamenti*), gained a worthy representative of the harmony between scholarship and the Church, and thereby secured for the Church of his native land a powerful support, working even to the most recent times.

A long conflict was carried on by the orthodox theologians Carpzov, Schelwig, Neumeister, Edzard, and particularly Valentin Ernst Löscher, court-preacher in Dresden (d. 1749), against Spener and his disciples, August Herrmann Francke (founder of the orphan-house of Halle, d. 1727), George Anton, Breithaupt, Freylinghausen, Rambach, and the contentious Joachim Lange (*Œconomia salutis eaque moralis*; *Antibarbarus*, 1709). After this struggle had endured for a long time a kind of mediating school between orthodoxy and pietism was formed—a gentler late summer of orthodoxy. To this belonged Hollaz (*Examen theologicum acroamaticum*, 1707), Johann George Walch the Elder (d. 1775), the thoroughly learned and honest but unoriginal writer of the *Einleitung in die Religionsstreitigkeiten innerhalb und ausserhalb der Lutherischen Kirche je in 5 Baenden*, 1730, ff.; the very skillful and intellectual chancellor of Tübingen, Christoph Matthæus Pfaff, advocate of the union of Protestants (d. 1760); the historian Lorenz von Mosheim of Göttingen (d. 1755). These have especial merit with reference to historical theology, as likewise Solomon Cyprian, Salig (*Vollstaendige Geschichte der Augsburger Confession*) and Veit Ludwig von Seckendorf (*Historia Lutheranismi*). The Magdeburg Centuriators in the sixteenth century (1559–74), Matthias Flacius (d. 1575), Wigand (d. 1587), and others, had employed their extensive historical material in such a manner that they regarded the ideal of the Church with reference to unity and purity of doctrine, especially of justification by grace, as realized in the most ancient times of Christianity, and from that time on they recognized no advance, but only a decline in the following centuries from the pure beginning, through the agency of the power of darkness concentrated in the papacy: thus the truth was regarded as having merely a history of suffering and not of progress; that is, a history of error, as if the truth were only to be maintained against it, and not unfolded. Gottfried Arnold (d. 1714), however, represented another method of treating history. In his *Kirchen und Ketzerhistorie* (1698–1700) he always takes the side of the heretics against the official doctrine and usages of the Church, by which it is true he did away with the claim that the Church was the unchangeable sanctuary of the truth, but still by no means found the true relation between the heretics or heterodox and the orthodox. It is true that Calixtus had not only claimed for the earliest beginnings of Christianity the possession of the pure doctrine, but had rather regarded the first five centuries as the ideal primitive time, and had thus distinguished the ancient Catholic Church from the papal

period; but he found no sufficient grounds for the movements and changes in the system of doctrine. Whatever had been added to the common Christian doctrine given in the Apostles' Creed was to him indeed not necessarily erroneous or a decline, but a matter of indifference and subordinate, as then he did not reckon the doctrine of justification among the common Christian doctrines. The theologians subsequent to Calixtus, just mentioned, were, like him, characterized by a more objective historical spirit of investigation. It is true they were in advance of Arnold, yet it was only through Arnold's exaggerations that their attention was directed to the importance of heretical movements; it was reserved for a subsequent period to recognize and show that it is by means of heretical movements that an advance in the Church is mediated, and to represent them not merely as an accidental swarm of opponents, but rather as those who stepped forth in opposition to a still unprepared Church doctrine in points where a further development was necessary, although with a one-sided or distorted emphasis of the elements that were still lacking.

The above-mentioned theologians, for the most part devoted to historical theology, in sympathy with the culture of the time, and in anticipation of approaching storms, desired to establish themselves on a good footing, and everywhere to break off the sharp edges of the old doctrines. Original sin became significant only after consent to it; inspiration was merely assistance by the Holy Spirit; the *communicatio idiomatum* was more and more limited; the doctrine of justification was obscured by mixing it with sanctification. With reference to other doctrines, such as the Trinity, the incarnation, the work of atonement, the Lord's Supper, they avoided the difficulties of the Church form of doctrine by referring to their inconceivableness and mystery. A new regenerative principle was lacking. Yet they went back to the Holy Scriptures in distrust of the doctrinal development of the Church. Faith in the Holy Scriptures—which were identified, on their part, with revelation itself—was regarded in its way as Christian faith, so that they thought only of doctrines, especially of mysteries, in connection with it, and not of real vital communion with God in Christ, and of the assurance to be wrought by the Holy Spirit. In the seventeenth century, notwithstanding the systematic subordination of the material principle to the formal, it was still maintained that assurance was to be gained only through the Holy Spirit, whose testimony united itself to the reading of the Scriptures; whereby, to be sure, the contents of the testimony were more and more regarded to be so much the power of the gospel unto salvation or the experience of salvation, as rather the divine origin of the Holy Scriptures (their inspiration), and through them the truth of Christian doctrines. In the eighteenth century the *testimonium Spiritus Sancti* was more and more abandoned, as in general the fervent sense of the active nearness of God and the presence of the Spirit in the Church vanished.

In order, now, to gain a substitute for the assurance of Christianity, the way of demonstration offered itself. To this path philosophy, which had begun its course since Leibnitz (d. 1716) and Wolff (d. 1754) with a strong feeling of self-consciousness, successfully invited. The school of Wolff, flourishing before the middle of the eighteenth century, undertook to establish Christianity by mathematical demonstration. Reusch, Schubert, Carpzov, Canz, Reinbeek and particularly Sigmund Jacob Baumgarten of Halle, (d. 1757), belong to this school. They began the proof for Christianity through a rational demonstration of the divine authority of the Holy Scriptures, which should be superior to what they regarded as the merely apparent proof from the experience of the operations of the Holy Spirit. The idea of God derived from the *lumen naturæ*, the righteousness, holiness, goodness, and power of God in the presence of sin and guilt, prove the necessity of the revelation of an atonement, if an atonement should in any way be possible or capable of being known. Its possibility is evident from the fact that the predicates ascribed to it are not contradictory; these predicates constitute at once the criteria whereby a true revelation may be known. Now, the Holy Scriptures correspond with these criteria, since they teach the way of peace, and contain mysteries which could not of themselves be derived from the reason. This method of proof goes no further into the consideration of the Scriptures, their origin, and the formation of the canon, while indeed these criteria do not of themselves prove the divine authority of the Scriptures. About this time the science of biblical theology began, after Ernesti's *Institutio interpretis Novi Testamenti* (1761), through the labors of Büsching, Zachariä, Hufnagel, Ammon, G. Lorenz Bauer, and especially Gabler, who has the merit of having clearly stated the historical character of biblical theology (which has since been more thoroughly wrought out by Schmid and Oehler, in Tübingen, B. Weiss, in Berlin, H. Schultz, in Göttingen, and others). From this circumstance, as well as the fact that Baumgarten's pupil, J. Sal. Semler (d. 1791), began the period of the criticism of the Holy Scriptures, it resulted that the elder Tübingen school, under Storr, Flatt, Süsskind, paved the way for the purely historical proof of the divine origin of the Sacred Scriptures, and thereby of Christianity. The apostles, and the scholars of the apostles, said they, composed the Scriptures of the New Testament canon (the proof of their authenticity and integrity); these Scriptures are historically worthy of confidence (*fides humana*); the apostles could, would, and must have spoken the truth. These writings describe, on the one side, Christ's sinless character—on the other side, His miraculous acts; both together attest the truth and full authenticity of His statements respecting Himself and His divine mission. Now, Christ promised His disciples the gift of the Holy Spirit; and that He was able to fulfill this promise is proved by His miracles; and thus they were in possession of an inspiration corresponding with His veracity; consequently, whatever is contained in these writings is divinely attested (*fides divina*); and the authority of the Old Testament likewise rests on that of the New. That which is here called *fides divina* is thus by no means assurance of salvation or divine assurance, but is human assurance of divine things. This whole method of proof is based on the formal principle, and is a revival and improvement of the idea of Hugo Grotius; it is in an altogether intellectual form, and essentially changes the principle of faith of the Reformation. About the same time theological ethics were likewise more and more separated from their internal connection with the principle of faith, partly through the influence of the popular philosophy of Wolff (Steinbart, Eberhardt, Bahrdt) in the manner of eudæmonism, partly in earnest natures, under the influence of Kant, through the ethics of the reason.

The supernaturalism of the rational as well as the historical method formerly maintained the supernatural character of Christianity—miracles, prophecy, etc.—but more and more tended to depreciate and weaken that which constituted the subject-matter of the doctrine. Thus the doctrine of the Trinity (and this could not but be significant for Christology) was constituted by some in the form of subordination—e. g. by Töllner (who likewise denied the saving significance of the active obedience of Christ), by Döderlein, and by Flatt; by others, as Urlsperger, in the form of Sabellianism or a modal Trinity. In place of the Church doctrine of the atonement, it was supposed that there was a kind of *acceptilatio* of the obedience of Christ for the blotting out of guilt; the Church was defined as a work of believing individuals uniting themselves together; and the doctrine of justification was placed almost at the end of the system. (Storr.)

The incongruity of the significance that was ascribed to the still remaining elements of Christianity with the supernatural form now invited rationalism to advance with confidence of victory; so much the more as the first philosophic systems of Wolff, Kant, Jacobi, and Fichte gave systematic expression with ever-increasing boldness to the self-confidence of the newly awakened subjectivity. Supernaturalism in vain sought to appropriate these systems and turn them in a direction favorable to itself. Thus with reference to the system of Kant: Stäudlin, Süsskind, K. L. Nitsch, and Stapfer—to that of Jacobi: Vater, Steudel, Emmerich, Heydenreich. The rationalists of the school of Kant, Tieftrunk—subsequently likewise Ammon; furthermore Löffler, Henke, Schmid, Krug, Röhr, Paulus, Wegscheider (to a certain extent tinctured with the deism of the school of Wolff); likewise scholars of Jacobi, such as Heinrich Schmid, Köppen, Köhler, or of Jacobi and Fries, such as De Wette—forced back supernaturalism still further from its standpoint, until that miserable abortion of a rational supernaturalism and supernatural rationalism threatened theology with self-destruction.

At first, the elements of Christian faith became rigid, and afterward weakened; and this had the saddest consequences with reference to the Church, its constitution and laws. In the sixteenth and seventeenth centuries the clergy

and civil authorities (*status ecclesiasticus* and *status politicus*) shared with one another in the management of ecclesiastical affairs; the people (*status œconomicus*) were excluded. The dangers of such a confederacy between the clergy and the autocratic power of the princes were observed by the declining orthodoxy of Benedict Carpzov (d. 1666), who now sought, by an un-Lutheran enhancing of clerical authority (power of the keys), over against the state to secure independence for the Church; but it was in vain ("the *Apapa* had stepped in the place of the *papa*"—the popery of a Cæsar in the place of the cæsarism of a pope). Moreover, through Christian Thomasius (d. 1728) the territorial system came into vogue, which handed over the Church entirely into the hands of the state, whose highest interest with reference to religion, according to him, was to see to it that the Church did not disturb the peace of the state. A more honorable position was assumed by the collegiate system of Pfaff (*v. supra*), which at least guaranteed the Church its independence by presenting it as a collegium, as a society with the rights of a society. But then he regarded the Church as originating through the free inclination of the individual, and its relation to the state remained a purely accidental one. The territorial system, however, gained the supremacy until the nineteenth century, and it even reckoned the mode of worship as among the external things under the control of the state.

IV. *Rationalism*, under the influence of English deism and Voltairism, more and more prevailed until the closing years of the eighteenth century. Among its supporters were Reimarus (d. 1768, author of the *Wolfenbüttel Fragments*, afterward published by G. E. Lessing), Nicolai (editor of the *Deutsche Bibliothek*), Biester, Gedike, Teller, Venturini (*Natürliche Geschichte des Grossen Propheten von Nazareth*, 2d ed. 1806, 3 parts). Against these there was a significant reaction in the second half of the eighteenth century, through distinguished men, who may be regarded as heralds of the theology of the nineteenth century. Among these were not only Klopstock (d. 1803) and Claudius (d. 1815), who again turned with devotion and grateful love to the person of the Redeemer, but also Herder (d. 1803), who recognized and represented the indissoluble bond between poesy and religion, and sought to present Christianity as the religion of humanity. He had the special gift of discerning the true human element in the sacred documents, which is often misunderstood, as well as the noble and beautiful therein; and especially did he reconquer, so to say, the Old Testament for German literature. His highly cultivated mind, his large heart, attracted him to all that was great in the literature of all nations, especially of the Orient. He likewise conceived the idea of a philosophy of the history of humanity. Furthermore, mention may be made of Hamann (d. 1788), a man of profound mind, full of new ideas, although from lack of dialectic training he wrought out but little of the rich ore of his spiritual mine. A free, grand insight into the character of Christianity exalted him above the anxiety of the pious of his times, and, deeply rooted in evangelical Christianity, he could look with a humor that was sure of victory upon the efforts of the entire coterie of neologians who supposed they were capable of overthrowing Christianity. His favorite principle was *omnia divina et humana omnia*. He did not regard the eternal and the historical as being in irreconcilable contradiction, as the deistical rationalists would have it; rather, history was to him the eternal becoming historical and embodied, and faith was the faculty of recognizing the facts of God in history and nature, of beholding the metaphysical, the eternal, and the historical in their unity by means of a mysticism which is not merely subjective, but objective, determined by the reality itself. Lessing (d. 1781) was by no means, as many suppose, a mind hostile to Christianity. He issued the *Wolfenbüttel Fragments* in the conviction that Christianity was able to meet this assault, but that it needed an entirely different method of representation than the prevailing one of demonstration. He despised the enervating rationalism, and preferred the muddy waters of orthodoxy to the dirty water of neology. But he was oppressed by the inconsistency between the eternal truths and history, and as he did not find the bridge, he offered, though in vain, a divine recompense to any one who would help him over the hideous chasm. And yet he had already in himself a presentiment that humanity needed something more than instruction in eternal truths, which still constituted the principal thing in his *Erziehung des Menschengeschlechtes*. There was likewise in him, notwithstanding all the power of his understanding, a deep mystical tendency. He ascribed to Christianity an internal truth, which, witnessing for itself, as the sun by its warming rays, makes all other testimony unnecessary. By emphasizing the *regula fidei* over against the criticism of the New Testament, he would give to susceptible Christians a secure position against assaults. At the same time, in contrast with that theology which makes the Holy Scriptures themselves a revelation, he would distinguish between Christianity as the foundation of revelation and the Bible as its record. He felt the need of a living God making himself known to the soul's experience, but remained shackled by the prevailing doctrines respecting God, which were held by deism as well as supernaturalism, which removed God too far away from history. This was all to be changed by the new philosophical movement which began with the nineteenth century.

The philosophical movement which originated in Germany after Kant and Fichte, through Schelling, Hegel, and Schleiermacher, began to make up the acknowledged defects of the previous Christology and Soteriology with reference to the consideration of the being of God, as well as their mutual relation to one another. The fundamental tendency of these philosophers was the rejection of the barren deistical view; and although to some extent they approached too closely to the opposite extreme of pantheism, yet a more vital idea of God, and a more intimate relation between the being of God and man, were the common conviction of the more recent philosophies of religion, which could not but be of advantage to a series of doctrines; for, according to Schleiermacher, for instance, there is not merely a temporal interruption of the ordinary course of things in miracles or divine acts, which do away with the usual distance between God and the world, as was the view of supernaturalism, but an element of truth was now accepted from rationalism, which advocated immutable, eternal truths; and it was said that all things on earth are ordered according to a fixed, eternal decree of God, yet in this decree establishing a fixed order of nature he likewise regarded as included the eternal living presence and activity of God. Thus the idea of the miracle as an abrupt act disturbing the order of nature was abandoned, and it was confined to its place as a part of the eternal decree. This does not mean that the entire contents of the eternal will of God are realized in every part alike, but that the temporal separation of the parts and the divine activity in different acts do not disturb the unity and continuity either of the decree or of the world; in that, rather, the new event attaches itself to that which already exists, which has developed so as to be capable of receiving and desiring it; yea, the new occurrence gains a permanent existence in the already existing one, or naturalizes itself in the world (*in der Welt sich naturire*). Schleiermacher (b. 1768; d. 1834), who among those mentioned has had the most permanent influence on theology, referred the Trinity solely to the world, and did not sufficiently maintain the independence of the Divine Being in and for itself. On the other hand, through his doctrine of Christianity as a second creation, and of Christ as a second Adam, he made several great scriptural truths fruitful, so that they came into play in overcoming the opposition between supernaturalism and rationalism. For Jesus was to him not from the earth, as merely the product of the sinful race, but, although true man, yet of a supernatural nature through the "existence of God in Him in a manner peculiar to Him alone" (*einzigartiges Sein Gottes in ihm*). In order to make the work of redemption easier of apprehension, he conceived the entire life of Christ, His actions and sufferings, as Christ's manifestation of Himself; and especially, in order that Christ's salvation might be imparted and man delivered from the consciousness of guilt and punishment, Schleiermacher applied the efficacious sympathy of Christ as high priest, and His position as the head of humanity, in whom God beholds the believing as parts of Christ's manifestation of Himself, so that they are well-pleasing to God on account of their vital union to Christ, and may know that they are justified, as then God has resolved to impart all His grace to humanity in Christ. Furthermore, Schleiermacher was the first to make the idea of the Church a living one, and recognize it in its glory. The Church was to him not a work of subjective choice or agreement, but a work of the Holy Spirit, who is constantly active in it, distributing His gifts; always, however, taking of that which is Christ's (John xvi. 4). Schleiermacher likewise rendered great service to the Church by establish-

ing the boundaries of truth, or by marking out the heretical points of the compass. He fixed in a scholarly manner the difference between heterodoxy and heresy, which the Moravian Brethren, among whom he had been trained, had practically carried out in the different types which it would embrace within itself. He thus defined the conditions of church membership, the limits of liberty in teaching. This led to the great service which he rendered for the union of the Reformed and Lutheran Churches in Germany. His *Glaubenslehre* (*Der christl. Glaube nach den Grundsätzen der evang. Kirche.* 2 vols., 1831; 2d ed. 1830), returning to the principles of the Reformation, sought a reconciliation of the Reformed and Lutheran types of doctrine. Thus in the doctrine of predestination he combined Lutheran universalism with the Reformed absolute decree; Lutheran mysticism and the demand that objective Christianity should be appropriated in the inmost soul, with the ethical tendency of the Reformed type of doctrine; and the personal assurance in one's self with the awakening of the sense for the practical problems of the Church and of Christian national and political life; and thus he became, although without high ecclesiastical office, a true prince of the Church in revived German Protestantism. He would not have the union itself to be a mere work of the state or politics; still less did he require for union that all differences of doctrine should be abandoned. According to the principle of individuality which he regarded as so important, there is no justice or necessity for blotting out any true peculiarities, whether they appear in individuals or in the uniform belief of great masses; but only of delivering them from morbid conditions, among which was especially to be reckoned a separatistic position toward other individualities. Thus he did not demand a union which should dissolve differences, nor indeed a postponing of union until a reconciliation of the points of difference in the Lutheran and Reformed doctrines should be reached through a higher unity; what he demanded was simply the mutual granting of church communion, especially in the Lord's Supper, and that such a significance should not be given to doctrinal differences as to allow them to bring about a separation of churches. It appeared to him unprofitable to go back to doubtful doctrines. He considered that the unity of the Church was not only consistent with the existence of different branches living in mutual recognition of one another, but that it was likewise quickened and enriched thereby in the interchange of spiritual blessings on the part of each one of the branches, which, going on without interruption, was thus preparing that higher unity.

Since the death of Schleiermacher, i. e. during the second and the last third of the nineteenth century, German theology has been divided into a liberal and a conservative party, each of which includes two principal schools or groups.

1. Of the *liberal* groups, the first appears (more or less) attached to the philosophical principles of Hegel. Most of the representatives of this Hegelianizing tendency belong to the so-called younger *Tübingen school*, whose founder and head was Ferd. Chr. Baur, professor at Tübingen (d. 1860). Among the more radical adherents of this numerous group of critics of the New Testament history and writings David Strauss (the famous author of the *Life of Jesus*, d. 1872) has exerted the greatest influence, but an influence not so much upon the theological world itself as upon the public opinion of laymen and larger circles of the people. To the more moderate scholars and successors of the Baurian critical doctrine belong Th. Keim (d. 1878), K. H. Weizsäcker, H. Holtzmann, O. Pfleiderer, A. Hilgenfeld, and others. A second group of liberal theologians is formed by a series of adherents of the philosophical standpoint of Kant in application to religious and theological principles. Of these *Kantianizing theologians* some—as Alex. Schweizer (d. 1888) and R. A. Lipsius (d. 1892)—for a part of their teachings recurred to the system of Schleiermacher, while the greater part, since about 1870, have gathered round the theology of Albrecht Ritschl, professor at Göttingen (d. 1889). W. Herrmann, Jul. Kaftan, Ad. Harnack, the first at Marburg, the two latter at Berlin, are the principal living representatives of this *Ritschlian school*, which, in some few of its most radical offsets (e. g., W. Bender, at Bonn), is nearly approaching to the position of the most advanced Tübingen critics, such as Strauss, etc.

2. Of the two *conservative* schools, the one adheres to the principle of the evangelical union, theologically founded and asserted by Schleiermacher, while the other is opposed to this union principle or general evangelic tendency from a more or less strict confessionalistic standpoint (either Lutheran or Calvinistic). To the most prominent leaders of the *unionistic* or *evangelical* school (sometimes called "the right wing" of the Schleiermacherian school), the writer of this article Isaac A. Dorner, professor at Göttingen and later at Berlin (d. 1884), belonged. Besides him, F. A. G. Tholuck and Jul. Müller, at Halle (d. 1877 and d. 1878), Richard Rothe, at Heidelberg and Bonn (d. 1867), and C. J. Nitzsch, at Berlin (d. 1868), were distinguished advocates of this group. A large part of the *Confessional* or *Lutheran-orthodox* theologians formerly gathered round the teaching of the Erlangen professors Harless (d. 1879), Thomasius (d. 1875), Hofmann (d. 1877), of whom the last for some time exerted a large influence, and therefore was regarded as the head of a hopeful and widespreading school. But this *Erlangen school* has lost somewhat of its former authority, and at the same time has modified its methods of teaching and tendencies. Among the living representatives of the Lutheran type of German theology Professors C. E. Luthardt, at Leipzig, F. H. R. Frank and Theod. Zahn, at Erlangen, and Steinmeyer, at Berlin, are among the most influential and worthy.

For an accurate and complete historical sketch of the development of German theology during the nineteenth century, compare chiefly the works of F. Nippold (Berlin, 1890) and of O. Pfleiderer (Freiburg, 1891).

Revised by O. Zoeckler.

**German Tinder**: See Amadou.

**Germantown** (Pennsylvania): See Philadelphia.

**Germany**: See German Empire.

**Germination** [viâ Fr. from Lat. *germina'tio*, sprouting, budding, deriv. of *germina're*, sprout, bud, germinate, deriv. of *ger'men*, sprout, bud, whence Eng. germ]: in botany, the term used to denote the steps in the development of the embryo in the seed into the plant. It is naturally extended to the analogous development of any cryptogamous plant from its spore, which answers to seed. The embryo, originated in the ovule through its fertilization by a grain of pollen, completes its first stage of development in the seed while connected with the mother-plant; when the seed matures it has a period of rest; after which, when placed in favorable circumstances, germination takes place. Seeds vary greatly as to the length of time during which they preserve their vitality. Many seeds, especially oily ones, soon lose the power of germination unless they are committed to the ground soon after their ripening, although when in the ground they sometimes remain quiescent for two or three years. Others, especially leguminous seeds, when kept dry, may retain the power of germination for several, or even for many, years. The same is true of many seeds when rather deeply buried in the soil; after long burial some of them germinate on being brought to the surface. But the accounts of "mummy-wheat," etc., growing after the lapse of 2,000 or 3,000 years may be wholly discredited. The conditions necessary to, or favorable for, germination are a congenial temperature, varying with the species, moisture, and darkness or a certain amount of obscurity. In the incipient process water is absorbed, and certain chemical changes (involving fermentation) are set on foot, through which solid nourishing matter in the seed is gradually liquefied and made available for growth. In this a certain amount of carbonic acid gas is evolved and the temperature raised (which becomes very perceptible in bulk, as is seen in the malting of barley), showing that a portion of the store in the seed is consumed or decomposed to render the rest available. Sometimes this store of food is in the embryo itself, usually in the cotyledons, as in the bean and pea, when the germ makes the whole kernel of the seed; sometimes mainly

Fig. 1.—1, section of seed of morning-glory, showing the embryo; 2, same embryo detached and straightened; 3, germination of the morning-glory; 4, same, further developed.

outside of it, as in corn and other grain. The particular mode of development of the embryo varies according to its conformation. Commonly the radicle lengthens and projects from the seed, takes a vertical position, develops a root from its lower end, raises the cotyledons above the ground to expand as the seed-leaves, and above these develops the plumule or bud into the succeeding stem and leaves. In many cases the radicle does not lengthen, and the cotyledons remain under ground and within the coats of the seed; then the first foliage that appears belongs to the plumule, as in the pea and the oak. It is the same, with a certain difference, in corn and other grain. In any case, when the embryo has developed into a plantlet, with root established in the soil and foliage in the air and light, so that it can provide its own nourishment, the process of germination is completed. See EMBRYOLOGY (in plants).

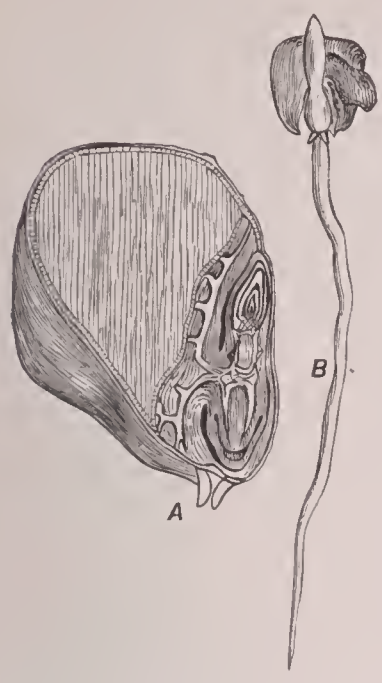



FIG. 2.—Section of a kernel of Indian corn showing the embryo; B, Indian corn germinating.

Revised by C. E. BESSEY.

**Germ Theory of Disease**: the theory that certain forms of disease, and especially contagious and infectious diseases, are caused by the introduction into the living body of certain forms of micro-organisms and by their subsequent multiplication and products. As regards a number of specific diseases this may now be said to be demonstrated, while with regard to many others it is very probable.

Proof that a given disease is due to a particular micro-organism depends upon the following points: 1. The disease must be one which presents distinctive results, either in its symptoms and appearances during life or in its pathology observed after death. 2. In all cases of such disease it should be possible to find at some stage of the affection the micro-organism in question, in such numbers and distribution as to furnish a reasonable explanation of the symptoms. 3. That it shall be possible to distinguish these micro-organisms from others by culture and other methods, as described in the article on BACTERIOLOGY (*q. v.*). 4. That by means of a pure culture of this organism the specific disease can be produced in man or animals. 5. That the micro-organism in question is never found in the body in health or in other diseases except as an accidental and non-pathogenic parasite.

Such a chain of proof has been provided for anthrax, tuberculosis, erysipelas, tetanus, and diphtheria. For others, such as Asiatic cholera and typhoid fever, the fourth link in the chain as above stated has not yet been forged, owing to the fact that these diseases have not yet been clearly and definitely produced in the lower animals, which do not seem to be susceptible to them, and the experimental infection of man by them is not considered justifiable. Most pathologists, however, now agree with Koch that the invariable occurrence of a specifically identifiable parasite in a given disease, coupled with the fact that it is never found in any other disease, is sufficient to establish the causal connection.

But while much has been done to demonstrate the truth of the germ theory, there still remains a large group of infectious diseases, such as scarlet fever, smallpox, typhus and yellow fever, and rabies, which it is believed are probably due to specific organisms, but in which such organisms have not yet been discovered. It is very possible that the specific germs of these and some other diseases are not bacteria, but parasites belonging rather to the lowest group of the animal kingdom, the Protozoa, than to the vegetable world. Such organisms have been found in the blood of men suffering from malaria, and the causal connection is very probable.

J. S. BILLINGS.

**Gérôme**, zhā′rōm′, JEAN LÉON: figure-painter and sculptor; b. at Vesoul, France, May 11, 1824. Pupil of Paul Delaroche; third-class medal, Salon, 1847, for his picture *The Cock Fight* (Luxembourg Gallery, Paris); second-class medals, Salon, 1848, and Paris Exposition, 1855; member of the Institute 1865; medals of honor, Salon, 1874, and Paris Expositions, 1867 and 1878; commander Legion of Honor 1878; Professor in the École des Beaux-Arts 1863. His work is scholarly, showing great erudition in the reproduction of archæological details; his figures are excellently drawn and show a pronounced sense of form, but his color is uninteresting and dull. His strongest point as a painter is his masterly composition. His pictures, owing to their composition and absence of strong color contrasts, have been well reproduced by photographic processes, and many of his works have thus obtained a worldwide popularity. In the later years of his career he has devoted himself almost entirely to sculpture, and exhibited various groups and single figures. Among his noted paintings are *Anacreon with Bacchus and Cupid* (1848), Toulouse Museum; *Russian Concert* and *Age of Augustus* (1855), Amiens Museum; *Abyssinian Chief*, *Sheik at Devotions*, Wolfe collection, Metropolitan Museum, New York; *Louis XIV. and the Grand Condé*, collection of Mrs. William H. Vanderbilt, New York; *Duel after the Masquerade*, collection of W. T. Walters, Baltimore; *Cæsar Dead*, Corcoran Gallery, Washington. Two of his best works, *Son Éminence Grise* and *Une Collaboration*, were sold in New York, in the Stebbins and Stewart sales respectively. Studio in Paris.

WILLIAM A. COFFIN.

**Gerona**, gā-rō′nă: fortified town of Spain; in the province of Gerona, on the Ter (see map of Spain, ref. 13–L). Its cathedral is a fine Gothic building of the fourteenth century. It has been besieged twenty-eight times, and taken five times. Pop. (1887) 15,497.

**Geropi′ga, Geropig′ia, Jerupig′ia** [from Portug. *geropiga*, from Mediæv. Lat. *hiera-picra*, kind of cathartic medicine (whence also Eng. *hickery-pickery*), liter., sacred bitters; Gr. ἱερά, neut. plur. of ἱερός, sacred + πικρά, neut. plur. of πικρός, bitter]: a liquor exported from Portugal as brandy, and imported into the U. S. and Great Britain as wine. It is variable in composition, but generally consists of grape-juice, brandy, sugar, logwood-extract, and other ingredients. The U. S. is the principal market. It is used in making imitations of wine and other liquors.

**Gerrára**, ger-raa′ra, or **Guerara**: town of Algeria; in the oasis of Wadi-Mzab; in lat. 32° 45′ N. and lon. 5° E. It is the rendezvous for all the neighboring tribes, and horses, asses, ivory, gold-dust, and ostrich feathers are exchanged for cottons, woolens, silk, and cutlery. Pop. estimated at 5,500.

**Gerry**, ger′i, ELBRIDGE, LL. D.: statesman; b. at Marblehead, Mass., July 17, 1744; graduated at Harvard 1762; became a successful merchant of his native town and a prominent provincial legislator and patriot; was specially interested in the naval operations of the Revolution, and was the founder of the Massachusetts admiralty court; in the Continental Congress 1776–85; signed the Declaration of Independence; one of the framers of the U. S. Constitution 1787, but refused to sign it; in Congress 1789–93; was a special minister to France 1797; chosen Governor of Massachusetts (Anti-Federalist) 1810 and 1811, and defeated when running for that office in 1798, 1801, and 1812; chosen Vice-President of the U. S. in 1812. D. Nov. 23, 1814.

**Gerry**, ELBRIDGE THOMAS: See the Appendix.

**Gerryman′dering**: See APPORTIONMENT BILL.

**Gers**, zhār: department of France; on the slope of the Pyrenees, ranges of which traverse it from S. to N., forming large, well-watered valleys. The soil, however, is only mediocre. Wine is the main produce, but it is of an inferior quality, and mostly transformed into Armagnac brandy. Many mules are reared for the Spanish market. Area, 2,390 sq. miles. Pop. (1896) 250,472. Capital, Auch.

**Gersau**, gār′sow: a Swiss climatic station and health resort, celebrated for its whey and grape cures; on the southern slopes of the Righi, on the Lake of Lucerne (see map of Switzerland, ref. 4–G). It is very picturesque and well sheltered, and has a remarkably mild climate, permitting the growth of almonds, laurels, and figs out of doors in winter. Pop. 2,000.

**Gerson**, zhār′sōṅ′, JEAN CHARLIER, de, called also DOCTOR CHRISTIANISSIMUS: scholar and divine; b. at Gerson, near Reims, France, Dec. 14, 1363. In 1377 he was sent to the College of Navarre, Paris; studied theology under d'Ailly (*Malleus hæreticorum*), from whose hands in 1392 he received the doctor's hat, having previously, while only a bachelor of

divinity, been employed upon missions to the rival popes, with a view to ending the great schism then existing. In 1409 he went to the Council of Pisa, and in 1414 to that of Constance, in which he represented the Gallican Church, and in which he favored the superiority of the councils to the pope and the reforms of the Church within itself. He zealously advocated the burning of Huss and Jerome of Prague. His opposition to the preaching friars (Dominicans), as rivals of the secular clergy, raised up so many enemies that he retired to Germany, where he lived until 1419, after which he went to the Celestine convent of Lyons and became a catechist of poor children. He died there July 12, 1429. Gerson's chief aim was the reform of the Church from within itself. He gave much attention to the subject of judicial astrology, which he combated with success. He was a voluminous writer, and many authorities (chiefly French or Benedictine) have claimed for him the authorship of *De Imitatione Christi*, usually ascribed to Thomas à Kempis.

**Gerstäcker**, gär'stek-*er*, FRIEDRICH: traveler and author; b. in Hamburg, Germany, May 16, 1816. After a brief schooling he was apprenticed to a grocer, but ran away to Bremen, whence he shipped in 1837 as cabin-boy on a vessel bound for New York. After journeying through the U. S. and Canada, performing such work as he could get, he returned to Germany in 1843, and published an account of his travels in several volumes (1843–49). He spent the years 1849–52 in making a journey around the world, and a narrative of his travels which he published on his return became very popular. In 1860–61 he made the tour of South America, and in 1862 accompanied Duke Ernest of Gotha on a tour through Africa; visited Central America in 1863, and in 1867 started upon another journey around the world, regarding which he wrote a number of interesting volumes. His works have been translated into English. D. in Vienna May 31, 1872.

**Gerster**, gär'ster, ETELKA: singer; b. in Kaschau, the capital of Upper Hungary, June 16, 1856. She studied under Madame Marchesi, the vocal teacher of the Vienna Conservatory, and, having been urged by Verdi to go on the lyric stage, made her *début* as a soprano singer in Jan., 1876, in Venice at the Teatro della Fenice, as Gilda in Verdi's *Rigoletto*, with much success. She subsequently appeared as Ophelia in Ambroise Thomas's *Hamlet*, in *Lucia*, *Sonnambula*, and *Faust*. She next went to Genoa, and afterward to Berlin, where Signor Carlo Gardini, whom she married, was her manager. She was equally successful in St. Petersburg, Moscow, and Paris. She first appeared before an English audience at Her Majesty's theater, London, June 23, 1877, in *La Sonnambula*. She sang for the first time in the U. S. in the New York Academy of Music, Nov. 11, 1878. Her success was pronounced and instantaneous. In 1879 she returned to Europe, and did not sing again until the season of 1880–81, when she again visited the U. S. She made a third tour of the U. S. in the season of 1883–84. Madame Gerster's voice at its best had a peculiar bird-like quality, with a compass of two and a half octaves.

B. B. VALLENTINE.

**Gervao**, gär-vaa'ō [the Brazilian name]: a South American and West Indian shrub, *Stachytarpheta jamaicensis* (family *Verbenaceæ*), whose leaves have valuable medicinal properties, and are used as a substitute for tea; also for adulterating tea in Europe.

**Ger'vase of Canterbury**: chronicler; b. in Kent about 1141; became a monk of Christ Church, Canterbury, 1163; began the composition of his valuable *Chronicle* 1188, and carried it down to 1210, when probably he died. He wrote also a history of the Archbishops of Canterbury. See his works, edited by Bishop Stubbs, Rolls Series (2 vols., London, 1879–80). S. M. J.

**Gervase of Tilbury**: historian; b. at Tilbury, Essex, England; a reputed nephew of Henry II.; about 1208 made marshal of the kingdom of Arles. Author of a remarkable *Otia Imperialia*, a medley of history, curious learning, fables, and the natural sciences of that day; and perhaps author of a *History of Britain*, which must not be confounded with the valuable *Chronicle* of GERVASE OF CANTERBURY (*q. v.*).

**Gervex**, zhär'vā', HENRI: figure and portrait painter; b. in Paris in 1848. Pupil of Fromentin, Cabanel, and Brisset; second-class medals, Salons, 1874 and 1876; officer Legion of Honor 1889. One of the ablest painters of the French school of to-day, his work being especially notable for purity and beauty of color. The nude female figure in *Rolla* (1878) is one of the finest pieces of painting by a modern master. Among other works are *Satyr playing with Bacchante* (1874), Luxembourg Gallery, Paris; *Civil Marriage* (1881), mayor's office, Nineteenth Arrondissement, Paris. Studio in Paris.

W. A. COFFIN.

**Gervinus**, gär-vee'nŏos, GEORG GOTTFRIED: historian and politician; b. at Darmstadt, Germany, May 20, 1805; studied at Heidelberg and in Italy; became in 1835 professor extraordinary at Heidelberg; was 1836–37 Professor of History and Literature at Göttingen, but lost his place for political reasons; became honorary professor at Heidelberg 1844. His works include *Geschichte der Angelsachsen im Ueberblick* (1830); *Geschichte der deutschen Dichtung* (1871); *Geschichte des neunzehnten Jahrhunderts* (8 vols., 1855–56); works on Shakspeare, etc. He was prominent as a liberal journalist. His history of the nineteenth century had a profound political influence in Germany, at once correcting the revolutionary tendencies of his time, and checking the opposing reaction of the conservative classes. His *History of German Poetry* is also a work of great value. D. at Heidelberg, Mar. 18, 1871.

**Ge'ryon** (in Gr. Γηρύων), or **Gery'ones** (in Gr. Γηρυόνης): the son of Chrysaor and Callirrhoe, a daughter of Oceanus. He was a giant with three bodies, six feet, six hands, and three heads. He was king of the island of Erythea, on the coast of Spain, beyond the Pillars of Hercules (Straits of Gibraltar). The tenth labor of Hercules was to bring to Greece the beautiful herd of cattle that belonged to Geryon and were guarded by the powerful Eurytion and the two-headed dog, Orthus, the son of Echidna and Typho. Master, servant, and dog succumbed to the prowess of Hercules.

J. R. S. STERRETT.

**Gesenius**, *ge*-sā'nĕe-ŏos, FRIEDRICH HEINRICH WILHELM, D. D.: Orientalist; b. at Nordhausen, Germany, Feb. 3, 1786; studied at Helmstädt and Göttingen, and taught in both universities; became in 1809 Professor of Ancient Literature at Heiligenstadt; Professor of Theology at Halle in 1810. He was an eminent scholar, and gave a great impulse to Semitic learning by his philological works. The chief of these are *Hebräisches und Chaldäisches Handwörterbuch* (1810–12; 10th ed. Leipzig, 1886; Eng. trans. by Robinson and by Tregelles); *Hebräische Grammatik* (1813; several English translations and editions); *Kritische Geschichte der Hebr. Sprache* (1815); *De Pentateuchi Samaritani Origine* (1815); a translation and commentary on Isaiah (1820–21); the Hebrew and Chaldee *Thesaurus*, finished by Rödiger (3 vols., 1827–53); and *Scripturæ linguæque Phœniciæ monumenta quotquot supersunt* (3 parts, 1837). D. at Halle, Oct 23, 1842. See his biography by H. Gesenius (Halle, 1886). Revised by C. H. TOY.

**Gesner**, ges'ner, JOHANN MATTHIAS: classical scholar and educator; b. in Roth, near Ansbach, Germany, Apr. 9, 1691; rector of the Thomas Gymnasium in Leipzig (1730), which dates its great celebrity from this time. In 1734 Gesner was appointed Professor of Poetry and Eloquence in the newly founded University of Göttingen. By reviving the study of Greek, and confining Greek and Latin instruction in the schools to classical authors, he became the great reformer of the learned institutions throughout Germany. D. Aug. 3, 1761. His chief work, justly esteemed for a long time, though now superseded, is his *Novus linguæ et eruditionis romanæ thesaurus*. He also edited the *Scriptores rei rusticæ* (2 vols., 1735); *Quintilian* (1738); *Pliny the Younger* (1739); *Claudian* (1759, and numerous school editions); *Opusc. Min.* (8 vols., Breslau, 1745). Cf. Ernesti's *Narratio de Gesnero* (Leipzig, 1762) and Fr. Paulsen's *Gesch. des gelehrten Unterrichts in Deutschland* (Leipzig, 1885, pp. 427–440). ALFRED GUDEMAN.

**Gesner**, or **Gessner**, SALOMON: author and artist; b. at Zurich, Switzerland, Apr. 1, 1730; author of *Daphnis* (1754); *Inkle und Yarico*; *Idyls* (1756), and other poetical works; *Der Tod Abels* (1758, a prose poem), beside dramas, tales, etc. His idyls were read with great enthusiasm, and were among the most popular literary productions of the time. His etchings are for the most part very fine, and he had a good reputation as a landscape-painter. D. at Zurich, Mar. 2, 1788.

**Gesner**, or **Gessner**, KONRAD, von, M. D.: naturalist; often called the German Pliny, from his extensive knowledge; b. at Zurich, Switzerland, Mar. 26, 1516. He was educated at

Strassburg, Bourges, and Lausanne; was Professor of Greek at Lausanne, and Professor of Physics and Natural History at Zurich. His published works are many, the most extensive being the *Bibliotheca universalis*, a descriptive list of all known works in Latin, Greek, and Hebrew. The work by which he is best known, however, is the *Historia animalium*, a zoölogical treatise in six volumes (Zurich, 1551–87), containing the names and descriptions of all the then known animals. At the time of his death, which occurred at Zurich, Dec. 13, 1565, he was engaged in the preparation of an equally extensive work on botany. F. A. Lucas.

**Ges'ta Romano'rum** [Lat., the acts of the Romans]: one of the oldest mediæval collections of pious legends, designed for the edification of the monks and clerks. It was compiled probably by one Elinandus at a very uncertain date, and moral reflections were interpolated by Peter Berchorius (d. 1362), a Benedictine of Poitou. It was written in Latin, but was translated into most of the vulgar tongues of Europe, and down to the revival of learning was extensively read. The style was barbarous, but many of the legends are told with charming simplicity. The work contains the germs of very many of the popular tales of modern literature. Richard Robinson's translation (London, 1577) is incomplete. Charles Swan's (1824, 2 vols.) has copious notes, and was re-edited by Wynnard Hooper (Bohn's Antiquarian Series, 1877). Best critical text of original Latin by H. Oesterley (Berlin, 1872). Revised by S. M. Jackson.

**Gestation** [Lat. *gestatio*, from *gesto*, to carry; Fr. *gestation*; Ital. *gestazione*; Span. *gestación*; Germ. *Trächtigkeit*; Gr. *κύησις*; syn. utero-gestation]: the carrying of the young animal by the mother up to the time of its birth. This being effected by the uterus, or womb, occurs only in the Mammalia (*q. v.*), since the females of that class alone possess that organ. Gestation begins with conception, and is brought to an end by parturition, and includes the progress of the young animal in development throughout this period. Gravidity or pregnancy, though of precisely corresponding duration, refers to the condition meanwhile of the mother alone. In birds and other oviparous animals the germ is expelled from the body of the female as one of the constituents of the egg, and subsequently undergoes further development during incubation until the young is hatched. In the Mammalia the young animal—called the embryo in the human species during the period from the close of the second to the close of the fourth week, and afterward till birth the fœtus—is not separated from the mother till so far developed as to be capable of at once maintaining life independently of her.

The *fecundity* of animals, or their capability of bearing young, depends both on the frequency of gestation and the number produced at a birth; both of which factors vary inversely with the size of the animal and the duration of gestation as a general rule. The elephant, camel, and horse very seldom produce more than one at a time; the lion one, more often two or three, sometimes five or more. In these animals also gestation occurs only at comparatively long intervals, while by the dog, cat, and rabbit from six to ten or more are produced at a litter, and several times a year. Gestation, however, occurs far less frequently in animals still in the wild state than in the same when domesticated. Pigeons breed in the former state but twice a year; in the latter six, and sometimes even nine, times. The fecundity of the domesticated rabbit (*Lepus cuniculus*) is truly astonishing. Since it begins to breed at six months, and has seven litters a year, each of from four to twelve, or even more, it was calculated by Pennant that the descendants of a single pair of rabbits would, without interference, amount in four years to 1,274,840. Fecundity increases within certain limits of the animal's age. The elk and bear produce but one at first, but afterward two at a time, and lastly again but one. The young hamster produces only three to six at a litter—that of a more advanced age eight to sixteen. The same is true of the sow. (*Burdach.*) In the human species single births are the rule, but twins are met with once in about every 700 cases, triplets once in every 7,000. Quadruplets are exceedingly rare, and more than four among the great rarities. Five and even six at a birth have, however, been authentically reported.

The *duration* of gestation varies in different animals with their size and the degree of development of their young at birth, both of these influences being, however, modified by the animal's habits. It is shorter in carnivorous than in herbivorous animals of similar size, since the greater activity of the former would be essentially curtailed by a prolonged gestation and a corresponding increase of size and weight. Hence also their young are less developed at birth, the eyelids, for example, not being yet separated, and therefore the eyes not opening for several days afterward. A very remarkable example of imperfect development at birth is presented by the kangaroo. The young animal is expelled from the uterus at the end of thirty-nine days, while still less than half an inch long, and in a gelatinous and embryonic condition, and then placed in a little pocket formed by a fold of skin in the inguinal region, where it remains, attached to a teat, until so far developed as to be capable of living when separated from the mother. The animals next to be named have the following periods of gestation: (1) *Herbivora.*—The elephant, 20 or 21 months; the giraffe, 14 months; dromedary, 12 months; buffalo, 12 months; ass, 12 months; mare, upward of 11 months; the tapir, between 10 and 11 months; rhinoceros, 9 months; the cow, 9 months; many of the larger deer, over 8 months; reindeer, 8 months; sheep and goat, 5 months; the sow, 4 months. (2) *Rodentia.*—The beaver, 4 months; dormouse, 31 days; rabbit, 30 to 31 days; squirrel and rat, 28 days; guinea-pig, 21 days or less. (3) *Carnivora.*—The bear, 6 months; lion, 108 days (Van der Hoeven says 3 months); the puma, 79 days; the fox, wolf, and dog, 62 or 63 days; the cat, 55 or 56 days. (4) *Marsupialia.*—The kangaroo (the largest), only 39 days; the opossum, 26 days. (5) *Cetacea.*—The Greenland whale, about 10 months. (6) *Quadrumana.*—The most common duration for the varieties of monkeys is 7 months, and they produce one, and sometimes two, at a birth.

It was erroneously claimed by ancient writers that every animal has a fixed period of gestation except the human female. The duration generally accepted for her is 280 days from the termination of the last preceding menstrual epoch, and 275 days after insemination; but the former is merely an average statement. The somewhat shorter duration of a first gestation has long been a popular idea, and has been proved by statistics, but in case only of young mothers. Its increase with the age probably does not, however, continue after twenty-seven to twenty-nine years. The length and weight (size) of the child are also found to increase with the mother's age up to the limits just mentioned, while the number of the birth after the first has no influence in this respect.

Gestation may terminate prematurely from violence or otherwise, such an accident being termed an abortion if occurring before the beginning of the fourth month, miscarriage if after the third month and before the seventh or period when the child may survive if born, and premature delivery if later, but still before the average time. If parturition occurs after the end of seven months (or 210 days) probably the child will live, the probability increasing the more nearly the average term is completed. Children born previously to seven months may also live, and experience has shown that, if by external warmth in an incubator and artificial feeding through a tube the rigors of the new surroundings be reduced to the minimum, a considerable proportion of children as young as the sixth month may be saved. In the celebrated Kinghorn case the child was born 174 days (24¾ weeks) after marriage, and lived more than eight months. The majority of the medical witnesses considered the child to have been begotten in wedlock. English law allows a child of seven months after marriage to be legitimate if former access can be denied. According to the French code, a child is legitimate if born as late as 180 days after marriage.

The proposition that human gestation may be prolonged for several days, or even weeks, beyond the average duration, was by some of the older writers pronounced absurd; and a discussion was continued for a long time, and not without acrimony. The presumption derived from comparative physiology is very decidedly in its favor. Tessier, whose observations were continued through a period of forty years with every precaution against inaccuracy, found that of 577 cows (the average term being 280 days), 20 calved beyond the 298th day, and some of these even as late as the 321st day—an excess of nearly six weeks. Of 447 mares (the average period being 335 days), 42 foaled between the 359th and the 419th day; the maximum protraction being 84 days, or one-fourth of the usual term. Of 912 sheep (average being about 151 days), 96 yeaned beyond the 153d day, and 7 of these went to the 157th day—an excess of 6 days. Of 161 rabbits (average about 30 days), 25 littered between the 32d and 35th

day, the greatest protraction being one-sixth of the whole period, and occurring also in nearly one-sixth of the total number. Even in the incubation of the common hen, Tessier found not infrequently a prolongation of 3 days, or one-seventh of the whole period. Earl Spencer, accepting 284 or 285 days as the average term for the cow, found the two longest terms in 764 cows to be 306 and 313 days; and also that of 106 calves born between the 290th and the 300th day, 74 were males, while all born after the 300th day were females. He also found that in 75 instances of the offspring of a particular bull, the average of gestation was prolonged from 284 to 288½ days. Mr. C. N. Bement found the average in 62 cows to be for males 288 days and for females 282, the longest period to be 336 days and the shortest 213. (*American Journal of Medical Sciences*, Oct., 1845.) The extremes of duration for the cow being thus found by these independent observers to be 321, 313, and 336 days, it might be expected that a similar prolongation is possible in human gestation, which is so nearly of the same average duration. Facts also demonstrate a possible prolongation at least beyond ten months. Instances frequently occur to obstetricians of parturition 300 days or more after the cessation of the last preceding menstrual flow. But such cases are of no value in the present inquiry, since it is insemination, and not menstruation, that determines the time of conception, and therefore the beginning of gestation; and that may have occurred even 20 days after the last monthly period, and just before next was due; and gestation therefore may have been prolonged but slightly, or not at all. Obviously, the only reliable cases are those of pregnancy from a single coitus or from connection on a single day; and in such, all the time beyond 275 days is to be regarded as a prolongation beyond the average duration. Of 25 cases given by Dr. Reid, the maximum of duration was 293 days; and of 50 reported by Dr. Montgomery, it was 297 days. The last case would have been at least 302 days after the end of the last menstruation, as the calculation is usually made, and might possibly have been even 20 more (317 days), as before explained. A case is also known of birth 301 days after insemination by a single coitus. Dr. Hodge mentions a case of gestation certainly continuing 302 days, and probably not less than 322 to 327 days. The French code is therefore not too indulgent in admitting the legitimacy of children born within 300 days after separation of the parents. The Scotch law does not declare a child a bastard unless born later than ten months after the death or departure of the husband. English law is still more complaisant in deciding that a child born within eleven months after the death or the possibility of access of the husband shall still be regarded as his. In the Gardner peerage case, however—which was tried in London in 1825–26—it was decided that a child born 311 days after separation from the husband was illegitimate; but mainly, if not entirely, on the ground that the mother had lived in open adultery after the separation. Twelve of the seventeen distinguished medical witnesses gave the opinion that natural gestation might have been prolonged to this extent. (*Lancet*, vol. x., p. 289, 1826.) It has been decided in the U. S. that a child born 317 days after separation was legitimate. (*Commonwealth* vs. *Porter*, *American Journal of Medical Sciences*, 1845.) Revised by WILLIAM PEPPER.

**Geste**: the subject-matter of a mediæval French historical epic poem, or *chanson de geste*. The word is derived from the neuter plural *gesta*, used in Late Latin to designate an historical narrative (e. g. *Gesta Regum Francorum*). In Romance it became a feminine singular, and gradually enlarged its signification, so as finally to be applied to (1) historical epic matter, (2) an historical epic poem, (3) a group or cycle of epic traditions, (4) a family of epic heroes. In England this process went so far that when the singers of epic poems, the *jongleurs*, had fallen into complete disesteem, becoming simply *jugglers*, *geste* (Eng. *jest*) was used of a mere joke, or amusing turn. The way in which the *chansons de geste* came into existence has been described elsewhere. (See EPIC POETRY.) Chanted by the JONGLEURS (*q. v.*), to the accompaniment of the *vielle*, these poems seem to have begun to assume the form in which we have them as early as the tenth century. (Cf. G. Paris, *Hist. Poét. de Charlemagne*, p. 50, *seq.*, and *Romania*, ix., 38, *seq.*, *à-propos* of the famous Latin *fragment de la Haye*.) There are no examples, however, of a period earlier than the second half of the eleventh century. During the twelfth and thirteenth centuries the production of *chansons de geste* was enormous; then they began to decline in vogue, especially among the more cultivated classes. In the middle class and among the vulgar, however, they lived on, undergoing continual revision and transformation, until in the fifteenth century they were reduced to prose and had a kind of revival of their popularity. And in prose they have survived, though in a constantly more debased form, until the present time; for from them is derived much of the material of those cheap volumes sold for a few pennies in the bookstalls of Paris, and known as the Bibliothèque Bleue.

From the middle of the eleventh to the middle of the thirteenth century may be called the great period of the *chansons de geste*. But this was a time of vast literary production in France, and all kinds of poetry, both lyric and narrative, flourished. It is at first sight a little difficult to determine which of the numerous secular narrative poems that have come down are true *chansons de geste*. As time went on the essential differences between these and other classes of poems grew less and less clear, and were finally almost altogether lost. It is certain, however, that in the Middle Ages a distinction was felt to exist between them, as well as between poets, TROUVÈRES (*q. v.*), and epic relaters, jongleurs, although later times have constantly confused both. The chief line of demarkation clearly indicated by mediæval writers themselves is that between *chansons de geste* and romances, or *contes d'aventure*. These two categories do not, however, include quite all the narrative works we have. A third considerable group is of those poems in imitation of the *chansons de geste*, but based upon antiquity. As the poet Jean Bodel says in beginning his *Chanson des Saisnes* (end of twelfth century):

> Ne sont que trois matères à nul home entendant:
> De France, de Bretagne, et de Rome la grant.

That is, a serious poet will use only the traditions of France, tales of Celtic origin (Arthurian, etc.), or stories of antiquity (Troy, Alexander, Cæsar, etc.). Of these three "matters," that of France was the proper material for *chansons de geste*; that of Britain was treated in the *contes d'aventure*; that of antiquity was employed less by the truly popular poets than by persons of greater learning, mainly clerks, like BENOÎT DE SAINTE-MORE (*q. v.*), who deliberately imitated the poems they found in vogue, but sought for greater success through the use of a less familiar material. Nor were these three the only materials of which mediæval French poets made use. A considerable number of poetical stories are based upon various Oriental and Byzantine themes, or in some cases pure inventions; but these are all to be reckoned among the *contes d'aventures*. And, finally, there are the poems of the FABLIAUX (*q. v.*) type, or of the beast-epic type, like the romance of REYNARD THE FOX (*q. v.*). As has already been indicated, then, the *chansons de geste* proper were devoted to the real or supposed history of France. Of all the forms of secular poetry this was felt in the Middle Ages to be the most worthy. Jean Bodel, in the passage above indicated, dwells upon the fact that the "matter of France" is true (*voir*), in contrast to that of Britain, which is vain and pleasant. And in the *Pénitentiel* of Thomas of Cobham (end of thirteenth century), all classes of players, singers, mountebanks, etc., are declared to be *damnabiles*, except those *qui dicuntur joculatores*, *qui cantant gesta principum et vitam sanctorum*, etc. It need hardly be said, however, that the truth to be found in the *chansons de geste* is not instructive because it is historical truth. On the contrary, the poems contain only the vaguest and most confused reminiscences of historical fact. The popular imagination has left little as it actually happened. Persons and events separated by many generations are brought into immediate connection with each other, and, indeed, often identified; and great masses of material having no historic basis whatever have been brought into service to meet the needs of a novelty-loving public. Still, in one way history was an all-important factor in the development of the *chansons de gestes*: it did to the end determine the main themes and the inter-relations of the poems—the latter a very important matter, especially after what has well been called the genealogical, or "cyclic," tendency manifested itself.

There are serious difficulties in the way of any satisfactory arrangement in groups of the hundred and more *chansons de geste* that have survived out of a number indubitably far greater. In some respects a chronological division is best suited to the nature of the poems as we find them. The earlier monuments, like the *Chanson de Roland* (the greatest of all), with their assonanced *laisses*, or long series of ten-

syllabled verses, all having the last accented vowel the same, differ fundamentally both in purpose and in execution from the later poems in rhymed alexandrines (still arranged in *laisses*, however), which are *contes d'aventures* in all except mere subject and name. In practice, however, a chronological grouping is decidedly confusing, for it separates from each other poems connected closely by the relationship of the characters appearing in them; and, more important still, it breaks the thread of the continuous tradition that maintains through all the changes in treatment the essential independence of epic themes having diverse origins. The most practicable method, therefore, is to neglect for the purposes of classification the decline of the true heroic impulse in the French epic poets into a mere romancing or cyclic effort, and to keep the poems in such families as were noted in the Middle Ages themselves. Three of these families are mentioned from an early date: the *Geste du Roi*, or *Pépin*; the *Geste de Garin de Monglane*; and the *Geste de Doon de Mayence*. The first consisted in general of the poems devoted to the royal family, with Charlemagne as the center of interest, and to national struggles; the second, of poems dealing with the conquest or defense of the southern provinces of France and Catalonia against the Saracens; the third, of poems reflecting the contests of the great feudal lords with the royal house. But this classification is by no means exhaustive, and Nyrop (*op. cit.*) finds it necessary to add four other groups: (1) Merovingian poems; (2) Capetian poems; (3) poems on themes connected with special provinces of France; (4) poems connected with the first crusade. Even under this classification there is much entanglement of several of the groups, and many of the monuments fall imperfectly within them. Gaston Paris (*Litt. franç. au moyen âge*, p. 41, *seq.*) suggests, rather than distinctly develops, a somewhat more satisfactory arrangement, which, with some variations, may be outlined as follows:

I. Royal Epic (*Geste du Roi*):
- (*a*) Merovingian.—Floovent (= *Chlodovine = Dagobert or Theodoric I).
- (*b*) Carolingian.—
  - (*α'*) Charles Martel (confused with Charles the Bald).
  - (*β'*) Charlemagne.
  - (*γ'*) Louis I. (confused with later Louises).
- (*c*) Capetian.—Hugh Capet.

II. Epic of the South of France (*Geste de Garin de Monglane*):

The central figure in this group of poems is a certain Guillaume d'Orange, called also Guillaume Fièrebrace and Guillaume au Court Nez, who is represented to be the great-grandson of Garin de Monglane, from whom the *geste* takes its name. Of all the *gestes* this is from the genealogical point of view the most carefully worked out; and yet it is probable that at least three historical Guillaumes contributed to make up the single epic hero of that name, i. e. Guillaume, Count of Toulouse (†812), Guillaume the Pious, Duc of Aquitaine, his great-grandson, and Guillaume, Count of Montreuil-sur-Mer in Picardy (middle of tenth century). Round about this composite Guillaume were grouped various provincial heroes, champions of Christendom against the Saracens, and all were connected together by ties of relationship. Some twenty-five poems are devoted to this family, among them *Aliscans*, one of the finest of all.

III. Feudal Epic:

(*a*) Struggles of feudal lords against the royal house:

The most important of these is the traditional one of Burgundy against its Frankish conqueror. To this is devoted the fine poem of *Girart de Roussillon*, the central figure of which is a certain Count Girart, who historically was a great person in Provence in the ninth century († before 879). This poem is not in French, but in a dialect intermediary between French and Provençal; and this fact has been improperly used as an argument for the existence of an extensive epic literature in Provençal.

(*b*) Intestine strifes of feudal lords:

Among the poems of this class the most interesting are a cycle of five known as *Les Lorrains*, describing a contest of generations between the people of Lorraine and those of Aquitaine (the Bordelais). No historical foundation for these poems has yet been discovered.

(*c*) Feudal rebels and traitors (*Geste de Doon de Mayence*):

It was but gradually that this *geste* became the depository for the stories of traitors, nor was the process thoroughly carried out in France. Only after French epic had taken new root in Italy and had developed there independently were the descendants of Doon de Mayence (the Maganzesi) consistently treated as deceivers and betrayers. Such, for example, is far from being the character of Renaut de Montauban, the hero of the fine poem that bears his name. On the contrary, he is the type of the perfect knight. But he is a rebel against his king, and, furthermore, in constant intercourse with a wizard, Maugi (Ital., Malagigi). Consequently, it was not repugnant to the feelings of the epic poets to represent Ganelon, the arch traitor of the *chansons de geste*, as his cousin. Several of the themes of the *geste*, however, seem to have been brought in there only because they would fit nowhere else.

IV. Biographic Epic:

Here belong a number of poems not firmly attached to cycles. They give the life and adventures of heroes who often are based upon historical personages.

V. Adventitious Epic:

Under this head come poems in which chance themes not truly epic in character are treated in epic fashion. Several of the poems that apparently belong to the other groups are really of this variety, being attached in the most artificial way to their cycles. The best of this class is *Ami et Amiles*, based upon an Oriental story of perfect friendship.

VI. Epic of the First Crusade:

Though elaborated in a very different spirit from the true heroic *chansons de geste*, the poems associated with the first crusade are essentially imaginative rather than historic in their character, and deserve to be mentioned here.

VII. Epic Essays of the Fourteenth Century:

Several poems describing the wars against the English bring to a close the long series of *chansons de geste*.

As will be seen from the above, the impulse that produced the *chansons de geste* lived long. From the eleventh to the fifteenth century there were never wanting poets to use the quasi-historical traditions of the French people in this way. And a very remarkable body of poetical work was the result. This can best be appreciated by following the diffusion and the influence of these poems in the rest of Europe. There is abundant evidence that they were known and admired in England, the Netherlands, Germany, Scandinavia, Iceland, Italy, Spain, Portugal, Greece, Hungary, and perhaps the Slavic nations. In most of these countries they were extensively translated and imitated. In Italy they actually took root again, as has already been remarked, and entered upon a new course of development, which reached its highest point in the poems of Pulci, Boiardo, and Ariosto. They thus contributed to the modern world a great mass of imaginative material, which has been largely drawn upon by many generations of poets.

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**Geta**: a son of Septimius Severus; b. in 189; was proclaimed emperor, together with his brother Caracalla, after the death of their father in 211, but was assassinated in the following year at his brother's instigation. G. L. H.

**Get'æ** (Gr. Γέται): a people of antiquity, occupying in the time of Herodotus the territory between the Balkans and the Danube; in later times confused with the Dacians, a neighboring and related people. The old belief that the Getæ were of the same race as the Goths (*q. v.*) is not now generally received. G. L. H.

**Gethsemane**, geth-sem'a-nĕe [= Gr. Γεθσημανῆ, from Heb. *Gath-shemen*, liter., olive-press]: a garden, or orchard, at the foot of the Mt. of Olives, where our Lord spent a part of the night preceding his crucifixion, and which had been a place of frequent resort for him and his disciples (Luke xxii. 39; John xviii. 2) (see map of Palestine, ref. 10–D). The spot now shown by Latin monks is a short half mile from Jerusalem, nearly opposite the Golden Gate, just across the Kedron, at the angle made by the two paths that lead up over Olivet. The garden is nearly square, 160 feet from N. to S., and 150 from E. to W., contains eight large olive-trees, which are believed to be at least 1,200 or 1,300 years old, and, since about 1840 or 1850, has been inclosed by a high stone wall. The actual spot, in Dr. Robinson's opinion (1838), may have been a little farther up the hill. Dr. Thompson (1858) pronounced in favor of a more secluded locality several hundred yards to the N. E. of the present Gethsemane. The Greek priests show their pilgrims a spot near that appropriated by the Latins and tell them that there was the garden of Gethsemane.

Revised by S. M. Jackson.

**Getty**, get i. George Washington: U. S. general; b. in Georgetown, D. C., Oct. 2, 1819; graduated at West Point Military Academy, July, 1840; entered the army as second lieutenant of artillery; promoted first lieutenant 1845, captain 1853, major 1863, colonel Thirty-seventh Infantry 1866, and transferred to Third Artillery 1871; served on the northern frontier during the Canada border disturbances 1840; in garrison 1841–46; in the war with Mexico 1847–48; engaged in the battles of Contreras (brevet captain), Molino del Rey, Chapultepec, and the capture of the city of Mexico; in Florida 1849–50 against hostile Seminole Indians; in garrison 1851–56; on frontier duty 1857–61. During the civil war (1861–65) he served with the Army of the Potomac in the Virginia Peninsula campaign, in the Richmond campaign of 1864, in the defense of Washington (July, 1864), and subsequently with the Army of the Potomac from the siege of Petersburg to the final surrender of Gen. Lee, Apr. 9, 1865. For gallant conduct in battles during the war he was breveted lieutenant-colonel, colonel, brigadier-general, and major-general U. S. army, and commanded various military districts till mustered out of volunteer service Sept., 1866; transferred to the Fourth Artillery July, 1882; retired 1883.

**Gettysburg**: borough; capital of Adams co., Pa. (for location of county, see map of Pennsylvania, ref. 6–F); on the Phila. and Read. and the W. Md. Railroads; 8 miles N. of Mason and Dixon's line, 28 miles W. by S. of York, 36 miles S. by W. of Harrisburg. It is in an agricultural region, is built on and surrounded by picturesque hills, and contains several mineral springs of high medicinal value. It has granite-yards and several manufactories, churches, hotels, and 1 monthly, 1 quarterly, and 2 weekly periodicals. It is the seat of the Theological Seminary of the General Synod of the Evangelical Lutheran Church in the U. S. (chartered 1827) and of Pennsylvania College (Lutheran, chartered 1832). The battle of Gettysburg occurred in and around the borough July 1, 2, and 3, 1863. The National Cemetery here, dedicated by President Lincoln Nov. 19, 1863, contains the graves of 3,580 Union soldiers, with a central monument built at a cost of $50,000, and a bronze statue of Gen. Reynolds. Since the close of the war numerous Northern State and regimental monuments have been erected on the various historic points on the battle-field. The Confederate dead have nearly all been exhumed from the battle-field and taken to Southern cemeteries. Pop. (1880) 2,814; (1890) 3,221; (1900) 3,495. See Gettysburg, Campaign and Battle of.

**Gettysburg, Campaign and Battle of**: the decisive campaign and battle of the civil war in the U. S.

Campaign.—After the battle of Chancellorsville (May 2–3, 1863) the Union and Confederate armies maintained their positions on the Rappahannock near Fredericksburg until early in June, when Hooker, seeing indications of a movement on Lee's part, sent his cavalry toward Culpeper to watch the fords. Lee started two corps, Ewell's and Longstreet's, by the Shenandoah valley, to invade Pennsylvania, retaining Hill's corps at Fredericksburg in front of Hooker. Hooker, learning of this movement through Pleasanton's cavalry combat at Brandy Station (June 9), started out to cover Washington, marching by Centreville, Edwards Ferry (June 26–27), and Frederick, threatening Lee's communications at or near Hagerstown, by occupying Middletown and the passes of the South Mountain, and ordering the Twelfth Corps to Harper's Ferry. Ewell, marching up the Shenandoah valley, defeated Milroy at Winchester June 14 and 15, and crossed the Potomac at Williamsport on the 15th, occupied Hagerstown and Sharpsburg, and sent his cavalry to Chambersburg for supplies. Following on, he marched via Chambersburg, Rodes's division to Carlisle, 27th, and Early's division to York, June 28; whence, under orders to join Longstreet and Hill at Cashtown, he returned to Heidlersburg, about 10 miles from Gettysburg, on June 30, joining in the battle the following day. Longstreet, keeping to the east of the Blue Ridge, with Stuart on his right flank, guarded the passes through the ridge until Hill's corps had passed him on its way to Shepardstown, where it crossed on the 23d, when he also moved into the valley, and crossing the river at Williamsport on the 24th and 25th, joined Hill, and marched across Maryland into Pennsylvania, reaching Chambersburg June 27 and Cashtown on the 29th, whence Gen. Heth, of Hill's corps, advancing toward Gettysburg on the 30th, discovered Buford's advance and returned to Cashtown. Stuart, with three brigades of cavalry, was detached from Longstreet when he entered the Shenandoah valley, and ordered to join Ewell on the Susquehanna. In pursuance of these orders he crossed the Potomac below Edwards Ferry, and passed around the rear and right of the Union army by way of Rockville, Hood's Mill, Westminster, Union Mills, Hanover, York, and Carlisle, closely followed at the last by the Union cavalry, and reached Gettysburg, meeting Gregg in the cavalry fight of July 3 on the right of the Union line. Early's movement toward the east through Chambersburg threatened Harrisburg and Columbia, and eventually Baltimore and Washington, and led Halleck to question the propriety of Hooker's movement against Lee's communications. This caused Hooker to ask to be relieved from command. His request was immediately granted and Meade was assigned in his place, assuming command on June 28. Meade at once directed the whole army northward toward Harrisburg, in order to force Lee into a battle before he could cross the Susquehanna. Kilpatrick led the advance cavalry, Buford following on the left and Gregg on the right. Kilpatrick reached Hanover on the 30th, in time to repulse an attack by a part of Stuart's cavalry. Stuart, finding his di-

rect road to Gettysburg barred, marched on to York and Carlisle and thence to Gettysburg on July 3. Buford, moving up the Cumberland valley by Boonsboro and Fairfield, reached Gettysburg on the afternoon of June 30, and passed on beyond Seminary Ridge, taking a position on McPherson's Ridge overlooking Willoughby Run, where he opened the battle on the following day, July 1. The several army-corps marching north were on June 30 much scattered. The First was at Marsh Run, about 5 miles S. W. of Gettysburg on the Emmetsburg road, the Eleventh at Emmetsburg, the Third at Bridgeport, the Fifth at Union Mills, the Twelfth at Littelstown, the Second at Uniontown, and the Sixth at Manchester with Gregg's cavalry. Kilpatrick's cavalry was at Hanover. All except the Sixth were under orders for July 1 that would bring them nearer Gettysburg. The Confederates were already concentrated, Longstreet and Hill at Chambersburg and Cashtown and Ewell at Heidlersburg marching to join them. Meade, while pushing on toward Gettysburg, had not decided to fight at that place, but, to better cover Baltimore and Washington, had directed his chiefs of engineers and artillery to select a line at Pipe creek for the coming battle, when the collision of the advancing troops determined that it should take place at Gettysburg.

The Battle.—Heth's division, advancing on the morning of July 1 by the Chambersburg (or Cashtown) pike, approached the line held by Buford with his dismounted cavalry upon McPherson's Ridge, and at about 8 A. M. Buford's artillery opened fire. Buford held back the advance of Heth's division for about two hours, until Reynolds, bringing up the First Corps with all haste, re-enforced him, establishing his line from the Fairfield (or Hagerstown) road on the left to the Mummasburg road, breaking back along this road at an acute angle, and extending a short distance down the hill toward the low ground lying N. and E. of the village of Gettysburg. The Eleventh Corps, arriving at about one o'clock, was placed on this low ground to the right and rear of the First Corps, its left on the Mummasburg road at some distance in rear of the right of the First Corps, and its right on Rock creek near the Harrisburg road. The right of the First Corps and the left of the Eleventh were commanded by Oak Hill, and the right of the Eleventh was enveloped by Ewell when he arrived from Carlisle. The line taken up by the Eleventh Corps was weak in itself, and too long for the number of men. Howard was, however, obliged to occupy it to cover the right and rear of the First Corps against Ewell's advance from the N. and E. In this position the First and Eleventh Corps held back Hill and Ewell until about 4 P. M., when Ewell, having enveloped the right of the Eleventh Corps, rendered its position untenable and drove it back through Gettysburg, uncovering the right of the First Corps, which now, enveloped on both flanks, also fell back in comparatively good order through the village, uniting with the Eleventh Corps on Cemetery Hill, where they took up a position which proved an important part of the line of the second and third days' battles. The fighting of the cavalry and the First Corps was desperate and bloody. Gen. Reynolds was killed. Gen. Doubleday, second in rank, commanded the corps until relieved by Gen. John Newton, who, ordered forward to command the corps, met it at Cemetery Hill. The losses on both sides were heavy, and the attack of Heth's corps on the third day was doubtless less vigorous in consequence. The right of the Eleventh Corps, under Barlow, was also heavily engaged and suffered severely before falling back. During the night and following day the other army-corps came up. The Twelfth arrived on the evening of the 1st, the Second and part of the Fifth at 7 A. M. of the 2d, the remainder of the Fifth arriving at noon, and the last of the Third Corps at about 9 A. M. The artillery reserve came up at 10.30 A. M., and the Sixth Corps, after marching 34 miles, at 4 P. M.

*Second Day.*—Some shifting of troops took place, and the divisions of the corps were in some cases separated, but when the line was formed the corps were, in general terms, placed as follows, viz.:

The Twelfth (Slocum) on the right, from Spangler's Meadow, extending around Culp's Hill, and covering the Baltimore pike; then the First (Newton), Eleventh (Howard), and Second (Hancock), extending the line along Cemetery Hill, and thence in a southerly direction toward Round Top, with the Fifth (Sykes) in reserve on the Baltimore pike near Rock creek. The Third Corps (Sickles) occupied the line of the Emmetsburg road to the peach orchard, where it was sharply refused with its left extending toward the Devil's Den and Little Round Top. The Confederate line extended from Benner's hill on its left, through the village and along Seminary Ridge, Ewell on the left, Hill in the center, while the right under Longstreet was extended to the S., overlapping Sickles's left. At about 4 P. M. Longstreet made a sudden and vigorous attack, forcing the salient at the peach orchard and driving in the successive regiments and brigades from the left toward the right of the Third Corps, pushing them back across the wheat-field, gaining the Devil's Den, and threatening to take Little Round Top. The latter was saved by the timely action of Warren, who, leading Vincent's and Weed's brigades and Hazlett's battery up the north slope, reached the summit in time to repulse the Confederate assault, but with the loss of Weed and Hazlett killed and Vincent mortally wounded. The Third Corps, although driven back with great loss, inflicted corresponding losses upon the enemy, and fell back in relatively good order, supported by part of the Twelfth, Second, and Fifth Corps and by the efficient action of the artillery under McGilvery. The Sixth Corps having now arrived, and having been placed in position on the left of the Second, the line was finally established with its left resting on Little Round Top, and the fighting in this part of the field ended with the close of the day. About 6 P. M. Ewell attacked the right center at Cemetery and Culp's Hills, Early gaining a temporary foothold on Cemetery Hill in Howard's front, from which he was soon driven; but on Culp's Hill a considerable extent of the earthworks, from which a part of the Twelfth Corps had been withdrawn to strengthen the left, was occupied and held during the night. The fighting on the Union left during the day was very severe, and the losses, particularly of the Third Corps, large.

*Third Day.*—At dawn of July 3 fighting for the recovery of the works at Culp's Hill began and continued until nearly noon, when the Confederates were driven out, the line re-established, and the Union right and rear again made secure. The Confederate losses in this part of the field were severe, and the Union losses also large. At about 1 P. M. Lee opened upon the Union center with about 155 guns, and Meade replied with about 80. The cannonade continued until about 3 P. M., when Pickett's division charged. The advance was made in three lines across the very gentle slopes of the valley for a distance of about 1,400 yards, over most of which it was exposed to a converging artillery fire, and after passing the Emmetsburg road to the full fire of the artillery and infantry. The Union infantry fire was reserved for close action, at from 200 to 300 yards. The attacking force advanced most gallantly, and at the center reached and drove back the first Union line to the second, where the assault was stopped and the Confederates beaten and driven back with great losses in killed, wounded, and prisoners. This was the culmination and end of the battle on the main line. Simultaneously with Pickett's charge Stuart's cavalry arriving from Carlisle, as previously described, fell upon the cavalry of the Union right wing under Gregg, with the evident design of breaking through and attacking the line in rear, and thus aiding Pickett's charge. A spirited cavalry fight took place, in which Gregg stopped and beat back a much superior force, compelling it to take a wide detour to join the rest of the army. Upon the Union left, after the repulse of Pickett's charge, a brisk cavalry action against the enemy's advanced skirmishers was inaugurated by Gen. Kilpatrick, in which Gen. Farnsworth was killed. This ended the fighting for the day. Throughout July 4 both armies occupied their positions, Lee withdrawing his trains during the night, and, following with his troops on the 5th, returned to Virginia.

The aggregate effective strength of the Union army was about 93,500 men. The Sixth Corps, which was hardly engaged, contained about 15,000. The best estimates place the Confederate force on the field at about 70,000 men. The Union losses were: killed, 3,072; wounded, 14,497; missing, 5,434: total, 23,003. The Confederates report their losses as killed, 2,592; wounded, 12,709; missing, 5,150: total, 20,451. See *Battles and Leaders of the Civil War. Official Record*, etc.

JAMES MERCUR.

**Geulincx** (Fr. pron. *zhü'lăńks'*), or **Geulinkx**, ARNOLD: Cartesian philosopher; b. in Antwerp, Belgium, 1625; studied at the University of Louvain, where he became a successful lecturer. He afterward went to Leyden and entered the Protestant Church, having previously been a Roman Catholic. D. 1669. In his philosophy he anticipated the system of Spinoza. Among his writings, most of which

were published posthumously, may be mentioned *Metaphysica vera* (1691) and Γνῶθι σεαυτόν, *Sive Ethica*, etc. (1696).

**Geyser**, gī'sėr [from Icel. *Geysir*, name of one of the Icelandic geysers (the generic term being *hoer* or *laug*), liter., the gusher, deriv. of *geysa*, gush]: an eruptive hot spring from which water is projected, at more or less regular intervals, as from a fountain. Geysers, hot springs, and mud springs are associated in districts of comparatively recent volcanic activity. It is probable that these different forms of water movement indicate different stages in the development of the springs, as changes have been known from one form to another. The water is received by infiltration from the surface, and the heat is believed to be derived from buried lava flows, not yet entirely cooled. According to the relation of the several elements concerned—rate and amount of water movement, temperature of underground rocks, arrangement of water-passages, etc.—the activity of the springs may take one form or another. Geysers are produced when a column of water accumulates in a nearly vertical passage of considerable depth so that it may be heated at the bottom to temperatures above the ordinary boiling-point. When the temperature reaches such a degree that the water boils in spite of the pressure of the superincumbent column, steam is formed rapidly and the greater part of the water is violently discharged. The water issuing from geysers usually forms a siliceous deposit around the vent; the hot springs of geyser districts build siliceous terraces of great beauty, both in form and color.

The geysers of Iceland have been known for seven centuries, and until the nineteenth century they were believed to be unique. The chief examples there are the Great Geyser, the Little Geyser, and the Strokhr or Churn. The action of the first endures five or ten minutes at intervals commonly about a day long, throwing water to a height of 100 or 200 feet. The geysers of the Yellowstone National Park (*q. v.*) are much more numerous than those of any other field in the world, over seventy being enumerated, besides more than 2,000 hot springs, for the most part in four "basins," within a large area of lava flows. Among the most remarkable are Old Faithful, so called from the regularity with which its eruptions occur at intervals of a little more than an hour; the Giant, from which a great volume of water is thrown 200 feet into the air; the Giantess, the Beehive, etc. The geysers, hot springs, and terraces of Rotomahana on the north island of New Zealand were destroyed by a volcanic eruption in June, 1886. See Peale, *Twelfth Annual Report of the Geological Surveys of the Territories* (Hayden's survey). W. M. Davis.

**Gfrör'er**, August Friedrich: historian: b. at Calw, Würtemberg, Mar. 5, 1803; studied at the University of Tübingen from 1821 to 1825, and in 1828 became a Repetent or tutor of theology in that university; but in 1830 gave up that position to become the librarian of the royal library at Stuttgart, where he devoted himself to historical studies, the result of which was his *Philo und die jüdisch-alexandrinische Theosophie* (1831). His subsequent works revealed an anti-Protestant tendency which became an avowed sympathy with Roman Catholicism in his work on church history, *Allgemeine Kirchengeschichte* (1841–46). In the latter year he was called to Freiberg as Professor of History. He sat in the Frankfort Parliament of 1848, where he identified himself with the *Grossdeutsche* party, and was one of the bitter opponents of Prussia. In 1853 he openly professed the Roman Catholic faith, championing it with the zeal of a new convert. D. at Carlsbad, July 6, 1861. Among his other works are a biography of Gustavus Adolphus, *Gustav Adolph, König von Schweden, und seine Zeit* (1835–37; 4th ed. 1863); a critical history of primitive Christianity, *Kritische Geschichte des Urchristenthums* (1838); a history of the Franks, *Geschichte der ost- und west-fränkischen Karolinger* (1848); and a work on Gregory VII., *Papst Gregor VII. und sein Zeitalter* (1859–61). F. M. Colby.

**Ghalcha Languages**: See Iranian Languages.

**Ghat**, gawt, or **Ghaut** [from Hind. *ghāt*, mountain pass or path, mountain-range, hillside path]: in India, (1), a pass through a mountain-range; (2) a landing-place or stairway for people to use in going on or off boats in the rivers. These ghats are used also as bathing-houses, and as places of rest and recreation.

**Ghats, or Ghauts, The**: two chains of mountains in the peninsula of Hindustan, running respectively along the eastern and western coasts, joining each other in Cape Comorin, and inclosing on the two sides the table-land of the Deccan. The Western Ghats form a distinct range, though interrupted by the gap of Palghatcheri, of a height varying between 4,000 and 7,000 feet. Their gold mines have long been worked, but in 1874 gold-bearing strata of extraordinary richness were discovered. The west side of these mountains is very steep, but toward the interior they slope in gentle undulations. The Eastern Ghats are lower, their average height being only 1,500 feet; they are often interrupted, and almost disappear ere reaching Cape Comorin.

**Ghawazis**, or simply **Ghawazi** (which is both a singular and a plural): a degraded class of public dancers in Egypt who amuse the populace with their performances. They are of both sexes, and must be distinguished from the more respectable class of Egyptian singing-girls called almehs. See Almeh.

**Ghazali**, or **Ghazzali**, Abu Hamed Mohammed: See Al-Gazzali.

**Ghazipur**, gaă-zĕe-poor': town of British India and the capital of the district of Ghazipur; on the left bank of the Ganges (see map of North India, ref. 6–G). Rose-culture and the manufacture of rose-water and rose-oil furnish the most conspicuous articles in its bazaars. Lord Cornwallis is buried here. Pop. 40,000.

**Ghaz'ni** (sometimes spelled Ghizni or Ghuznee): a walled city of Afghanistan, the seat of two mediæval dynasties and not without importance in modern history; on the central table-land in lon. 68° 20′ E., lat. 33° 24′ N.; 7,726 feet above the sea, on the direct road from Candahar to Kabul (see map of Asia, ref. 5–D). Its history begins with the tenth century, when it was the capital of the Ghiznevid empire. After falling successively into the hands of the Sultan of Ghûr and of the Mongols, it was in the eighteenth century incorporated in the kingdom of Afghanistan. In 1839 the British took the place by assault, and having lost it in 1842 retook it in the same year. There are many ruins in the vicinity and some structures of interest, as the tomb of Mahmud, the minaret of Mahmud and that of Massand, and the tomb of Fatteh Khan. The Gates of Somnath, celebrated wooden gates of deodar richly carved in geometric Saracenic patterns, formerly belonged to the tomb of Mahmud, but were carried off by Lord Ellenborough in 1842, and are now in the arsenal at Agra. They are 11 by 9½ feet in size. They were objects of veneration, and, according to prophecy, the downfall of the Sikh dominion turned on their removal. There are many holy shrines about Ghazni to which Mohammedans make pilgrimage. Pop. about 10,000.
M. W. Harrington.

**Ghee**, gee [from Hind. *ghī* < Sanskr. *ghrtá*, ghee, originally perf. partic. of *ghar-*, drip]: a variety of butter prepared in India from the milk of the buffalo or the cow. The milk is boiled, then cooled, curdled with sour milk, churned, and after the butter comes it is put aside till it begins to grow rancid; then boiled, mixed with sour milk (*dhye*), salt, and sometimes with aromatics, and is then ready for use. It has a strong and disagreeable smell and flavor, but is extensively used in India.

**Gheel**, gāl: town of Belgium; in the province of Antwerp (see map of Holland and Belgium, ref. 9–F). Since the seventh century this town and its surroundings have been inhabited by a great number of idiots and lunatics, who at first sought a cure here from the shrine of St. Dymphnea, and later from the peculiar and often advantageous treatment they underwent in the houses of the citizens and farmers. The establishment is now under government control. Pop. 10,800.

**Ghent**, gent (in Fr. **Gand**): city of Belgium, and the capital of the province of East Flanders; situated at the confluence of the Scheldt and the Lys, and traversed with numerous canals and branches of the rivers, which divide the city into twenty-six islands, connected with each other by about 300 larger and minor bridges (see map of Holland and Belgium, ref. 9–C). The general character of the city is that of a town of the Middle Ages which has largely become modern; dark and narrow streets, with singular houses towering like castles, alternate with open and beautiful quays lined with elegant edifices. The best view of the city may be had from the Belfry (Beffroi), which occupies a central position, is 375 feet high, built 1183–1339, and adorned on its highest point by a golden dragon 10 feet in length. Other interesting edifices are the Cathedral of St

Bavon, one of the most splendid church edifices of Belgium, the interior covered with marble, the doors cast in bronze, the crypt built 941, the choir and the chapels 1228; the Church of St. Nicholas, a Gothic structure of the thirteenth century; the Church of St. Michael, of the fifteenth century, with an unfinished tower; the Church of St. Peter, restored in 1629–1718, and containing many fine pictures; and the ruins of the chapel of St. Macarius, belonging to the old citadel. The town-house, or hôtel de ville, standing near the Beffroi, is a very interesting structure; its front, finished in 1533 and twice restored, is very rich in its ornamentation; in the hall the Pacification de Ghand was signed in 1576. The university, situated on the other side of the Beffroi, was built in 1818 by Roelandt, and contains a magnificent commencement-hall, a rotunda with room for 1,700 persons, and lighted from above through a cupola; it has a library of 250,000 volumes, and is attended by about 900 students. The Bourse occupies the lower part of the Palace of Justice, built in 1846 by Roelandt, and presenting an elegant peristyle of the Corinthian order; opposite stands the beautiful theater, built in 1848. The Begynhof, or Grand Béguinage, a large nunnery founded in the thirteenth century, was in 1875 transferred from its former position near the Bruges gate to a site on the N. E. of the city. It forms a little town of itself, with eighteen convents and a church, and is inhabited by about 700 Béguines. Ghent also contains many monasteries. Among the public places the most remarkable are the Vrydag-markt, where the Dulle Griete (Crazy Margaret) lies, a giant cannon from the fifteenth century, and where the executions under the Duke of Alva took place; and the Kauter, a parade-ground and flower-market, where Van Eyck and Jacob van Artevelde lived. Ghent has an excellent botanical garden, a conservatory of music, and numerous other scientific and benevolent institutions. With respect to its manufactures, it does not occupy so prominent a place as it formerly did, yet its spinning, weaving and cotton-printing industry, and its manufactures of lace, leather, sugar, and machinery, are considerable, and a single linen-factory employs 3,000 persons. The horticultural interests of Ghent are very great. Its commerce is extensive, and its harbor and shipping facilities excellent; vessels drawing 17 feet can get close to the city.

In historical respects Ghent is a famous place. In 949 the Emperor Otto the Great built a castle in order to defend the city against the Counts of Flanders; nevertheless, in 1000 the counts seized the city. In the fourteenth century Ghent, under Jacob van Artevelde, waged violent wars against Louis of Flanders and the Dukes of Burgundy. It was at that time at the culmination of its prosperity. It mustered an army of 50,000 men; the contingent of the wool-weavers alone was 18,000 men. In the fifteenth century it fought obstinately against Charles the Bold, but under the Emperor Charles V. its splendor began to wane; it was conquered by the emperor in 1540, and heavily taxed. Charles V. was born at Ghent, but showed no partiality for his native city. When his sister Maria, regent of the Netherlands, demanded a subsidy of 1,200,000 gold florins from Flanders and the citizens refused to pay, the emperor carried through his will without mercy. In 1576 the Pacification de Gand was concluded in Ghent, a confederation between Holland, Zealand, and the southern provinces of the Netherlands against Spain. It was conquered in 1584 by the Duke of Parma, and in 1678 by Louis XIV. of France, who, however, restored it to Spain. In 1713 it fell to Austria. Several times it was taken by the French, but by the Peace of Paris in 1814 it was incorporated into the kingdom of the Netherlands; on the establishment of the kingdom of Belgium in 1830 it became a Belgian possession. Pop. (1891) 150,223; (1896) 159,218.

**Ghent, Treaty of**: a treaty between the U. S. and Great Britain, negotiated on the part of the U. S. by John Q. Adams, Henry Clay, Albert Gallatin, and two other envoys at Ghent. It was concluded Dec. 24, 1814, and the ratifications were exchanged Feb. 17, 1815. It put an end to the war which was begun by an act of the two Houses of Congress, signed by the President June 18, 1812. The leading provisions were: (1) Restoration of all territory, places, and possessions taken by either party from the other during the war, except the islands mentioned in Article IV. Public property remaining in such places at the time of ratifying the treaty was not to be destroyed or carried away, and the same engagement was made as to slaves and other private property (Art. I.). (2) Article IV. provides the appointment of a commission to decide to which of the two powers certain islands in and near Passamaquoddy Bay belong; and if the commission should fail to come to a decision, the subject was to be referred to some friendly sovereign or state. (3) Articles V.–VIII. provide for several commissions to settle the line of boundary as described in the treaty of 1783—one commission to settle the line from the river St. Croix to where the 45th parallel cuts the river St. Lawrence (called the Iroquois or Cataraqua in the treaty); another to determine the middle of the water-communications from that point to Lake Superior; and a third to adjust the limits from the "water-communication between Lakes Huron and Superior to the most northwestern point of the Lake of the Woods." If either of these commissions should not make a decision, the subject was to be referred to a friendly sovereign or state, as before. (4) Article IX. binds both parties to use their best endeavors to abolish the slave-trade, as being "irreconcilable with the principles of humanity and justice." The Treaty of Ghent is remarkable for omitting to provide for some important interests. The impressment of seamen, one of the main causes of the war, together with certain questions of maritime rights concerning pre-emption and paper blockades for instance, and the claims of the U. S. still to participate in the fisheries according to the provisions of the treaty of 1783, were passed over in silence; and no conclusion was reached touching the naval forces to be maintained conjointly on the northern lakes, which were common to both parties.

Revised by T. S. Woolsey.

**Gherardesca**, *gā-raar-des'kaa*: a noble family of Pisa; prominent in the Ghibelline party. The most noted name is that of Ugolino della Gherardesca, who conspired against his former party with Giovanni Visconti, the chieftain of the Guelphs. Their plans were discovered and Ugolino was imprisoned, but escaped and joined the Florentines, then at war with Pisa. Fear induced his fellow citizens to restore his possessions to him, and on his return in 1276 his liberality in distributing gifts gained him a high position in the city. On the outbreak of the war with Genoa he was made a captain of the Pisan fleet, and was one of the three admirals to command in the battle of Meloria in 1284, the fatal issue of which was attributed to his treachery or cowardice in setting the example of flight at the critical moment. Yet he was soon afterward intrusted with almost dictatorial powers, which he employed in advancing his selfish interests at the expense of the city's welfare. He seemed to wish neither victory for the Pisans nor an advantageous settlement of their differences with the Guelph cities lest it should strengthen the hands of his enemies. He offended both parties in the city, and was forced for a brief interval to associate his nephew Nino Visconti with him in the government, but regained his power and ruled more tyrannically than before. At last his violence provoked a revolt headed by Ruggiero, the archbishop, whose nephew was one of Ugolino's victims. The Ghibellines invested the Palazzo del Populo, which after a desperate defense Ugolino was forced to surrender July, 1288. With his two sons and two grandsons he was imprisoned in the Gualandi Tower, afterward called the Tower of Hunger, and at the instance of the archbishop left to die of starvation. The sufferings of the prisoners and the story of Ugolino form the subject of one of the most pathetic passages in Dante's *Inferno*. In spite of the fate of Ugolino, the family continued to be prominent in Pisan affairs for many years, and in 1329 again held the chief power in the person of Nieri Donoratico Gherardesca. F. M. Colby.

**Gherardi**, *gā-raar'dē*, Bancroft: rear-admiral U. S. navy: b. in Jackson, La., Nov. 10, 1832; entered the navy as a midshipman June 29, 1846; served in the Pacific squadron till 1850; entered the Naval Academy in 1852, and was made passed midshipman that same year; became master and lieutenant in 1855: served on the Lancaster of the Pacific squadron; was made lieutenant-commander in 1862, and commanded the steamers Chocorua and Port Royal (West Gulf blockading squadron) during 1863 and 1864, taking part in the latter vessel in the battle of Mobile Bay. Toward the end of the war he was given command of the Pequot. He was promoted commander in 1866, captain 1874, commodore 1884, and rear-admiral in 1887. He was commandant of the Brooklyn navy-yard 1887–89, and commander-in-chief of the North Atlantic squadron 1889–92. In 1892, as commander of a special squadron of five

vessels, and he visited the Central and South American republics for the purpose of presenting to each an invitation from the President to take part in the international naval parade and review, in honor of Columbus, in New York harbor, Apr. 26–27, 1893. Admiral Gherardi himself was placed in command of the review, and took a prominent part in the subsequent festivities in honor of the foreign naval visitors. He was highly commended by the Secretary of the Navy for his conduct of the affair, and was appointed commandant of the Brooklyn navy-yard. Retired Nov. 10, 1894.

**Gherkin**, gėr'kin [loan-word from Dutch *agurkje*; cf. Germ. *Gurke*, introduced by way of Polish ultim. from Pers.]: a small cucumber or cucumber-like fruit used for pickling. The common form of gherkin is simply a very small and immature cucumber. There are several small varieties of cucumber grown for gherkins. The burr or West Indian gherkin is a distinct species (*Cucumis anguria*), which bears small prickly fruit. This is little grown. L. H. B.

**Ghibellines**, gib'*e*-lėėnz: See GUELPHS.

**Ghiberti**, gėė-bār'tėė, LORENZO: Florentine sculptor; b. at Pelago in 1378. He learned the arts of modeling and fusing metals and of architecture from his stepfather, Bartolo or Bartoluccio di Michele, a distinguished goldsmith, in whose workshop Brunelleschi and Donatello also studied. Starnina is supposed to have taught him painting. In his early years Ghiberti went by the name of Lorenzo di Bartolo, an appellation which gave doubts as to the legitimacy of his birth, and would have prevented his being elected as magistrate, had he not appealed to the Signory and established the fact of his being son of Cione di Ser Bonaccorso, the first husband of Mona Fiore.

In 1400, when the plague was devastating Florence, he went to Rimini in company with a painter of the Giottesque school to decorate some rooms in fresco in the Gattolo, the palace of Carlo Malatesta. No remains of his work there exist. He was recalled to Florence by Bartolo, his stepfather, to take part in the competition for the gates of San Giovanni the Baptistery. The seven most able sculptors of Tuscany were elected to compete; the subject given was Abraham about to sacrifice Isaac. The judges wavered between Brunelleschi and Ghiberti's designs, but the prize fell to Ghiberti, who well merited it, as both Donatello and Brunelleschi generously avowed to the judges that he had surpassed them all. The first pair of doors was completed by Ghiberti after twenty-one years' work. These doors cost 22,000 florins, the metal alone weighing 34,000 lb. This pair of doors is now in the northern doorway of the baptistery; it was finished in 1424. Ghiberti's fame having spread during this time, he had other important works in hand—a *San Giovanni* in bronze for one of the niches in Orsanmichele, two bas-reliefs for the baptistery of the cathedral in Siena, representing stories from the life of St. John, a *St. Matthew* in bronze for the Arte del Cambio in Florence, a reliquary in metal for the bones of the martyrs Protus, Hyacinth, and Nemesius, besides other statues and delicate works in gold and silver of exquisite finish. The second pair of doors for San Giovanni was intrusted to him in 1424 by the priors, with the injunction to surpass himself in this work, having surpassed all others in the former one. These gates, declared by Michaelangelo to be worthy of being the gates of Paradise, are now in the eastern doorway, facing the cathedral; they afforded so much satisfaction to the Signory that besides the price agreed upon they gave Ghiberti a farm near the Abbey of Settimo. While this important work was going on he was intrusted with the designs for the stained glass windows in Santa Maria del Fiore, three of which are in the Tribune. There is also a *Coronation of the Virgin* designed by him in stained glass at Arezzo in the basilica. This evidently was originally intended for Santa Maria del Fiore, but Donatello's composition was chosen in its stead. Ghiberti died in Florence in 1455. Although the register affirms that Lorenzo Ghiberti was buried in Santa Croce, the site of his grave is quite undiscoverable. W. J. STILLMAN.

**Ghika**, gee'kăă: the name of a princely family of the Danubian principalities, over which several Ghikas ruled as hospodars, and in which many of them held very high state offices. In 1657 George Ghika was first appointed by Turkey hospodar of the principalities, and after him eight other members of that family held the same princely office in Moldavia or in Wallachia. Since the beginning of the nineteenth century Alexander, Constantin, Demetrius, and John have been the most celebrated and the most active members of the Ghika family. They took part in all the conspiracies and political measures which finally brought about the fusion of the two principalities of Moldavia and Wallachia into a single state, now called Roumania, and they hold a large influence in that country. John Ghika died Apr., 1881.

**Ghilan**, gėė-laan', or **Gilan**: province of Persia; on the northwestern slope of the Elbruz and along the Caspian Sea. The coast is swampy and bordered by sandbanks and lagoons, but where the ground rises large fields of rice and sugar-canes appear, the former being raised in such abundance as to be used as food for horses. With the hills begin the forests—fruit-trees, especially figs and mulberries, of a most luxuriant growth and intertwined by vines to the very top. After the forests follow the pastures, and over the whole rise the naked snow-clad peaks of the Elbruz. The climate is marked by a heavy rainfall which, with the fertility of the soil, gives great luxuriance to the vegetation. Area about 5,000 sq. miles. Pop. estimated at 200,000, of mixed race, but chiefly Iranian. Ghilan is a part of ancient Hyrcania. Revised by M. W. HARRINGTON.

**Ghirlandajo**, gėėr-laăn-daa'i-*ō*, DOMENICO BIGORDI, or, as some say, CORRADI: a Florentine painter: called GHIRLANDAJO after his father, who derived the name either from the manufacture or the sale of children's garlands—whether in metal or not is doubtful. He was a goldsmith, and under him his distinguished son learned drawing and designing. Domenico was born in Florence, probably in 1449. As a boy he was remarkable for correctness of eye and hand, and used, says Vasari, to catch the likenesses of people as they passed by the shop. The chapels and churches of Florence bear testimony to the originality, freshness, and delicacy, as well as to the exuberance, of his genius. The accuracy of his portraits, the freshness of his nature, the liveliness of his grouping, the unconventional ease of his treatment, attracted attention from the beginning. He painted men and women in the costumes of their time, discarded tinsel ornaments, gilded scrollwork, and plaster borderings, substituting honest brush-work. In his pictures the aërial perspective was so wonderful that he is credited with having been the discoverer of its laws. He painted in oil, but chiefly in fresco, and very much in places exposed to the weather, which explains the ruinous condition of many of his pictures. When about thirty years of age he was invited by Pope Sixtus IV. to Rome to assist in decorating his chapel. Of his two pictures there, but one, *Christ calling Peter and Andrew from their Nets*, is preserved. Ghirlandajo painted in Pisa, Lucca, and Siena, but his best work is seen in Florence, especially in the Tassetti chapel, in the Church of the Trinità, and in the choir of the Santa Maria Novella. In the first series portraits are introduced of Lorenzo de' Medici and other eminent Florentines, and in the last series, in the portion illustrating the life of the Virgin, is the celebrated portrait of Ginevra de' Renci, a young beauty of Florence. The altar-piece of the Tassetti chapel, in which the artist has introduced his own portrait as a shepherd, is in the gallery of the Academy. Ghirlandajo's influence on Italian art was very great. He was a man of ideas as well as of skill, of great facility and boldness of conception—an innovator and discoverer. Michael Angelo is said to have studied with him as an apprentice for three years when a youth. Ghirlandajo died in Florence, probably in Jan., 1494.

**Ghirlandajo**, RIDOLFO: son of Domenico Ghirlandajo; also an artist of very great talent. He was born in 1483. One of his best works represents St. Zenobius raising a dead boy to life. This extraordinary picture is in the Uffizi at Florence; another, an *Adoration of the Shepherds*, is at Pesth. D. in 1561.

**Ghiustendil'**: See KOSTENDIL.

**Ghizeh**, gee'ze, or **Gizeh** [also written JEEZEH]: town in Egypt; on the left bank of the Nile, just above Cairo. It was formerly a large and splendid town, but now it is mostly in ruins. The principal pyramids are in its immediate neighborhood. See PYRAMIDS.

**Ghiznevides**, giz'ne-vidz: a famous dynasty of Afghan monarchs who reigned at Ghazni (Ghizni or Ghuznee) and at Lahore from 961 A. D. to 1184. At the time of the Sultan Mahmoud (d. 1030) the empire had its widest extent, occupying a great part of Persia, Western Tartary, a part of India, and the intermediate countries. These sultans were zealous orthodox Mohammedans.

**Ghiz'ni**, or **Ghuznee**: See GHAZNI.

**Ghogra**: See GOGRA.

**Ghost** [O. Eng. *gāst*: O. H. Germ. *geist* < Indo-Eur. *ghoizdos* > Sanskr. *héḍa-s*, anger, rage]: the spirit of a human being, or, in a more popular sense, an apparition, or a departed human spirit made visible. Belief in the occasional appearance of ghosts exists in all countries, and has existed in all ages. Among the more recent developments of this belief are the newer phases of the so-called spirit manifestations, studied by Sir W. Crooke and his coadjutors.

Artificial ghosts, such as are seen upon the stage, are easily made by means of glass plates which reflect only a faint outline of the person who personates the ghost. By equally simple means the ghost may be magnified, distorted, decapitated, etc., in many surprising ways.

**Ghost-dance**: the ceremonial of an Indian religious movement, commonly known as the Messiah Religion, which originated in Nevada among the Piutes about 1889. The belief in a redeemer who was to come at some future time to restore his people to their original happy condition was common to all the nations of antiquity, and a similar faith was general among the Indian tribes of North America. More especially since they have felt the pressure of white civilization, and seen themselves deprived of their lands and cut off from their former mode of living, have prophets arisen from time to time among the tribes, who have preached the speedy return of the Indian life and a future happy existence in the old Indian manner, secure from disturbance by the whites. Such a doctrine was preached in Pontiac's time by a Delaware prophet, and by the brother of Tecumtha just before the war of 1812. It was also taught among the Piutes about 1868 by the father of the messiah of the ghost-dance, who has simply revived and elaborated an old Indian doctrine, and given to it a characteristic ceremonial. This messiah, known by the Indians as Wivoka, and better known to the whites as Jack Wilson, evidently is an expert hypnotist, and has acquired great influence among all the wild tribes, some of whom have sent delegates 2,000 miles to listen to his teachings. A return of the old Indian life is promised, a reunion with dead friends, and a future happy state apart from the whites. Universal peace is recommended, and the discarding of the war-dance and everything savoring of war, together with the self-mutilation and destruction of property formerly so common among the Indians on funeral occasions. In every respect the new religion is an improvement upon the old, and is an approximation to Christianity.

The dance usually takes place in the night and continues until daylight, and is different from any other Indian dance. Men and women in full Indian costume join hands in a circle, facing inward, and move around from right to left, singing the ghost-songs, which are sometimes songs of the old-time pleasures and occupations—the hunts, the games, and the dances, but never of war—supplications to the father of the Indians, or chants in the form of messages from their friends in the other world. While the dance is in progress certain leaders within the ring devote their attention to those of the dancers who are most affected by the excitement, and by means of hypnotic action reduce them to a state of unconsciousness or trance, during which the subjects are supposed to receive visions of the spirit world and to commune with their departed friends. From this comes the name of ghost or spirit dance. No drum, rattle, or other musical instrument is used in the dance, but gaming sticks and other reminders of the old life are frequently carried by the performers. Much symbolic detail pertains to the ceremonial, and much of the old mythology is interwoven with the new religion, which is held and practiced by nearly all the tribes of the plains and westward almost to the Pacific Ocean. The Sioux outbreak in the winter of 1890–91 was indirectly connected with the ghost-dance, but the disturbance was only local, while the ghost-dance is general.

JAMES MOONEY.

**Ghost-moth**: a European moth (*Hepialus humuli*) of the family *Bombycidæ*, whose destructive larvæ, known as *otters*, bore into hop-vines and the stalks and roots of many plants. The moths are white below and brown above; and hence, as the upper surface is turned toward or away from the spectator in flight, the moth appears and disappears by turns.

**Ghûr, Gaur, or Ghore, Dynasty of**: descendants of an ancient race of Afghan princes, and the second line of Mohammedan rulers in Hindustan. Allah-ad-deen (d. 1160) almost destroyed the power of the Ghiznevides, and his successors conquered the whole country from the Caspian to the Bay of Bengal; but their power was short-lived. The period of their authority is usually given as from 1176 to 1206, after which their power was feeble and hardly more than nominal. They are also called GHÛRI and GOURIDES.

**Gianibelli, or Giambelli**, FEDERIGO: military engineer; b. at Mantua, Italy, about 1530; offered his services to Philip II. of Spain, but finding slight appreciation of his abilities at the Spanish court he went to the Netherlands, where he gave valuable aid in the defense of Antwerp in 1585, destroying by means of explosives the bridge across the Scheldt, built by the Duke of Parma, and causing great carnage among the Spaniards. At the time of the Armada he entered the service of Elizabeth, to whom he rendered effectual aid by directing the fortification of the coast, and by fitting out fire-ships which were sent into the lines of the Spanish fleet. The date of his death, which is thought to have occurred in London, is unknown.

**Giannone**, PIETRO: historian; b. at Ischitella, Italy, May 7, 1676; studied law at Naples, where in 1723 he published a *Civil History of the Kingdom of Naples* (*Storia Civile del Regno di Napoli*), which by its sharp criticism of the holy see brought upon its author the displeasure of the ecclesiastical authorities. Excommunicated and forced to leave Naples, he took refuge in Vienna, where he received a pension from the emperor, Charles VI.; but in 1734 he was deprived of his pension, and again driven into exile. After a similar experience at Venice, where he incurred the suspicions of the government, he lived at Geneva, but a fresh attack on the papal policy in his *Il Triregno*, etc., again exasperated the Church authorities. He was decoyed across the border of Savoy and thrown into prison. Died in the citadel at Turin, Mar. 7, 1748. Many editions of his history have been published. Two volumes of his posthumous works (*Opere postume*) were published at Lausanne in 1760, and an edition of his *Opere inedite* was issued by Mancini at Turin in 1859.

F. M. COLBY.

**Gianni**, jaan'nĕĕ, LAPO: Italian lyric poet of the end of the thirteenth century. He is said to have been a Florentine nôtary, but apart from this there is no record of his life. He was an intimate friend of Dante and Guido Cavalcanti (cf. Dante's sonnet *Guido, vorrei che tu e Lapo ed io*, etc.), and belonged to the so-called school of the *dolce stil nuovo*. We have from him twelve *ballate*, two *canzoni*, and perhaps a sonnet. See G. Tropea, *Rime di Lapo Gianni* (Rome, 1872); A. Bartoli, *Storia della Letteratura italiana*, vol. iv. (Florence, 1881); D. G. Rossetti, *Dante and his Circle* (London, 1874).

L. A. PATON.

**Giannotti**, jăăn-not'tĕĕ, DONATO: Italian writer; b. in Florence, Nov. 27, 1492. Early an ardent upholder of the republican *régime* that had been inaugurated in Florence after the flight of Piero de' Medici before Charles VIII. (1494), he became in 1527 secretary to the Ten. Upon the victory and return of Alessandro de' Medici (1530) he was forced into exile, and little of the remainder of his life was spent in his native city. He seems to have made an attempt to enter the service of the victor, but without success, and only after the assassination of Alessandro (1537) could he return to Florence. He found it unsafe to remain, and about 1538 removed to Venice, where he soon after entered the service of Cardinal Niccolò Ridolfi. In him he found a kind patron so long as Ridolfi lived, and a benefactor when he died. When this event occurred, Giannotti was in Rome, and soon after he attached himself to Cardinal François de Tournon, in whose company he made several journeys to France. In 1563 he settled again in Venice, living on the income of the bequest received from Ridolfi. In 1566, however, he was living in Padua, and in 1571 he was invited to Rome by Pius V. as secretary of briefs. He held the office only a short time, and died in Rome in 1573. As a writer he is to be grouped with Machiavelli and Guicciardini, though possessing neither the force of the one nor the clearness and accuracy of the other. His reflections upon the true basis of a republican government will always, however, be extremely interesting. His preoccupation with this question gave his work a certain philosophic character, which makes it worthy of the culminating period of the Italian Renaissance. His earliest treatise, begun in 1526, finished in 1530, was entitled *Della Republica de' Viniziani*. Then came a *Discorso sopra il fermare il governo di Firenze* (1527); *Della Republica Fiorentina* (1531); *Discorso della cose d' Italia* (1535). We have, furthermore, from his pen

two comedies—one entitled *Milesia*, probably written in his younger years; the other, *Il Vecchio Amoroso*, in imitation of the *Mercator* of Plautus, completed in 1536. See the *Opere Politiche e Letterarie di Donato Giannotti*, ed. Polidori, with biography by Vannucci, 2 vols. (Florence, 1850); *Alcune Lettere di Donato Giannotti*, ed. by Milanesi, in *Giorn. Stor. degli Arch. Tosc.*, vii., 155, 222; *Lettere inedite di Donato Giannotti*, ed. by L. A. Ferrai, in *Atti del R. Istituto Veneto*, serie vi., t. iii. L. A. Paton.

**Giant Powder**: See Explosives.

**Giants** [through F. and Lat. from Gr. *γίγας*, *γίγαντος*, giant]: human beings of extraordinary size and strength. The term giant is primarily a mythological one. After Zeus had overthrown his father, Cronus, some of the Titans submitted willingly to him, though most of them declined to submit to his supremacy, but with the help of the Cyclops and Hecatoncheires (Hundred-handers) he subdued the rebellious Titans after a long war, and cast them all down to Tartarus, the abyss beneath the earth. But Gæa, who on two former occasions had conspired successfully against the supreme rulers of the universe (i. e. against Uranus and Cronus), was enraged at this treatment of her children, and determined to head still a third rebellion against the highest god—this time against Zeus. Accordingly, she begat by Tartarus, that most terrible of all monsters, Typhœus, in order through him to avenge herself and her children upon Zeus. But after a mighty struggle Typhœus was finally conquered and crushed beneath Mt. Ætna, where forever afterward he continued to display his restless might as he struggled to free himself from his prison-house. But Gæa, still bent upon unseating Zeus, begat the race of the giants in the hope that they might prevail against the usurper. Some of the ancients claimed that the giants sprang from the drops of blood that fell upon the earth (*Gæa*) from the mutilated body of Uranus. This makes them older than does the version of the myth given above, though in any event they are the children of Gæa. The battle between the giants and the gods, all of whom took an active part in it, raged long and furiously in the plain of Phlegra, in Thessaly, the giants piling Pelion on Ossa, in order thus to take Olympus by storm. But finally the giants were conquered and sent to keep their brethren company in Tartarus. The story of the battle between the gods and the giants was made use of by the artists of Greece in a variety of ways and in all periods of art. In vase-paintings are found not only general combats, but single combats also between individual gods and giants. The battle is a favorite subject on gems, reliefs, and for statues in the round. In the most ancient vase-paintings the giants are represented with human bodies, differing in this respect in no way from the gods, but in later times they were figured as monsters, whose legs are serpents' bodies and end in serpents' heads instead of feet. The myth has been explained in a variety of ways, but the most widely accepted interpretation connects them with volcanic eruptions and earthquakes, which in the mind of the common man were the results of the efforts made by the giants to free themselves from their prison beneath the earth. The giants were also symbolical of thunderstorms and tornadoes. The Norse mythology gives the giants (jotuns, frost-giants, etc.) a very prominent place. The giants are held by some writers to represent the adverse forces of nature—by others, human enemies of foreign race. Thus English folk-lore abounds in traditions and nursery-tales of Cornish and Welsh giants, and Cæsar speaks of the huge stature of the ancient Germans and Gauls. But in authentic history there are accounts of races of men of very large size. The Hebrew Scriptures allude to giants (nephilim) before the Flood; in and about Palestine there were, in Joshua's time, the Rephaim, Anakim, Emim, and Zamzummim, all men of great stature, and the names of Og, two Goliaths, Ishbibenob, and Saph are preserved in the same writings. In comparatively recent times there was a belief that the Patagonians and the men of Guayaquil were giants; and it is unquestionable that the former considerably exceed in stature the average of mankind. Scores of well-authenticated instances could be cited of persons exceeding 7½ feet in height. Several are on record of men measuring 9 or even 9½ feet, but these examples are open to some question. Very tall persons, it is observed, are much less numerous than those who are undersized. As a rule "giants" are comparatively feeble in body and mind, and nearly all are short-lived. There is on record an account of Bishop Berkeley's attempt to produce a giant. He fed an orphan named Magrath on selected articles of food. When Magrath died, aged twenty, his height was 7 feet 8 inches.

Literature.—M. Mayer, *Die Giganten und Titanen in der antiken Sage und Kunst* (Berlin, 1887); Wieseler, the article *Giganten* in the *Halle Encyclopädie*; the articles in Roscher, *Lexicon*, and Baumeister, *Denkmäler*; Köpp, *De Gigantomachia* (Bonn, 1883); Stark, *Gigantomachie auf antiken Reliefen* (Heidelberg, 1869); Roscher, *Die Gorgonen und Verwandtes* (Leipzig, 1879, pp. 36, 79, 103); Rinck, *Religion der Autochthonen* (i., 70 f.); Schwartz, *Prähistorisch-anthropologische studien* (Berlin, 1884, pp. 78, 96).

Revised by J. R. S. Sterrett.

**Giant's Causeway, The**: a promontory of columnar basalt on the north coast of Ireland. The outpouring of lava in Tertiary times that formed the beds of basalt of the islands of Mull and Staffa (on the latter of which is the celebrated Fingal's Cave), off the Scottish coast, at the same period overwhelmed extensive tracts in what is now the county of Antrim, and the coast for some miles E. of Portrush is formed of dark volcanic rocks, which by their unequal decomposition give rise to a line of cliffs from 400 to 500 feet in height, remarkable for their boldness and wild picturesqueness. The transition from the snow-white chalk rocks which it overlies to the almost black basalt gives additional variety and beauty to the scenery around the Causeway. The cliffs consist of thick sheets of basalt, with intervening beds of ocherous clay. The lower layers of basalt are rich in zeolitic and other minerals, and in certain beds the columnar structure is very strongly developed, and in places these are beautifully exposed. The Causeway itself consists of columnar basalt that has been laid bare by the waves, but has itself resisted their action; and here the visitor can make his way for a long distance over an irregular floor formed of perfectly developed polygonal columns, which remarkably illustrate the peculiarities of this kind of rock formation.

**Giaour**, jowr [from Turk. *giaur*, infidel, from Pers. *gāwr*, *gabr*, infidel, fire-worshiper, whence Eng. *Gheber*]: a term applied by Turks and other Mohammedans to Christians and others not of their own faith. Its use is not always intended as a reproach, but very commonly has that character. It resembles the *gentile* of Jewish designation, which likewise may be used in a perfectly innocent sense.

**Giarre**, jaar'rā: a Sicilian town of considerable commerce, in the province of Catania (see map of Italy, ref. 9–G). It is near the seashore, and in its neighborhood, at Carpineta, are some of the largest chestnut-trees known. Pop. 7,819.

**Gibara**: See the Appendix.

**Gibb**, Charles: Canadian horticulturist; b. in Montreal in 1845; graduated at McGill University in 1865. In company with Prof. J. L. Budd, of Iowa, he made a journey in Russia in 1882, for the purpose of discovering fruits adapted to Canada and the cold prairies of the U. S. In 1886 he made a second journey to Russia. He traveled much in the interest of pomology, and in 1889 left his home at Abbotsford, Quebec, for China, Mongolia, and Japan, to study the fruits of those countries, hoping to introduce many of them into Canada and the U. S. He died at Cairo, Egypt, on his homeward voyage, Mar. 8, 1890.

L. H. Bailey.

**Gibbes**, gibz, Robert Wilson, M. D.: scientist and historian; b. at Columbia, S. C., July 8, 1809; graduated at South Carolina College in 1827, where he became assistant professor, and afterward Professor of Chemistry; took his medical degree in Philadelphia; became distinguished as a paleontologist, ornithologist, ichthyologist, and antiquary, as well as a physician; was twice mayor of Columbia, and for some time editor of *The Daily South Carolinian* and *The Weekly Banner*; became in 1861 surgeon-general of South Carolina. In 1865, when Columbia was burned upon its occupation by Sherman, his mansion, with its treasures of art and literature and its valuable cabinets, was destroyed by fire. Author of an excellent *Monograph of the Squalidæ*; one of great value on *Typhoid Pneumonia* (1842); *Memoir of James De Veaux* (1845); *Documentary History of South Carolina* (3 vols., 1853); *Sketch of Charles Frazer*; *Memoir on Mososaurus*; *Cuba for Invalids* (1860); and many scientific papers. He was a member of numerous learned societies in Europe and the U. S. D. at Columbia, S. C., Oct. 15, 1866.

**Gibbites**, gib'īts: a fanatical sect which arose in Scotland in the last part of the seventeenth century, and was led by a sailor, John Gibb, whence the nickname. They combined

some of the doctrines of the Quakers with others of the strict Covenanters, and were never numerous. Imprisonment of the Gibbites in jail broke up the movement, and they soon ceased to exist as a separate body.

**Gibbon**, gib′ŭn: a name applied to the tailless monkeys of the East Indies. They belong to the genus *Hylobates*, and constitute with the gorillas, chimpanzees, and orangs, the group called anthropomorphous apes. They are rather small, very long armed, destitute of cheek pouches, and provided with naked callosities upon the buttocks. They are of gentle disposition. They live among the branches of trees, and leap from branch to branch with great freedom. Among the rather numerous species may be mentioned the active

Active gibbon, or oungha.

gibbon (*Hylobates agilis*)—which is particularly remarkable for its power of flinging itself from branch to branch or from one tree to another—the hooluck (*Hylobates huluk*), the lar (*Hylobates lar*), and the white-handed gibbon (*Hylobates albimana*).

**Gibbon**, Edward: historian; b. at Putney, England, Apr. 27, 1737. From his father he acquired a considerable fortune. As the health of his mother was very poor, he was early placed under the care of an aunt, to whose devotion and intelligence he was accustomed to attribute a large part of his subsequent success. As early as his twelfth year he became an omnivorous reader, and the list of books he had read before he was sixteen was astonishing. After a few months of school life at Westminster and Esher he was matriculated at Magdalen College, Oxford, "with a stock of information," as he says in his autobiography, "which might have puzzled a doctor, and a degree of ignorance of which a schoolboy might be ashamed." Though he had acquired an extraordinary amount of literary and historical learning, he was not well grounded in those elementary branches which are deemed essential to university studies. He disliked the university and the university disliked him. At the end of fourteen months, which he declares to have been "the most idle and unprofitable" of his life, he was expelled from the university for having abjured the national faith. He now devoted himself anew to studies in literature and history. He visited Switzerland, where he fell under the influence of Voltaire, and became so imbued with current French thought and literature that for a time he seriously meditated the presentation of an important work in the French language. In 1757 he made the acquaintance of the daughter of M. Curchod, the French pastor of Crassier, and no doubt would have married her, but the opposition of his father seemed to him insurmountable. In his autobiography he says: "I soon discovered that my father would not hear of this strange alliance, and that without his consent I was myself destitute and helpless. After a painful struggle I yielded to my fate; I sighed as a lover, I yielded as a son; my wound was insensibly healed by time, absence, and the habits of a new life." He never married. Mademoiselle Curchod subsequently became the wife of Necker, and was the mother of Madame de Staël. It was still six years before a theme worthy of his historic genius revealed itself. During this period he applied himself with the utmost diligence to classical studies. In 1764 he visited Rome, and contemplated the ruins of the ancient city with extraordinary enthusiasm. In describing this visit he says: "It was at Rome on the 15th of October, 1764, as I sat musing amidst the ruins of the Capitol, while the barefooted friars were singing vespers in the temple of Jupiter, that the idea of writing the decline and fall of the city first started to my mind." From this time on the work absorbed his attention, though he published a number of minor works, and even for a short time after 1774 held a seat as a member of Parliament. The first volume was published in 1776, and was immediately recognized as a work of transcendent genius. Other volumes followed at intervals, until the last three were issued from the press in London on his fifty-first birthday, in 1788. The essential greatness of the work has become more and more obvious as time has gone on. Though it is not without striking faults, yet, in view of the difficulties encountered, the vastness of the subjects involved, and the skill with which the details are treated, it is probably entitled to be regarded as the most important product of historical genius. Gibbon's own religious experience made him intolerant on the subject of Christianity, and his *History of the Decline and Fall of Rome* should be read and studied with this fact constantly in mind. Especially objectionable are chapters xv. and xvi. But in every other respect the work may still be regarded as one of the highest importance. Many of the foremost historical scholars of Europe have enriched the volumes with supplementary notes, the most important of which have been embodied in the edition of Dr. William Smith, published in 8 vols. in London and New York. Gibbon died in London, Jan. 16, 1794.

C. K. Adams.

**Gibbon**, John: soldier; b. near Holmesburg, Pa., Apr. 20, 1827; graduated at West Point July, 1847; served in the war with Mexico 1846–47, and with distinction in the civil war, being engaged in the second battle of Bull Run, battle of South Mountain, Antietam, Fredericksburg, Chancellorsville, Gettysburg, and various battles in Grant's Richmond campaign; subsequently commanded the Twenty-fourth Corps, and was constantly engaged in operations about Petersburg against the army of Gen. Lee up to the surrender of the latter in Apr., 1865. For his gallant services he received the successive brevets from major to major-general. After the war he held various posts in the army, and was promoted to brigadier-general July 10, 1885; retired Apr. 20, 1891. D. in Baltimore, Md., Feb. 6, 1896. He published *The Artillerist's Manual* (New York, 1859) and contributed to various magazines.

Revised by C. H. Thurber.

**Gibbons**, Abigail (*Hopper*): philanthropist; b. in Philadelphia, Dec. 7, 1801; daughter of Isaac Tatem and Sarah Hopper; was a teacher in Philadelphia and New York; was married in 1833 to James Sloan Gibbons, of Wilmington, Del., who removed to New York in 1836. In 1845 Mrs. Gibbons was an efficient co-worker with her father in the formation of the Women's Prison Association, and in founding the home for discharged prisoners, since known as the Isaac T. Hopper Home. In 1861 Mrs. Gibbons visited the army hospitals at Washington, and throughout the civil war rendered efficient services in hospital and camp, often at personal risk. The anti-slavery sympathies of her husband and herself were well known, and in the New York riots of 1863 their house was one of the first to be sacked. In 1871 she was actively interested in the establishment of the New York Infant Asylum; in 1873 took an active part in opening the New York diet kitchen, and became president of the association which supports it. D. in New York city, Jan. 10, 1893.

**Gibbons**, Charles: lawyer; fourth son of William Gibbons, a distinguished member of the Philadelphia bar; b. at Wilmington, Mar. 30, 1814; studied law in the office of Charles Chauncey, Philadelphia, and was admitted to practice in 1838; was president of the National Whig Club in 1844; for several years a member of the State Senate, and Speaker of that body in 1847; actively promoted the passage of a law to punish the kidnaping of Negroes, to prevent the use of the State jails for the detention of fugitive slaves, and prohibiting the judges of the State courts and magistrates from issuing writs for the arrest of such fugitives; was chairman of the first Republican State committee; one of the founders of the Union League, the first organization of that kind in the U. S., and the author of its constitution; represented the Government under a special commission during the civil war in the argument of prize

cases in the U. S. courts at Philadelphia. D. in Philadelphia, Aug. 14, 1885.

**Gibbons,** Grinling: wood-carver, statuary and decorative sculptor; b. probably in Rotterdam, Holland, in 1648; went to London after the Great Fire of 1666, and attracted the notice of John Evelyn, through whose influence he sold important carvings to the king, Charles I., and leading persons of the court and city. By Sir Christopher Wren's wish he was employed upon the works at St. Paul's in London, and other London churches. The bishop's throne at Canterbury Cathedral is his work. Several of the princely houses of England—Chatsworth, Petworth, and Burghley—contain specimens of his exquisite work in screens, sideboards, chimney-pieces, ornamental panels with flowers, fruit, birds, carved with a precision and delicacy that entitle them to the rank of works of very fine art. Several important monuments in marble and bronze remain showing his merit as a sculptor. D. in London, Aug. 3, 1720.

**Gibbons,** James: cardinal; b. in Baltimore, Md., July 23, 1834; graduated at St. Charles College, Md., 1857; studied theology in St. Mary's Seminary, Baltimore, Md.; became pastor of St. Bridget's church in that city in 1861; in 1868 was consecrated Vicar Apostolic of North Carolina; became Bishop of Richmond, Va., in 1872, and in 1877 Archbishop of Baltimore, which see, being the oldest in the U. S., is looked on as the chief or primatial among the Roman Catholic dioceses. He was made cardinal June 30, 1886, with the title of Santa Maria in Trastevere. He is well known for his frequent valuable contributions to secular and religious reviews, and for two important works, *The Faith of our Fathers: Our Christian Heritage*, and *The Ambassador of Christ* (1896). The former has had about forty-seven editions (250,000 copies). Cardinal Gibbons is also chancellor of the Catholic University of America.

**Gibbons,** James Sloan: philanthropist; b. in Wilmington, Del., July 1, 1810; married Abigail Hopper, daughter of the philanthropist Isaac Tatem Hopper, 1833; engaged in banking in New York 1835; was prominent in the anti-slavery agitation; became a friend of Garrison, Wendell Phillips, Theodore Parker, Edmund Quincy, Horace Greeley, and other prominent abolitionists; started the movement for preserving the forests which became national and led to Arbor Day; author of *The Banks of New York*; *The Public Debt of the United States*; and of the famous war poem *We are coming, Father Abraham, three hundred thousand more.* D. in New York city, Oct. 16, 1892.

C. H. Thurber.

**Gibbons,** William, M. D.: scientist and philanthropist; b. in Philadelphia, Pa., Aug. 10, 1781; educated by his father and at the University of Pennsylvania, where he graduated 1805; practiced in Wilmington, Del.; president of Delaware Academy of National Sciences, of the Peace Society, of the Delaware Temperance Society, and a member of the society for preventing the kidnaping of Negroes; established and conducted, 1824–28, a religious periodical, *The Berean*, devoted to the principles of the Society of Friends; took a prominent part in the religious controversy which resulted in a separation of the society into Friends and Orthodox Friends 1827; he wrote, under the signature of Vindex, a series of letters entitled *Truth Vindicated*, replying to an attack on the Friends by a Presbyterian clergyman, one of the clearest expositions of Quaker doctrines ever published. D. in Wilmington, Del., July 25, 1845.

C. H. Thurber.

**Gibbs,** Alfred: soldier; b. at Astoria, L. I., Apr. 22, 1823; son of George Gibbs, mineralogist (1776–1833); graduated at West Point, and entered the army as brevet second lieutenant mounted rifles July, 1846; served in the war with Mexico; brevet first lieutenant and captain for gallant conduct in battle. Promoted to be second lieutenant of rifles in 1847 and first lieutenant 1853. From 1848 to 1856 served on the Pacific coast and in Texas; and from 1856 to 1861 frontier duty and against hostile Indians. He was appointed colonel of the 130th New York Volunteers, Sept., 1862, being engaged in operations about and defense of Suffolk, Va., till Aug., 1863, when his regiment was changed to be the First New York Dragoons, and organized by him into a cavalry regiment. During Gen. Grant's Richmond campaign (1864–65) he commanded a cavalry reserve brigade, participating in various actions till Aug., 1864, when he resumed command of his regiment in the Shenandoah campaign. Appointed a brigadier-general of volunteers Oct. 19, 1864, in the final conflict with, and pursuit of, the Confederate army of Northern Virginia, he commanded a brigade of cavalry, being engaged at Dinwiddie Court-house, Five Forks, Sailor's Creek, etc., and present at the surrender of Gen. Lee at Appomattox Court-house. He subsequently commanded a cavalry brigade and division in the department of the Gulf, and was mustered out of the volunteer service Feb., 1866. For gallant conduct during the war he received the various brevets from major to that of major-general U. S. army. Promoted in the army to be major Seventh Cavalry in July, 1866, he served on frontier duty in Kansas. D. at Fort Leavenworth, Kan., Dec. 26, 1868.

**Gibbs,** Josiah Willard, LL. D.: philologist; b. at Salem, Mass., Apr. 30, 1790; graduated at Yale in 1809; was tutor there 1811–15; Professor of Sacred Literature 1824–61; librarian of the college 1824–43. He published several philological works and many learned and valuable papers. Among his works are a Hebrew lexicon 1824; an abridgment of Gesenius's lexicon 1828: *Philological Studies* (New Haven, 1856); *Teutonic Etymology* (1860). D. at New Haven, Conn., Mar. 25, 1861.

**Gibbs,** Wolcott, M. D., LL. D.: chemist; brother of Gen. Alfred Gibbs (*q. v.*); b. in New York city, Feb. 21, 1822; after graduation at Columbia College, 1841, studied chemistry and physics in Giessen and Berlin. Shortly after his return from Germany, Dr. Gibbs was elected Professor of Physics and Chemistry in the College of the City of New York 1849; in 1863 resigned this position, having been elected to fill the Rumford professorship in Harvard University. Dr. Gibbs is the author of many elaborate and valuable chemical researches; as, for example, on the platinum metals, on the ammonia-cobalt bases, on the equivalent of cobalt, on niobic acid, etc. Besides these he has made extensive contributions to analytical chemistry, both organic and inorganic. In the department of physics his contributions have been equally valuable and almost as numerous; among them are his elaborate work on the wave-lengths of light, that on vapor densities, and his methods of avoiding the troublesome effects of temperature and pressure in gas analysis. His memoirs on these subjects, along with those on theoretical chemistry, are scattered among the volumes of *The American Journal of Science and Arts*, of which he has for many years been one of the editors. He is (1893) emeritus professor in Harvard, and resides at Newport, R. I.

**Gibel,** gib'el, or **Prussian Carp** [Germ. *Gibel*, Fr. *gibel*; etym. obscure]: a small European fresh-water fish, the *Cyprinus gibelio.* It is prized for the table, but is not very easy to catch, as it seldom takes the hook.

**Gib'eon** [Heb. *Gibhghon*, liter., built on a hill, deriv. of *gibhgha* (*Gibea*), hill]: town of Palestine; one of the four cities of the Hivites, 5 miles N. W. of Jerusalem; is mentioned in Joshua ix. 3 as obtaining by craft exemption from the destruction which overtook their neighbors, and in several other places in the Old Testament. It was within the territory of Benjamin (Joshua xviii. 25), and was one of the cities given by lot unto the Levites (Joshua xxi. 17). Its site is now occupied by a small village, *El Jîb*, and the surrounding district is well cultivated. Here in later times was the Tabernacle (1 Chr. xvi. 39). Solomon paid it a visit in state at the beginning of his reign, and it was there that he made his momentous choice (1 Kings iii. 4, 5).

Samuel Macauley Jackson.

**Gibraltar,** ji-brăwl'ter: the southernmost promontory of Spain; an insulated rock connected with the mainland only by a low, sandy slip of land between the Bay of Gibraltar on the W. and the Mediterranean on the E. (see map of Spain, ref. 20–D). This rock, together with that of Abyla, now Ceuta, on the African coast, formed the so-called Pillars of Hercules, which by the ancients were considered the western boundary of the earth. The Rock of Gibraltar is 1,400 feet high, almost perpendicular on its southern and eastern sides, and sloping and accessible only on its northern and western sides. It is a mass of limestone, and, like most limestone formations, is honeycombed by caves and caverns, some of which, besides their fantastic form, have an additional interest on account of the palæontological and archæological remains which they contain. St. Michael's Cave is that most frequently visited by strangers. Its entrance is on the western side of the rock, 1,100 feet above the sea; it is 200 feet long and 70 feet high, and is by tortuous passages connected with four other similar halls. On the northwestern slope is situated the town of Gibraltar,

with a population (exclusive of garrison) of 19,000. Wool, grain, and wax are sent from Morocco, wine, oil, and fruit from Spain, to be transshipped at Gibraltar for Great Britain, France, Holland, and Germany. Vessels aggregating 5,000,000 tons burden yearly enter the port; about three-fourths of them are British. Besides the legitimate business, very considerable smuggling is carried on, in spite of the vigilance of the British and the Spanish authorities. In 1704 Gibraltar was taken by the British, and they have retained it since as the key to the Mediterranean, and have fortified it, especially on its western and northern sides, so as to make it impregnable. Gibraltar was named *Gebel al Tarik* (Tarik's Mountain), from Tarik ben Zeyad, a famous Saracen leader who landed there in 711. It remained a Moorish stronghold till 1309, when Ferdinand IV. took it. The Moors held it again 1333–1462, and it was surprised and taken by the English 1704. During the war of the Spanish Succession a British fleet under the command of Sir George Rooke, assisted by a Dutch squadron and a body of troops under Prince George of Hesse-Darmstadt, took possession of the fortress and the rock in the name of the Archduke Charles of Austria, whose candidacy for the throne of Spain was supported by Great Britain. But, though the sovereignty of Charles over the fortress had been proclaimed, Sir George Rooke saw fit to hoist the British flag, and the Government afterward sanctioned his proceedings. It was ceded to Great Britain 1713; besieged again 1727; blockaded and besieged by the French and Spaniards 1779–83, when it made one of the most obstinate and famous defenses recorded in history.

**Gibraltar, Strait of:** the channel connecting the Atlantic with the Mediterranean; 15 miles wide and 900 fathoms deep. It separates Spain from Africa, and extends from Cape Spartel to Cape Ceuta on the African coast, and from Cape Trafalgar to Europa Point on the Spanish coast. The central current of the channel constantly sets from the Atlantic into the Mediterranean, and makes it very difficult for sailing vessels to pass through to the Atlantic unless aided by a brisk east wind. The lower level of water in the Mediterranean is caused by its greater evaporation.

**Gibson**, Edmund, D. D.: bishop and author; b. at Bampton, Westmoreland, England, 1669 (baptized Dec. 19, 1669); proceeded M. A. at Queen's College, Oxford, and was admitted a fellow 1694; became Bishop of Lincoln 1716, of London 1720. Gibson was a man of severe virtue and great learning, but of an intolerant spirit, for he advocated penal laws against the Quakers and caused Meade's edition of the *Restitution* of Servetus to be burned. His edition of the *Saxon Chronicle*, with notes (1692), and the *Codex juris ecclesiastici Anglicani* (1713) are very important. His polemical works, written against Romanism and infidelity, are highly esteemed. He translated Camden's *Britannia*, and wrote also upon archæological and biographical subjects. D. at Bath, Sept. 6, 1748.

**Gibson**, John: sculptor; b. at Gyffyn, near Conway, Wales, July 19, 1790. He was the son of a landscape-gardener; at the age of fourteen was apprenticed to a cabinet-maker, then to a wood-carver. He first studied sculpture under the Messrs. Francis, statuaries of Liverpool. Several gentlemen, attracted by his genius, which was revealed in models and figures, supplied him with money for a two years' residence in Rome. There, in 1817, Canova welcomed him, admitted him without charge to his studio and academy, and procured for him distinguished patronage. His first pieces, *Mars and Venus* and *Hero and Leander*, were executed for the Duke of Devonshire. After Canova's death (in 1822) Gibson studied under Thorwaldsen. He lived in Rome, revisiting England but once in twenty-four years. He modeled the statues of the Queen in Buckingham Palace and in the princes' chamber of the Houses of Parliament. He partially revived the ancient practice of tinting marble statues by adding color to the *Aurora*, the *Venus*, and the statue of the Queen. This novelty in modern work he defended warmly, basing his opinion on the practice of the ancients, saying that whatever the Greeks did was right. It is curious that he had assured himself of the general use of painted sculpture among the ancients at a time when few archæologists admitted it. He was regularly an exhibitor at the Royal Academy in London, was chosen an associate in 1833, and made a member in 1836. He was also a member of the academies of Munich, St. Petersburg, Turin, and St. Luke in Rome. At the Paris Exposition of 1855 Gibson had four pieces—a hunter, a hunter and dog, a wounded Amazon, and *Hylas carried away by Nymphs*, and at the London Exhibition of 1862 he exhibited the *Venus*, the *Pandora*, and a cupid, all colored. D. in Rome, Jan. 27, 1866. Revised by Russell Sturgis.

**Gibson**, John Monro, D. D.: Presbyterian pastor and author; b. in Whithorn, Wigtonshire, Scotland, Apr. 24, 1838; educated at Glasgow, the University of Toronto, Canada, and Knox College, Toronto. He was pastor of Erskine church, Montreal, 1864–74; of the Second Presbyterian church, Chicago, 1874–80; and from 1880, of St. John's Wood Presbyterian church, London, England. In 1891 he was moderator of the Synod of England. In addition to pastoral duties he was six years lecturer on Hebrew and Greek Exegesis in Montreal Theological College, and has also lectured in Mansfield College, Oxford. His published volumes are *The Ages before Moses* (New York and Edinburgh, 1879); *The Foundations* (Chicago, 1880), republished as *Rock versus Sand* (London, 1883, and later editions); *The Mosaic Era* (London and New York, 1881); *Pomegranates from an English Garden* (selected poems from Browning, New York, 1885); *Christianity according to Christ* (1888); the commentary on the Gospel according to Matthew, in the *Expositor's Bible* (1890).

Willis J. Beecher.

**Gibson**, Lieut.-Col. John Morrison, Q. C.: Canadian official; b. in the township of Toronto, Ontario, Jan. 1, 1842; graduated B. A. and LL. B. at University of Toronto. He was examiner in law in his *alma mater* 1871–72; a member of its senate 1873, 1878, and 1883; organized the Hamilton Art School, and was its president for five years. He is a lieutenant-colonel of militia; was a member of the Canadian Wimbledon teams in 1874, 1875, 1879, and the latter year won the Prince of Wales's prize. In 1881 he commanded the Canadian Wimbledon team which defeated the British team in the rifle contest for the Rajah of Kolapore's cup; has been president of the Ontario Rifle Association, and is (1893) president of the Canadian Military Rifle League. He was elected to the Legislature of Ontario in 1879, 1883, 1886, 1889, and 1891; appointed Provincial Secretary in Jan., 1889. Neil Macdonald.

**Gibson**, Randall Lee: U. S. Senator; b. at Spring Hill, Ky., Sept. 10, 1832; graduated at Yale College in 1853, and at the law department of Tulane University in 1855; commanded a company, regiment, brigade, and division in the Confederate army during the civil war; resumed the practice of his profession in New Orleans; president of board of administrators of Tulane University; trustee of the Peabody fund; regent of the Smithsonian Institution; was elected a Democratic Representative to Congress in 1872, 1874, 1876, 1878, and 1880; entered the U. S. Senate 1883; re-elected 1888. D. Dec. 15, 1892. C. H. Thurber.

**Gibson**, Thomas Milner: English politician; b. in Trinidad, West Indies, Sept. 3, 1806; was educated in England, graduating at Cambridge in 1830; and entering politics was returned as Conservative member for Ipswich in 1837, but having become a convert to Liberalism he resigned two years later, and was defeated at the polls when he sought a re-election. He was an early proselyte of the Manchester school and became one of the ablest orators of the anti-corn-law movement. In 1841 he was returned for Manchester, and five years later was appointed vice-president of the Board of Trade, holding that office till 1848. In 1850, as president of the Association for the Repeal of the Taxes on Knowledge, he began a crusade against the newspaper stamp, the excise on paper, and the advertisement duty, and the abolition of these taxes is due mainly to his efforts. In 1857 he lost his seat for Manchester in consequence of his opposition to the Crimean war, but was returned in the same year for Ashton-under-Lyne, and continued to represent that constituency till 1868, when, on suffering a defeat at the polls, he retired from public life. He had in the meanwhile been president of the Board of Trade from 1859 to 1866, administering the office with success. D. on board his yacht at Algiers, Feb. 25, 1884. F. M. Colby.

**Gibson**, William, M. D., LL. D.: surgeon; b. in Baltimore, Md., in 1788. He took his medical degree from the University of Edinburgh; was the pupil and associate of Sir Charles Bell; was at the siege of Corunna 1809, and Waterloo 1815, where he was slightly wounded. In 1819 he succeeded Dr. Physick in the chair of Surgery in Philadelphia, resigning in 1855. Dr. Gibson published *Principles and Practice of Surgery* (2 vols., Philadelphia, 1824),

which passed through nine editions; was also the author of several lectures, of *Rambles in Europe* (1839), containing biographical sketches of surgeons, etc. He was the first to perform the Cæsarean operation twice on the same patient, successful to both mother and children. D. in Savannah, Ga., Mar. 2, 1868.

**Gibson**, William Hamilton: artist and author; b. at Sandy Hook, Conn., Oct. 5, 1850. From 1870 he resided in Brooklyn, N. Y. His paintings and drawings are mainly in the field of landscape, natural history, and out-door life, and many of them were prepared as illustrations of his books, such as *Camp-life in the Woods* (1876); *Pastoral Days* (New York, 1881); *Highways and Byways* (New York, 1883); *Strolls by Starlight and Sunshine* (New York, 1891); *Sharp Eyes* (New York, 1892). D. at Washington, Conn., July 16, 1896.

**Gibson City**: town; Ford co., Ill. (for location of county, see map of Illinois, ref. 5–F); on the Ill. Central, the Lake E. and W., and the Wabash Railroads; 35 miles E. of Bloomington, and 113 miles S. of Chicago. It is in an agricultural region, and has several churches, public schools, 2 banks, and 1 daily and 2 weekly newspapers. Pop. (1880) 1,260; (1890) 1,803; (1900) 2,054.

**Giddiness**: See Sensation.

**Giddings**, Franklin Henry, A. M.: Professor of Sociology; b. at Sherman, Conn., Mar. 23, 1855; graduated at Union College 1877; spent several years on the Springfield *Daily Union* and Springfield *Republican*; continued in the meantime to contribute economic studies for various publications; Professor of Political Sciences at Bryn Mawr College 1888, and since 1891 lecturer on Sociology at Columbia College; editor of the monographs of the American Economic Association, and for a time associate editor of the *Annals* of the American Academy of Political and Social Science. Author of *Report on Profit-sharing* in seventeenth annual report of Massachusetts Bureau of Statistics of Labor (1886); *The Modern Distributive Process* (written with Prof. J. B. Clark, 1888); and numerous articles on his special subject in *The Quarterly Journal of Economics*, *The Political Science Quarterly*, and other periodicals.

C. H. Thurber.

**Giddings**, Joshua Reed: statesman; b. at Tioga Point, Pa., Oct. 6, 1795. Six weeks after the birth of their child his parents went to Canandaigua, N. Y., and when he was about ten years old they removed to Ashtabula co., O., a part of the Connecticut Western Reserve. His youth was one of severe toil, yet he became a man of great size and strength, as well as of capacious mind and generous and enterprising spirit. After Proctor's retreat the troops with which Giddings served were sent home. His education was acquired from books, mostly borrowed, and read at night by the light of a hickory fire. He taught school, studied law with Elisha Whittlesey, a prominent lawyer, and was admitted to the bar in 1821. In 1826 he went as a representative to the State Legislature; declined re-election in 1827; was defeated in running for State Senator in 1828; devoted himself to his profession, in which he rose to the first rank. In 1839 he was sent to Congress. Though he was not an abolitionist in the strict sense of the term, yet he believed that Congress had no right to protect slavery in the States, that slavery was a great evil, and that it was wrong and unconstitutional to compel the free States or the general Government to return fugitive slaves to their owners. He also believed it was the duty of Congress to prohibit slavery in the District of Columbia and the Territories, and to break up the coastwise slave-trade. During his membership of Congress a large share of his attention was given to the tracing out of the constitutional relations of the Government, the States, and the people to slavery, and the exposition of his views thereupon; but he also took a prominent part in questions of tariff and of appropriations and in other important affairs. He opposed the Florida war on the ground that it was an attempt to recapture fugitive slaves at the expense of the U. S. In 1841 the Creole, a vessel laden with slaves, sailed from Norfolk, Va., for New Orleans. The slaves arose, seized the vessel, and finally found the British port of Nassau, N. P., where they were recognized as free. Mr. Webster, then Secretary of State, having demanded compensation of the British Government, Mr. Giddings introduced into the House resolutions declaring that the slaves upon the Creole were guilty of no crime in taking their freedom upon the high seas, inasmuch as they were outside of the jurisdiction of Virginia, that persons held in slavery cease to be slaves when upon the high seas, and that the demand for the slaves or for compensation for them was not warranted by the U. S. Constitution. For presenting these resolutions (which he temporarily withdrew at the earnest request of many friends) Mr. Giddings received the censure of the House, without being permitted to speak in his own defense. He thereupon resigned, but was at once re-elected without opposition. In his early years in Congress his views were shared by no member except his friend John Quincy Adams. In 1843 he produced the famous *Pacificus* essays upon the slavery question. He zealously opposed the annexation of Texas. In 1844 he successfully opposed the bill to pay for the Amisted Negroes. He strongly favored the Wilmot proviso. Upon the nomination of Gen. Taylor for the presidency in 1848 he left the Whigs and joined the new Free-soil party. He declined to vote for a Whig Speaker of the House in 1847 and 1849, and thus in the latter year caused the choice of a Democratic Speaker. In 1850 he opposed the new compromise, the Fugitive-slave Bill, and the Texas bill. In 1859, after a service of twenty-one years, he closed his congressional career. He was twice assaulted in Congress by armed men, and was once set upon by a mob in Washington. In 1853 he published a volume of speeches; in 1858 the *Exiles of Florida*, an historical sketch of much interest. In 1861 he was appointed consul-general to British North America. He wrote a congressional history of slavery, and in 1864 published *The Rebellion, its Authors and Causes*. D. at Montreal, May 27, 1864.

**Giers**, Nicholas Carlovitch, de: See De Giers, Nicholas Carlovitch.

**Gie'seler**, Johann Karl Ludwig: church historian; b. at Petershagen, Germany, Mar. 3, 1792; studied and taught in the Halle Orphan-house 1803–13; served against Napoleon 1813–15; taught at Halle, Minden, and Cleves 1815–19; became Professor of Theology at Bonn 1819, and at Göttingen 1831. His great work on church history (*Lehrbuch der Kirchengeschichte*) was published in five volumes in 1824–57, the last two volumes being edited by Redepenning. It is one of the most valuable and impartial works of the kind ever produced. The best English translation is that of H. B. Smith (New York, 4 vols., 1856, and 5th vol. in 1880). D. at Göttingen, July 8, 1854.

**Giessen**, gee'sen: town of Germany; capital of the province of Upper Hesse; on the Lahn; 40 miles by rail N. of Frankfort-on-the-Main (see map of Germany, ref. 5–D). It has a university (founded in 1607) and other educational institutions, and manufactures of iron, machinery, beer, and tobacco. Pop. (1895) 22,929.

**Giesshübl-Puchstein**, gees'hüb'l-pook'h'stīn: the source of the Giesshübler waters; near Carlsbad, in Bohemia, Austria. There is a good *Kurhaus* here, but the waters are chiefly bottled and exported. M. W. H.

**Giffard's Injector**: See Steam-engine.

**Gifford**, Robert Swain: landscape-painter; b. on Naushon island, Mass., Dec. 23, 1840. Pupil of Alfred van Bust, Rotterdam, Holland; National Academician 1878; member Society of American Artists (1877); American Water-color Society and British Society of Painter-etchers; medal, Centennial Exposition, Philadelphia, 1876; third-class medal, Paris Exposition, 1889. One of his works which received a prize of $2,000 at the American Art Association (not a professional society) in 1885 is in the Metropolitan Museum, New York. W. A. C.

**Gifford**, Sanford Robinson: landscape-painter; b. at Greenfield, N. Y., July 10, 1823. Pupil of John Rubens Smith and National Academy, New York; graduated at Brown University 1842; National Academician 1854. He traveled and sketched in Europe in 1855–57 and in 1868–69. His work was very highly esteemed in his time, but has greatly lost in popularity since his death. It is not of a very serious character artistically considered, being without much truth to nature and not remarkable for color qualities. One of his principal works, *Ruins of the Parthenon*, is in the Corcoran Gallery, Washington. He was fond of painting glowing pictures of autumn landscape in the U. S. D. in New York, Aug. 29, 1880. W. A. C.

**Gifford**, William: author; b. at Ashburton, Devon, England, in Apr., 1756; went to sea in childhood; was apprenticed to a shoemaker in 1772, and afterward, through the kindness of friends, was sent to Exeter College, Oxford, and received the patronage of Lord Grosvenor. His successful

*Baviad* (1794), directed against the Della Cruscans, was followed by the *Mæviad* (1796) and the severe *Epistle to Peter Pindar*, which called forth an equally caustic reply. In 1797–98 he was editor of *The Anti-Jacobin*, and from 1809 to 1824 editor of *The Quarterly Review*. His translations of Juvenal (1802) and of Persius are spirited and accurate, but his reputation is founded on his work as a critic and reviewer. He was a most bitter enemy of the Whigs, and was distinguished for his hostility to Hunt, Keats, and all the liberal authors of his day. His editions of the old English dramatists are noteworthy. Gifford was of small stature, very ugly in his appearance, but kind, says Southey, to every living thing except authors. The general voice of subsequent criticism has been adverse to his opinions on most questions of literary taste. D. in London, Dec. 31, 1826.

**Gift**: the voluntary transfer of property without consideration. The term is now generally confined to the voluntary transfer of personal property, but it was originally applied in England to the creation of an estate-tail. Any person, who is *sui juris*, has the power to make a gift of any part of his property. Delivery of the property in question, with the intention to transfer the title, is absolutely necessary to the validity of the gift. Words of gift are not sufficient, but there must be an actual and positive change of possession. If anything remains undone to complete the gift it can not be enforced, there being no consideration. It is essential to the validity of a gift that the transaction be fully completed during the donor's lifetime, as an agreement to give, without consideration, passes no title and confers no right. Hence a promissory note intended as a gift by the maker can not be enforced against him, as it is a mere promise to pay in the future. It is held that the delivery by the donor to the donee of a savings-bank deposit-book standing in the name of the donor is a valid gift of the money deposited. Ordinarily it is not in the donor's power to retract a gift once made, but the gift can be set aside where it is the result of fraud, force, or undue influence, or where it is prejudicial to the rights of creditors. And so when a confidential relation exists between donor and donee, as in the case of client and attorney, patient and physician, or parishioner and priest, the gift can be set aside unless it was the free, voluntary, and unbiased act of the donor.

HENRY WADE ROGERS.

**Gigantostraca**, jī-găn-tos'tra-ka [Mod. Lat., from Gr. *γίγας, -αντος*, giant + *ὄστρακον*, shell]: a name given to that group of Arthropoda which includes the horse-shoe crab and the extinct Trilobites and Eurypteroids.

**Gignoux**, *zh*ĕĕn'yoo', FRANÇOIS RÉGIS: landscape-painter; b. at Lyons, France, in 1816; educated at Fribourg; studied art in the Academy of St. Pierre in Lyons; entered later the School of Fine Arts in Paris, and afterward was a pupil of Delaroche, who confirmed his bent toward landscape-painting. In 1840 Gignoux went to the U. S., and entered on an industrious career in New York and Brooklyn. His pictures are sincere studies of nature, chiefly in her more cheerful aspects. His style is unambitious; his subjects commonly unobtrusive, as, for example, *Spring*, *The First Snow*, *The Indian Summer*. He was, however, bold at times, as in the *Niagara in Winter*, *Niagara by Moonlight*, the *Bernese Alps at Sunrise*, and other large canvases. He was chosen the first president of the Brooklyn Art Academy. In 1870 he returned to France. D. at Paris, Aug. 6, 1882.

**Gigoux**, *zh*ĕĕ'goo', JEAN FRANÇOIS: figure and portrait painter; b. at Besançon, France, Jan. 8, 1806. Pupil of the École des Beaux-Arts, Paris; first-class medal, Salon, 1835; officer Legion of Honor 1885; medal of honor, Paris Exposition, 1889. His work is meritorious and sound in method. Three works are in the Luxembourg Gallery, Paris, and two in the Versailles Museum. D. Dec. 10, 1894. W. A. C.

**Gijon**, hĕĕ'hōn': seaport of Spain; in the province of Oviedo, on the Bay of Biscay; 20 miles by rail N. E. of Oviedo (see map of Spain, ref. 11–D). It has manufactures of glass, earthenware, and tobacco, and a large trade in fruit, butter, and cheese. Pop. (1887) 35,170.

**Gila**, hee'la: a river of the U. S.; rises in Socorro co., N. M., and flows first S. W., then S., and finally W., joining the Colorado about 180 miles from its mouth. Its course is entirely within the Territories of New Mexico and Arizona. Its total length is not far from 500 miles. Half of its course is through mountain cañons, but its lower half flows through a series of desert plains. Its waters and those of its tributaries are utilized for irrigation, and the volume reaching the Colorado in summer is very small. Its lower valley abounds in ruins, relics of ancient culture now represented by the Pima and Maricopa Indians, and a few other tribes.

**Gīlakī**: See IRANIAN LANGUAGES.

**Gila Monster**: a popular name in the Southwestern U. S. for a peculiar lizard (*Heloderma suspectum*). See HELODERMA.

**Gilan**: See GHILAN.

**Gilbert**, CHARLES BENAJAH: See the Appendix.

**Gilbert**, CHARLES HENRY, B. S., M. S., Ph. D.: ichthyologist; b. at Rockford, Ill., Dec. 5, 1859; educated at Butler and Indiana Universities; successively Professor of Zoölogy in the University of Cincinnati (1884–88), Indiana University (1888–91), and Leland Stanford Junior University. He is one of the leading authorities on the fishes of North America, has published numerous ichthyological papers between 1880–92, chiefly in the *Proceedings* of the U. S. National Museum, and was joint author with Dr. D. S. Jordan of the well-known *Synopsis of the Fishes of North America* (Washington, 1882). F. A. L.

**Gilbert**, GROVE KARL, M. N. A. S.: geologist; b. at Rochester, N. Y., May 6, 1843; graduated at the University of Rochester in 1862; assistant on Ohio Geological Survey 1869–71; geologist of various national surveys since 1871; chief geologist of U. S. Geological Survey 1889–92. He was president of the American Society of Naturalists in 1885 and 1886, and of the Geological Society of America and the Philosophical Society of Washington in 1892. His more important writings pertain to the geology of the Western U. S., and to the principles of dynamic geology and physical geography. Among them are *Geology of the Henry Mountains* (1877) and *Lake Bonneville* (Monograph I., U. S. Geological Survey, 1890).

**Gilbert**, Sir HUMPHREY: navigator; half-brother to Sir Walter Raleigh; b. at Dartmouth, England, in 1539; educated at Eton and Oxford; was destined for the law, but entered the army; in 1570 suppressed a rebellion in Ireland, where he was made commander-in-chief, governor of Munster, and knighted; served for the next five years as colonel of English forces in the Netherlands; wrote *Discourse of a Discoverie for a New Passage to Cathaia and the East Indies*, which was published without his knowledge by George Gascoigne in 1576; in 1578 received a patent from Queen Elizabeth authorizing him to take possession of any uncolonized lands in North America upon payment to the crown of a fifth of all the gold and silver found. In 1578–79 he sailed for Newfoundland in company with Sir Walter Raleigh, but one of his vessels was lost, and the others returned to England. In 1583 another small squadron was fitted out for him, which reached Newfoundland in August, and Gilbert took possession of the island in the name of the queen. He soon proceeded to explore the coast south, but his largest vessel was wrecked upon Cape Breton; the squadron was dispersed, and Gilbert with two small vessels set sail for England. On the night of Sept. 9, 1583, a gale sprung up, and the frigate Squirrel, with Gilbert and all on board, was lost; of the whole squadron only one vessel, the Golden Hind, reached England. See the *Lives* by Tytler (1833), St. John (1868), and Edwards (1868).

**Gilbert**, Sir JOHN: historical, genre, and portrait painter; b. at Blackheath, Kent, England, in 1817. He began his career as an illustrator and received no art instruction; took up painting in water-color and was elected a member of the British Water-color Society in 1853, and president 1872; painted in oil and was elected Royal Academician 1876; knighted in 1872; third-class medal, Paris Exposition, 1878; Legion of Honor 1878. His pictures are good in color, but his figures are not very well drawn. *Touchstone and Audrey* (1850); *Convocation of Clergy* (1871); *Naseby* (1873); and *Morning of Agincourt* (1884) are some of his best works. He also illustrated the works of Shakspeare, Longfellow, Scott, and others, and contributed for many years to *The Illustrated London News*. D. in Villers-sur-Mer, France, Oct. 5, 1897. WILLIAM A. COFFIN.

**Gilbert**, JOHN GIBBS: actor; b. in Boston, Mass., Feb. 27, 1810; was educated in the public schools. After some experience as an amateur he made his first appearance Nov. 28, 1828, at the old Tremont theater, Boston, as Jaffier in *Venice Preserved*. He was soon after engaged by Caldwell, manager of the New Orleans theater, and played utility parts in the Southwestern theaters. He acted for five years in Boston, one year in New York city, and again five years

in Boston. In 1847 he went to London, playing in the company at the Princess's theater. His first appearance there was as Sir Robert Bramble in *The Poor Gentleman*. After a short visit to Paris he returned in 1848 to the U. S., and appeared under the management of Hamblin at the New York Park theater. After playing for a long period in Philadelphia, in Boston, and again in Philadelphia, he joined the company of Wallack's theater in New York city in 1862, with which he remained until it ceased to exist on the retirement of Lester Wallack in 1888. Gilbert was the last of that school of actors able to portray effectively the fine old English gentleman of other days. Among his most popular personations were Sir Peter Teazle, Sir Anthony Absolute, and Old Dornton. D. in Boston, Mass., June 17, 1889.

B. B. VALLENTINE.

**Gilbert**, Sir JOHN THOMAS: historian; b. in Dublin, Ireland, in 1829; was in 1867 appointed secretary of the public record office of Ireland, an office he held till its abolition in 1875; is chiefly known to the world through his studies of Irish history and archæology. By the publication of his great work, *The National Manuscripts of Ireland*, he gave a strong impulse to the study of the Celtic language. Among his other works are *History of the City of Dublin* (1854–59, 3 vols.); *History of the Viceroys of Ireland* (1865); *History of Affairs in Ireland 1641–52* (1879–81, 6 parts); *History of the Irish Confederation and the War in Ireland 1641–49* (7 vols. quarto, 1882–90). D. in London, May 23, 1898.

**Gilbert**, JOSEPH HENRY, Ph. D., LL. D., F. R. S.: agricultural chemist; b. at Hull, England, Aug. 1, 1817; educated at the University of Glasgow and at University College, London, and later under Liebig at Giessen; devoted special attention to chemistry; in 1843 became associated with Mr. (now Sir) J. B. Lawes, of Rothamsted, in the work of agricultural experimentation. His writings have been published in a large number of papers and in various journals; 1884 he was appointed Professor of Rural Economy in the University of Oxford; reappointed 1887, still retaining his position as director of the Rothamsted laboratory. Mr. Gilbert's work at Rothamsted has given him a wide and permanent fame as an investigator. See LAWES, SIR JOHN BENNET; and AGRICULTURAL EXPERIMENT STATION.

C. H. THURBER.

**Gilbert**, or **Gilberd**, WILLIAM, M. D.: b. at Colchester, England, in 1540; was educated at St. John's, Cambridge, and in 1573 settled in London. He became Queen Elizabeth's physician, and held the same office under James I. Author of *De magnete magneticisque corporibus, et de magno magnete Tellure* (1600) and *De mundo nostro Sublunari Philosophia Nova* (1651), works of surprising accuracy of statement and full of profound thoughts. He stood far in advance of his time as a scientific observer and theorist, and as a recorder of facts relating to electricity. His *De magnete*, etc., anticipates many of the most important discoveries in electricity, and is, in the opinion of many, the first comprehensive treatise on that subject. Whewell, in his *History of the Inductive Sciences*, credits him with having presented "all the fundamental facts of the science." He was the first to use the terms "electric force" and "electric attraction," and to point out that the phenomena of terrestrial magnetism and of electricity were manifestations of the same force. Died at either Colchester or London, Nov. 30, 1603.

**Gilbert**, WILLIAM SCHWENCK: dramatist; b. in London, Nov. 18, 1836; educated in the University of London, and called to the bar of the Inner Temple in 1864, but later on devoted himself entirely to literature, and has become widely known as a dramatic writer. His first play, *Dulcamara*, was produced in 1866. His fairy-comedies—*The Palace of Truth* (1870); *Pygmalion and Galatea* (1871); *The Wicked World* (1873); *Broken Hearts* (1876), etc.—and his farces—*Engaged* (1877); *Ne'er-do-Weel* (1878), etc.—were very popular; and a still greater measure of success was achieved by his comic operas, written in conjunction with Arthur Sullivan: *The Sorcerer* (1877); *H. M. S. Pinafore* (1878); *The Pirates of Penzance* (1880); *Patience* (1881); *Iolanthe* (1882); *Princess Ida* (1883); *The Mikado* (1885); *Ruddigore* (1887); *The Yeoman of the Guard* (1888); *The Gondoliers* (1889); *Utopia* (*Limited*) (1893). Among other plays are *Charity* (1874); *Comedy and Tragedy* (1884); and *Brantinghame Hall* (1888). His *Bab Ballads* originally appeared in *Fun*, but were afterward printed separately.

**Gilbertines**, gil'ber-tinz [from Mod. Lat. *Gilberti'nus*, pertaining to St. Gilbert, deriv. of *Gilbertus*, Gilbert]: an order of monks and nuns founded about 1135 in England by St. Gilbert, priest of Sempringham (1083–1189). The nuns were Benedictines, but in most of their houses there were also monks who were canons regular of St. Augustine. There were also lay brothers, who followed the Cistercian rule. The rules of the order were very strict with regard to the separation of the monks and nuns. The order was extinguished by Henry VIII. It then numbered twenty-five houses.

**Gilbert Islands**, or the **Kingsmill Group**: the southeasternmost group of Micronesia, containing sixteen small inhabited islands of coral formation, situated in the Pacific, between lat. 1° S. and 2° 30′ N. and lon. 172° and 174° 30′ E. Area, 166 sq. miles. The islands are low, and covered only with a thin layer of vegetable mould. Cocoanuts, taro, and pandanus are cultivated. The inhabitants, who number 35,200 and have some resemblance to the Malays, are very barbarous, and some are cannibals. Missions are maintained here by the Congregationalists of Hawaii and the U. S. The group was discovered in 1788, and was taken possession of by Great Britain in 1892.

**Gilchrist**, gil'krist, WILLIAM WALLACE: musician; b. in Jersey City, N. J., Jan. 8, 1846. In 1853 Philadelphia became his permanent place of residence, and there he received all his education. His first success was winning three prizes offered by the Mendelssohn Club of New York for vocal compositions of various styles. The Cincinnati festival of 1882 offered a prize of $1,000 for the best work for solo, chorus, and orchestra. The judges were Theodore Thomas, then of New York, C. Saint-Saëns, of Paris, and Carl Reinecke, of Leipzig. Mr. Gilchrist won the prize with his setting of the Forty-sixth Psalm, and it was performed at the festival. He has also written a ballad for alto solo and chorus, entitled *The Rose* (1886), and a few other works.

D. E. HERVEY.

**Gil'das**, surnamed SAPIENS: the oldest historian of Britain; b. in 516 A. D., but the place of his birth is not known; went to Armorica about 550, and wrote his *History* there about 560; went to Ireland between 566–569, and died there in 570. His *De Excidio Britanniæ Liber Querolus* is diffuse and inflated in style, but of great value. See Stevenson's edition (1838); also *Monumenta Historica Britannica*, by Petrie and Sharpe (1848); and *Council and Ecclesiastical Documents Relative to Great Britain* (Oxford, 1869).

Revised by M. WARREN.

**Gilder**, RICHARD WATSON: poet and editor; b. at Bordentown, N. J., Feb. 8, 1844. From 1864 to 1870 he was connected with various journals in Newark and New York. In 1870 he was made associate editor of *Scribner's Monthly*, of which, under its later name, *The Century Magazine*, he has been chief editor since 1881. His published poems include *The New Day* (1875); *The Poet and his Master* (1878); *The Celestial Passion* (1878); a collective edition, *Lyrics and Other Poems* (1885); *Two Worlds* (1891); *The Great Remembrance and Other Poems* (1893).

**Gildersleeve**, BASIL LANNEAU, LL. D.: classical scholar; b. in Charleston, S. C., Oct. 23, 1831; graduated at Princeton in 1849; received his Ph. D. degree in Göttingen in 1853; Professor of Greek and Latin at the University of Virginia from 1856 to 1876, when he was called to the chair of Greek in the newly founded Johns Hopkins University. Editor of a *Latin Grammar*, of *Persius* (1875), *Justin Martyr* (1877), the *Olympian and Pythian Odes of Pindar* (1885), and author of *Essays and Studies* (1890). He is also the founder and editor of *The American Journal of Philology*, established in 1880.

**Gilding** [pres. partic. of *gild* < M. Eng. *gilden* < O. Eng. *gyldan*, gild < Teuton. **guldan*, deriv. of **guldom*, gold]: the application of a thin layer of gold upon the surface of another substance. There are various methods in use for effecting this. The ancient process, that of applying gold-leaf, is still the best for many kinds of work. Gold-leaf is made to adhere by the use of "gold-size," a tempera priming rendered adherent by an admixture of glue; or by "oil-size," a varnish of linseed oil and ocher, the last chiefly used for work that is exposed to the weather. For gilding book-covers the leaf is made to adhere by heat and pressure (if the cover is of cloth), or by the use of albumen or gelatin for leather-work. Gold is often applied to metals by means of an amalgam, from which the mercury is driven

off by heat after the application, leaving the gold. Whatever method is employed, the gilded surface has to be burnished afterward. Much gilding is done by the electro-plating process (see ELECTRO-PLATING), or even by simple immersion of the article to be gilded in a gold solution. Glass and porcelain are gilded by gold applied like paint, and afterward fixed in the furnace at a comparatively low temperature. For the gilding of particular kinds of goods there are innumerable speeial processes, many of them involving widely different chemical reactions.

**Gil'ead** [from Heb. *Gilghadh*, liter., the hard, stony region]: a district of Palestine, bounded W. by the Jordan, E. by the Arabian desert, N. by the Hieromax (*Yermûk*), and S. by the Arnon (*Mojib*). Northern Gilead extended from the Hieromax to the Jabbok (*Zerka*), about 35 miles; in the time of Moses was under the dominion of Og, King of Bashan, and after its conquest was assigned to the half-tribe of Manasseh. Southern Gilead extended from the Jabbok to the Arnon, about 50 miles; in the time of Moses belonged to Sihon, King of the Amorites, and after its conquest was assigned to the tribes of Reuben and Gad. In this southern portion, which at one time belonged to the Moabites, were Nebo, Pisgah, and Peor. The whole district is wildly mountainous (the greatest elevation being about 4,000 feet above the sea), but exceedingly picturesque, clad with noble forests, and very fertile. The northern part is cultivated and has many settlements, but the southern is practically given up to wandering tribes and is neglected. The streams, unlike most of those W. of the Jordan, are perennial. Revised by S. M. JACKSON.

**Giles**, jīlz, HENRY: clergyman, lecturer, and author; b. in Craanford, Wexford County, Ireland, Nov. 1, 1809; educated in Belfast, at the Royal Academy, in the Roman Catholic faith, but became a Unitarian. As a minister of this sect he preached in Greenock, Scotland, 1835–37, and in Liverpool 1837–40; in the latter city he bore an able part in the controversy between the Unitarians and Episcopalians, in 1839, with Mr. Martineau and Mr. Thom. In 1840 he went to the U. S., where his excellence as a preacher and lecturer made him known in every city as a man of brilliant gifts. He published several volumes of essays, lectures, and discourses, marked by ingenuity of thought, fullness of diction, and fervor of style. Their titles are *Lectures and Essays* (2 vols., Boston, 1845); *Christian Thought on Life* (1850); *Illustrations of Genius* (1854); *Human Life in Shakspeare* (1868). D. near Boston, Mass., July 10, 1882.

**Giles**, WILLIAM BRANCH: statesman; b. in Amelia co., Va., Aug. 12, 1762; was educated at Princeton, N. J.; became a lawyer of Petersburg, Va.; was in Congress 1790–98, 1801–02; in the U. S. Senate 1804–15; Governor of Virginia 1827–30; presidential elector 1801, 1805. Mr. Giles entered public life as a Federalist, but very early left that party and acted mainly with the Jeffersonians. He was, however, often found outside of all party lines. He was one of the best debaters and parliamentarians of his time, and was prominent as a State legislator, and published several severe but effective political letters. D. in Albemarle co., Va., Dec. 4, 1830.

**Gilfillan**, gil-fil'an, GEORGE: clergyman and author; b. at Comrie, Perthshire, Scotland, Jan. 30, 1813; educated in Glasgow University; in 1835 became a minister of the United Presbyterian Church, and after 1836 was settled at Dundee and remained there till his death. Author of *Gallery of Literary Portraits* (Edinburgh, 1845–55, three series); *The Bards of the Bible* (1850); *Martyrs and Heroes of the Scottish Covenant* (1852); *Night*, a poem (1867); an edition of the *British Poets* in forty-eight volumes, etc. D. at Arnhalt, Brechin, Scotland, Aug. 13, 1878.
Revised by S. M. JACKSON.

**Gill**: See WEIGHTS AND MEASURES.

**Gill**, DAVID: astronomer; b. in Aberdeenshire, Scotland, June 12, 1843. He was educated at Marischal College, Aberdeen. His attention was turned to astronomy through his interest in clocks and other instruments. On beginning his astronomical career he became the coadjutor of Lord Lindsay, under whose auspices he went to Mauritius in 1874 to observe the transit of Venus. In 1877 he conducted an expedition to the island of Ascension, in the South Pacific Ocean, to determine the solar parallax by observations of Mars. An interesting account of this expedition was published by his wife under the title *Six Months in Ascension*. In 1881 he was commissioned by the Government as astronomer at the Cape of Good Hope, and director of the observatory which had been established there by the British Government. By his skill, activity, and energy he has made this establishment one of the leading observatories of the world, fitting it out with the best instruments and inaugurating a system of observations of the stars of the southern hemisphere. Among his most important works are his determinations of stellar parallaxes, made in co-operation with William L. Elkin, and of the solar parallax by observations on the asteroids. S. NEWCOMB.

**Gill**, JAMES MARSHALL, D. D.: minister and educator in the Cumberland Presbyterian Church; b. in Davidson co., Tenn., near Nashville, Apr. 1, 1827; graduated at Cumberland University. His work has been mostly done in Kentucky, his residence being Elkton, in that State. He was moderator of the General Assembly in 1876, and represented the Cumberland Church in the meeting of the Presbyterian Alliance in London in 1888. W. J. B.

**Gill**, JOHN, D. D.: rabbinical scholar; b. at Kettering, Northamptonshire, England, Nov. 23, 1697. He was self-edueated, but became proficient in the classics and in Hebrew. He was baptized in 1716, and preached at Higham Ferrers, and occasionally at Kettering. In 1719 he became pastor of a Baptist church in Southwark, from which he was called in 1757 to a Baptist church near London bridge, where he remained until his death. He received his degree from Aberdeen University. His most important works were *Exposition of the Song of Solomon* (1728); *Exposition of the New Testament* (1746–48); *Exposition of the Old Testament* (the two republished as one work, 9 vols., with memoir, 1810); *A Body of Doctrinal Divinity* (1769); *A Body of Practical Divinity* (1770). He was an able controversial writer. D. at Camberwell, Oct. 14, 1771.

**Gill**, THEODORE NICHOLAS, M. A., M. D., Ph. D.: naturalist; b. in the city of New York, Mar. 21, 1837; received a classical education in private schools and under special tutors; in 1863 became a resident of Washington, D. C., and an assistant in the Smithsonian Institution; from 1884 to 1887 Professor of Zoölogy in Columbian University, Washington, D. C.; member of the National Academy of Sciences. His earlier contributions to science were chiefly on fishes, and later on mammals, but in the course of his investigations he has published articles on mollusks, crustaceans, and other departments of natural history, in all amounting to nearly 200 papers. The most noteworthy of these are *Arrangement of the Families of Mollusks* (1871); *Arrangement of the Families of Mammals* (1873); *Arrangement of the Families of Fishes* (1873); *Catalogue of the Fishes of the East Coast of North America* (1875); *Bibliography of the Fishes of the Pacific Coast of the United States to the End of 1879* (1882). Since 1879 he has prepared the reports on zoölogy for the Smithsonian Institution.

**Gil'lem**, ALVAN CULLEM: soldier; b. in Jackson co., Tenn., in 1830; graduated at the U. S. Military Academy July, 1851, and entered the army as brevet second lieutenant of artillery; promoted to be second lieutenant Dec., 1851, first lieutenant 1855, captain and assistant quartermaster 1861, and colonel Twenty-fourth Infantry July, 1866; served in garrison and on frontier duty 1851–61, and in the civil war in defense of Fort Taylor, Fla.; as brigade and chief quartermaster Jan., 1861, to June, 1862, being engaged in the battle of Shiloh and siege of Corinth; appointed colonel Tenth Tennessee Volunteers May, 1862, and was provost-marshal of the city of Nashville Aug.–Dec., 1862; appointed brigadier-general of volunteers Aug., 1863, and participated and commanded in numerous engagements and expeditions in Tennessee. Upon the reorganization of the State government of Tennessee he was vice-president of the convention to revise the constitution and a member of the State Legislature; subsequently was engaged in various expeditions and combats in Tennessee and North Carolina. In Sept., 1866, he was mustered out of the volunteer service. For gallant conduct in the field he received the successive brevets from major to that of major-general U. S. army. In 1867–68 he commanded the district of Mississippi; in 1869 was transferred to the command of the Eleventh Infantry, and in 1870 to that of the First Cavalry. He was conspicuous in the conflict with the Modoc Indians in 1873. D. near Nashville, Tenn., Dec. 2, 1875.

**Gillespie**, gil-les'pēē, WILLIAM MITCHELL, LL. D.: author; b. in New York, 1816; graduated at Columbia College 1834;

studied in Europe; returned in 1845, and was Professor of Civil Engineering in Union College 1845–68; author of *Roads and Railroads* (1845); *Philosophy of Mathematics*, after Comte (1851); a treatise on *Land-surveying* (1855); another on *Leveling, Topography, and the Higher Surveying* (1870). D. in New York, Jan. 1, 1868.

**Gil'let**, Ransom H.: b. in New Lebanon, N. Y., Jan. 27, 1800; removed first to Saratoga co., and in 1819 to St. Lawrence co., N. Y.; studied law with Silas Wright, and became a lawyer of Ogdensburg, where he was postmaster 1830–33; Democratic member of Congress 1833–37; an Indian commissioner 1837–39; register U. S. Treasury 1845–47; solicitor U. S. Treasury 1847–49; assistant U. S. Attorney-General 1855–58; solicitor of the court of claims 1858–61. Author of a *History of the Democratic Party* (New York, 1868); *The Federal Government* (1871); and a *Life of Silas Wright*. D. Oct. 24, 1876.

**Gillett**, jil-let', Ezra Hall, D. D.: author; b. in Colchester, Conn., July 5, 1823; graduated in 1841 at Yale, and in 1844 at Union Theological Seminary, where, also, he spent a fourth year in study; was pastor of a Presbyterian church in Harlem, New York city, 1845–70, and professor in the University of New York from 1870 till his death in Harlem, Sept. 2, 1875. He was an indefatigable student, and contributed largely to the reviews. His principal published works were *Life and Times of John Huss* (2 vols., Boston, 1863–64; 2d ed. 1864); *Life Lessons in the School of Christian Duty* (1864); *History of the Presbyterian Church in the United States* (2 vols., Philadelphia, 1864; revised ed. 1875); *God in Human Thought* (2 vols., New York, 1874); *The Moral System* (1874).

**Gillies**, gil'lēez, John, LL. D.: historian; b. at Brechin, Scotland, Jan. 18, 1747; educated at Glasgow, where he was for some time Greek professor; became historiographer-royal for Scotland in 1793. Author of a *History of Ancient Greece* (2 vols., 1786–1810); *View of the Reign of Frederick II. of Prussia* (1789); *History of the World from Alexander to Augustus* (2 vols., 1807–10); published translations of Aristotle, Lysias, and Isocrates, and was author of several other works. None of these have any value. D. at Clapham, London, Feb. 15, 1836.

**Gilliflower**, jil'li-flow-er [(by analogy with *flower*) < M. Eng. *gyllofer*, from O. Fr. *gilofre, girofle*, clove-tree (whence Fr. *giroflée*, gilliflower), from Gr. καρυόφυλλον, clove-tree; κάρυον, nut + φύλλον, leaf]: a popular name for the cruciferous plants of the genus *Matthiola*, called also by the general name of stock or stock-gilliflower. They are herbaceous or partly shrubby. All the common kinds are European. *Matthiola annua* includes the ten-weeks stocks; *Matthiola Græca*, the Grecian stock; *Matthiola incana*, the purple gilliflowers, Brompton stocks, etc.; and *Matthiola fenestralis*, the large window stocks. The varieties are many, and several species besides the above are recognized. Considerable skill is required in growing fine stocks, which are favorite flowers in cultivation, especially in Great Britain. Formerly, the carnation was known as gilliflower, and it is now sometimes called clove-gilliflower. The name gilliflower was applied to the carnation (still sometimes called clove-gilliflower) because of its clove-like odor, and from the carnation it passed to the stock or stock-gilliflower, because of some resemblance of this plant to the carnation.

Revised by L. H. Bailey.

**Gilliss**, James Melvin: astronomer; b. in Georgetown, D. C., Sept. 6, 1811; midshipman U. S. navy 1827, captain 1862; organized one of the first astronomical observatories in the U. S. at Washington 1838; organized the naval observatory at Washington 1842–45; was put in charge of the national observatory at Washington 1861. Published a volume of the *American Astronomical Observations* (1843) and a *Report of the United States Astronomical Expedition of 1849–52* (2 vols., 1855), besides many scientific papers of importance. He also introduced important improvements in the instruments employed in astronomical work. D. in Washington, Feb. 9, 1865.

**Gillmore**, Gen. Quincy Adams: U. S. military engineer; b. at Black River, Lorain co., O., Feb. 28, 1825; graduated at West Point at the head of the class of 1849. Early in the civil war he was promoted to a captaincy and distinguished himself by the successful bombardment of Fort Pulaski. In June, 1863, he was called to command the department of the South, and in July following the Tenth Army-corps. It was while holding this command that he conducted the famous operations against Charleston, comprising the descent on Morris island, the reduction and capture of Fort Wagner, and the bombardment and practical demolition of Fort Sumter from batteries 2 miles distant. After the war he was assigned to duty in charge of fortifications situated on the Atlantic coast from New York to Florida, and was also intrusted with the improvement of rivers and harbors on the coasts of South Carolina, Georgia, and Florida. For gallant conduct at Morris island, Forts Wagner and Sumter he was breveted brigadier-general and major-general. Among his published works are the *Siege and Reduction of Fort Pulaski*; *A Practical Treatise on Limes, Hydraulic Cements, and Mortars*; *Engineer and Artillery Operations against the Defenses of Charleston in 1863*; *Report on Béton Aggloméré, or Coignet-Béton*; practical treatise on *Roads, Streets, and Pavements*, etc. D. in Brooklyn, N. Y., Apr. 7, 1888.

**Gill-nets**: See Fisheries.

**Gillott**, gil'lŭt, Joseph: manufacturer; b. in Warwickshire, England, Oct. 11, 1799; became a knife-grinder in Sheffield, and began in early life the manufacture of steel-pens at Birmingham in a very small way. But his improvements in steel-pens gradually increased their popularity, and his establishment became by far the largest in the world in that line of manufacture. His acquired wealth was great, and he made a famous collection of paintings. D. in Birmingham, Jan. 6, 1872.

**Gill-over-the-ground**, jil'-. or **Ground-ivy**: a strong-smelling, trailing plant (*Nepeta glechoma*) belonging to the *Labiatæ*; a native of Europe, but naturalized in the U. S. At one time it was used in medicine, chiefly as a domestic remedy for colds, coughs, etc.

**Gillray'**, James: caricaturist; b. at Chelsea, England, in 1757; the son of a Chelsea pensioner; was a goldsmith's apprentice; ran away with a company of strolling actors; studied art at the Royal Academy; became a good engraver, and was distinguished as an unrivaled political caricaturist, in which line he produced some 1,200 copper-plate etchings. His political and social caricatures appeared almost continuously from about 1782 to 1811. His intemperate habits brought on insanity, and he died of delirium tremens in London, June 1, 1815. The political caricatures, which circulated not only throughout Great Britain, but also over the Continent, and exercised a powerful influence, form a most instructive series of illustrations to the latter part of the reign of George III. See his *Life and Times*, by T. Wright (London, 1851; new ed. 1873).

**Gills** [plur. of *gill* < M. Eng. *gylle*, from Dan. *gjælle*, gill; in Lat. *branchiæ*]: the organs of respiration in water-breathing animals. In general a gill may be defined as an expansion of the animal body, permeated by blood-vessels, and with thin walls through which an exchange of oxygen and carbonic dioxide can take place between the water and the blood. As gills are thus physiological rather than morphological differentiations, general statements concerning them can only be made with difficulty. In the invertebrates they may occur on any part of the body, but in the vertebrates they are invariably developed in connection with openings or gill-slits upon the sides of the neck. For the various modifications, see Comparative Anatomy.

J. S. Kingsley.

**Gilman**: city; Iroquois co., Ill. (for location of county, see map of Illinois, ref. 4–G); on the Illinois Central Railroad and the Tol., Peo. and West. Railway; 81 miles S. by W. of Chicago, and 208 miles N. E. of St. Louis. It is in the center of the principal corn region of the State, and has large stock-raising and fruit-growing interests. It has an opera-house, public library, extensive nursery, tile-works, linseed-oil mill, a bank, and a weekly newspaper. Artesian-well water is obtained at depths of from 90 to 200 feet. Pop. (1880) 1,299; (1890) 1,112; (1900) 1,441. Editor of "Star."

**Gilman**, Arthur: educator; b. at Alton, Ill., June 22, 1837; educated in New York, and in 1857 engaged in business there as a banker, but removed in 1862 to Lenox, Mass., where he engaged in literary pursuits and in labors in behalf of education and religious instruction. In 1871 he became editorially connected with the publications of the American Tract Society, Boston, and in 1876 he took charge of the Harvard Annex. Author of *First Steps in English Literature* (1870) and *History of the American People* (1883), and editor of the Story of the Nations Series and of an edition of Chaucer. H. A. B.

**Gilman**, Caroline (*Howard*): author; b. in Boston, Mass., Oct. 8, 1794; the wife of the Rev. Dr. Samuel Gilman (1791–1858). Her poems, *Jephthah's Rash Vow* and *Jairus's Daughter* (1810), attracted much attention. In 1819 she married and removed to Charleston, S. C., and in 1832 began to edit *The Rosebud*, afterward *The Southern Rose*. She was the author of many volumes of prose and verse, including *Recollections of a New England Housekeeper* (1835) and *Recollections of a Southern Matron* (1836). D. at Washington, D. C., Sept. 15, 1888.

**Gilman**, Chandler Robbins, M. D.: b. at Marietta, O., Sept. 6, 1802; received his degree at the University of Pennsylvania, his father having removed to Philadelphia several years before. Dr. Gilman for many years practiced in New York; was appointed in 1840 Professor of Obstetries and Diseases of Women and Children in the College of Physicians and Surgeons, and in 1851 assumed also the chair of Medical Jurisprudence. He wrote *Legends of a Log Cabin* (1835), *Life on the Lakes*, and a number of professional works. D. at Middletown, Conn., Sept. 26, 1865.

**Gilman**, Daniel Coit, LL. D.: educator; b. at Norwich, Conn., July 6, 1831; graduated at Yale in 1852; was superintendent of schools at New Haven, Conn., 1856–60; Professor of Physical and Political Geography at Yale and college librarian 1856–72; superintendent of schools in Connecticut 1863–65; president of the University of California 1872–75; became in 1875 president of Johns Hopkins University; resigned 1901; author of memoir of James Monroe in the American Statesman Series (Boston, 1883), and of numerous reports, addresses, scientific, historical, and educational papers, and editor of the miscellaneous writings of Francis Lieber (1881) and of Joseph P. Thompson, D. D. (1884). Jan. 1, 1896, he was appointed a member of the Venezuela boundary commission.

**Gilman**, Edward Whiting, D. D.: b. in Norwich, Conn., Feb. 11, 1823; graduated at Yale College in 1843; studied theology at Union (1845–47) and Yale (1847–48) Theological Seminaries; was tutor in Yale College 1847–49; entered the Congregational ministry in 1849, and held the pastoral office in Lockport, N. Y., 1849–56; Cambridge, Mass., 1856–58; Bangor, Me., 1859–63; and Stonington, Conn., 1864–71. In 1871 he became secretary of the American Bible Society. He has contributed to *The New Englander* and to other periodicals. Revised by S. M. Jackson.

**Gilman**, John Taylor: Governor of New Hampshire; b. at Exeter, N. H., Dec. 19, 1753; joined the Revolutionary army at Cambridge, Mass., 1776; was prominent in State and national affairs; was in Congress 1782–83; treasurer of New Hampshire 1783–92; Governor 1794–1805 and 1813–16. He was a strong Federalist. D. at Exeter, N. H., Sept. 1, 1828.

**Gilman**, Nicholas: Senator; a brother of John Taylor Gilman (1753–1828); b. at Exeter, N. H., Aug. 3, 1755; served with distinction in the continental army during the Revolutionary war; was sent to Congress from New Hampshire in 1786; was one of the framers of the U. S. Constitution, and was again in Congress 1789–97; and U. S. Senator 1805–14. D. in Philadelphia, May 2, 1814.

**Gilman**, Nicholas Paine: clergyman and writer on economies; b. at Quincy, Ill., Dec. 21, 1849; graduated at Harvard Divinity School 1871; professor in Antioch College 1878–81; became editor of *The Literary World* of Boston in 1888; of *The New World*, Boston, in 1892; secretary of the Association for the Promotion of Profit-sharing; author of *Profit-sharing between Employer and Employee* (1889); *The Laws of Daily Conduct* (1891); *Socialism and the American Spirit* (1892). C. H. T.

**Gilman**, Samuel: clergyman and author; b. at Gloucester, Mass., Feb. 16, 1791; graduated at Harvard in 1811; was a tutor in mathematics there 1817–19; pastor of the Unitarian church, Archdale Street, Charleston, S. C., 1819–58; author of several volumes of miscellaneous literature and many contributions in prose and verse to periodicals. His best-known work is the *Memoirs of a New England Village Choir* (1829); wrote also *Pleasures and Pains of a Student's Life* (1852); *Contributions to American Literature* (1856); a poem on the *History of a Ray of Light*, etc. He also translated the satires of Boileau, and was conspicuous in his efforts to promote the temperance cause during his residence in Charleston, S. C. D. at Kingston, Mass., Feb. 9, 1858.

**Gilmer**, George Rockingham: lawyer; b. in what is now Oglethorpe co., Ga., Apr. 11, 1790; admitted to practice at Lexington, Ga.; was 1813–18 an officer of the Forty-third U. S. Infantry, and served against the Creeks; served in the State Legislature; was Governor of Georgia 1829–31, 1837–39; was in Congress 1821–23, 1827–29, 1833–35; a presidential elector in 1836 and 1840; trustee of Georgia University for thirty years, and in his will left large sums to it. D. at Lexington, Ga., Nov. 15, 1859. Author of an historical work entitled *Georgians* (1855).

**Gilmer**, Jeremy Francis: Confederate general; b. in Guilford co., N. C., Feb. 23, 1818; graduated at the U. S. Military Academy, and entered the army as second lieutenant of engineers July, 1829, and continued in the service of the U. S., in the construction of fortifications, surveys, improvements of rivers, etc., till 1861, being then captain of engineers, when he resigned and espoused the Southern cause, being appointed major of engineers C. S. A. Sept., 1861, and served as chief engineer on the staff of Gen. A. S. Johnston until the death of the latter on the field at Shiloh Apr. 6, 1862; became chief of engineer bureau at Richmond, Va., with the rank of colonel of engineers; remained in this office to the close of the war; was made major-general C. S. A. 1863. D. Dec. 1, 1883.

**Gilmore**, James Roberts: author and editor; b. in Boston, Mass., Sept. 10, 1822; prepared for college but entered the shipping commission business, in which he was so successful that in 1857 he retired. He published several novels portraying Southern life, under the name of *Edmund Kirke*, and in 1862 founded, with others, *The Continental Monthly*. In July, 1864, with Col. Jaquess, he was intrusted with an unofficial mission to the Confederate Government with a view to arrange a peace. For his services at this time he was tendered by Mr. Lincoln the place of minister to Switzerland, but declined the appointment. He engaged in business again in 1873, but finally retired in 1883 and devoted himself to literary pursuits. Author of a number of works, including *Among the Pines* (New York, 1862); *My Southern Friends* (1862); *Down in Tennessee* (1863); *Adrift in Dixie* (1863); *Among the Guerrillas* (1863); *On the Border* (1864); *Patriot Boys* (1864); *Gospel History* (with Dr. Lyman Abbott, 1880); *Life of Garfield* (1880); *The Rear Guard of the Revolution* (1886); *John Sevier as a Commonwealth Builder* (1887); *Advance Guard of Western Civilization* (1888), etc. In the winter of 1888–89 he lectured on the *Early Southwest* before the Lowell Institute of Boston, and in 1890 he gave a course of lectures before the Peabody Institute of Baltimore. C. H. Thurber.

**Gilmore**, Joseph Henry: b. in Boston, Mass., Apr. 29, 1834; graduated at Brown University 1858; studied theology at Newton Seminary, where he was instructor in Hebrew 1861–62; held pastorates of Baptist churches at Fisherville, N. H., and Rochester, N. Y., and became in 1868 Professor of Logic and Literature in Rochester University. He is the author of the hymn *He leadeth me*.

**Gilmore**, Patrick Sarsfield: musical conductor; b. near Dublin, Ireland, Dec. 25, 1829. At an early age he was a member of the Athlone band; went to Boston when eighteen years old; organized Gilmore's band in 1858; served two years in the Union army during the civil war under Gen. Burnside; in 1869 organized the Peace Jubilee in Boston, and in 1872 the World's Jubilee, held in the same city. Soon after he went to New York and organized the famous Twenty-second Regiment band of 100 pieces, with which he gave concerts in the U. S., and in 1882 made a European tour. He also played for several successive summers at Manhattan Beach, Coney Island. His last engagement in New York was at Madison Square Garden, early in the summer of 1892. Among the few works he composed was an anthem, *Columbia*, which he hoped would be accepted as the country's national hymn. D. at St. Louis, Mo., Sept. 24, 1892. D. E. Hervey.

**Gilo'lo**, **Jilo'lo**, or **Halmahe'ra**: an irregular, volcanic island in the Malay Archipelago, among the Moluccas or Spice islands, belonging to the Dutch, and situated on the equator in lon. 128° E. It is separated from Celebes, which it resembles somewhat in shape, by the Molucca Passage, from Ceram by Pitt's Passage, and from New Guinea by the Gilolo Channel. It is mountainous, densely wooded, very fertile, and produces spices and fruits, horses and cattle, gold-dust, and pearls. Edible birds' nests are one of its exports. Its area is estimated at 6,410 sq. miles; its population at 27,000, consisting partly of Malays and partly of an indigenous tribe, the Alfuros.

**Gilpin**, Bernard: "Apostle of the North" of England; b. at Kentmere, Westmoreland, in 1517; a nephew of Tunstall and patronized by Wolsey; educated at Queen's College, Oxford, he was induced to accept the principles of the Reformation by disenssions with Hooper and Peter Martyr; was protected during Mary's reign by Tunstall, and afterward became rector of Houghton-le-Spring, Archdeacon of Durham, and itinerant preacher in the Debatable Land. While he completely succeeded in gaining the hearts of his rough parishioners by his bold sermons, he was twice indicted for his attack on the vices of the clergy—first before the Bishop of Durham and afterward before the Bishop of London. D. at Houghton, Mar. 4, 1583. His *Life* (London, 1628) by Bishop Carleton, a pupil of his, is found in Bates's *Vitæ selectorum aliquot Virorum* (London, 1681), and a translation of it in Wordsworth's *Ecclesiastical Biography*, vol. iii. See also *Life* by W. Gilpin (1753).

**Gilpin**, Henry Dilwood: lawyer; son of Joshua Gilpin, a resident of Philadelphia and author of two volumes of verse; b. in Lancaster, England, Apr. 14, 1801; graduated at the University of Pennsylvania; in 1819 studied law, and began practice in Philadelphia in 1822; became U. S. attorney for Pennsylvania in 1832; solicitor of U. S. Treasury in 1837, and was U. S. Attorney-General 1840–41; edited *Atlantic Souvenir* (7 vols., 1826–32); was president of the Pennsylvania Academy of Fine Arts; published *Reports of Cases in the United States District Court for the Eastern District of Pennsylvania 1828–36* (Philadelphia, 1837); *Opinions of the Attorney-Generals of the United States from the beginning of the Government to 1841* (2 vols., Washington, 1841); edited *The Papers of James Madison* (3 vols., 1840). D. in Philadelphia, Jan. 29, 1860.

**Gil Polo**, Gaspar: See Polo, Gaspar Gil.

**Gilroy'**: city (incorporated 1880); Santa Clara co., Cal. (for location of county, see map of California, ref. 8–C): on the S. Pacific Company's railway system; 30 miles S. E. of San José, the county-seat, 80 miles S. of San Francisco. General agriculture, dairying, fruit-growing, and stock-raising are carried on extensively, and tobacco is being cultivated largely and cured locally by a patent process which makes it compare favorably with the best Havana. The city has a good water-supply, and contains a flour-mill, tobacco and cigar factory, creamery, winery and distillery, a bank, and two newspapers. Pop. (1890) 1,694; (1900) 1,820.

Editor of "Gazette."

**Gilson**, Paul: See the Appendix.

**Gilsonite**: an asphaltic mineral that occurs in veins in the Uintah Mountains in Eastern Utah. It has also been called Uintahite. It is more easily fusible than grahamite or Albertite (*q. v.*). But little is known of the extent of the deposits, and it has scarcely yet assumed commercial importance. It is considered to be a true asphalt, and in many respects resembles the bitumen of the Dead Sea. It is a lustrous, black friable solid with a specific gravity of 1·065 to 1·070. It is a non-conductor of heat and electricity to a remarkable degree. It fuses very much like sealing-wax, taking sharp impressions, and is decomposed at a temperature above 400° F. It is completely soluble in the heavy distillates of Pennsylvania petroleum, in carbon disulphide, and chloroform, but not in the lighter paraffines. Ninty-five per cent. is soluble in benzole, 86·5 per cent. is soluble in ethylic ether, and 9·5 per cent. in absolute alcohol. See Bitumen.

S. F. Peckham.

**Gilthead**: an excellent food-fish (*Sparus aurata*) of the European and African coasts, allied to the American scup.

The gilthead.

The name is also applied to the *Crenilabrus melops*. See Connor.

**Gil Vicente**, zheel'vĕĕ-sen'tā: best of Portuguese dramatists, called "the Portuguese Plautus"; b. probably in Lisbon in 1485; became an actor, and was patronized by John III. Author of forty-two pieces written in several languages, consisting of comedies, tragedies, farces, and Christmas pieces. He was one of the fathers of the modern drama. A good edition of his works is that published at Hamburg in 1834. Died about 1537, probably at Evora.

**Gimbals**, gim'balz [plur. of *gimbal* < M. Eng. *gemel*, from O. Fr. **gemel*, *gemeau*, twin, Mod. Fr. *jumeau* <Lat. *gemel'lus*, twin, dimin. of *ge'minus*, twin]: pairs of brass or copper rings in which are mounted a ship's compasses, chronometers, or barometers. One of the rings turns on a horizontal axis; the second ring, within the first, turns upon an axis at right angles with that of the first. The object is to keep the instrument right side up in spite of the pitching and rolling of the ship. To this end the instrument is weighted heavily. The object is attained in a very satisfactory, though by no means perfect, manner.

**Gin**, or **Geneva** [*gin* is abbrev. of *genever*, older form of *geneva*, or *Geneva* (by analogy with place-name *Geneva*), from Dutch *jenever*, from O. Fr. *genevre*, juniper < Lat. *juni'perus*, whence Eng. *juniper*]: an alcoholic spirit distilled from grain and flavored with the volatile oil of juniper. A principal seat of its manufacture is Schiedam in the Netherlands, which has some 220 gin-distilleries, and hence the liquor sometimes bears the names of Hollands and Schiedam schnapps. One part by measure of barley-malt and two parts of the best rye are usually mashed together for gin, but buckwheat and other grains have a limited use. The mashing (at 165° F.) lasts until the grains are brought to a smooth paste, when, after resting the process two hours, the whole mash is cooled to 80° by adding the spent wash of a former distillation till the worts show 33 by Dicas's hydrometer. Yeast is added, and the grains and worts ferment for two or three days. Grains and all (whole worts) are then put into the still, and the low wines are taken off, which are very weak. These are then redistilled with about a pound of juniper-berries to every 50 gal. of low wines; a little salt and a pugil of hops may be added. The resulting liquor is gin. It commonly stands about 17° below proof, and before it reaches the consumer its proof is still further lowered. Ordinary gin is made by rectifying corn-whisky with a little oil of juniper or oil of turpentine, while coriander, grains of paradise, orange-peel, etc., still further improve or modify the flavor. Gin is also made in Great Britain from a mash of malt, rye, and potatoes, and rectified with oil of turpentine. The oil of juniper or of turpentine present gives gin a diuretic quality which causes it to have a great popular reputation for the cure of diseases of the kidneys. It has also a limited use in regular practice, but is not official in the U. S. or Great Britain. Gin is a very popular stimulant in England. There is no question but that the abuse of gin in supposed kidney disease is a fruitful cause of diseases of the kind it is intended to cure; and the so-called cirrhosis of the liver (gin-drinker's liver), and the consequent ascites or dropsy of the abdomen, are often produced by it.

**Ginckell**, gin'kel, or **Ginkel**, Godart, van: Dutch soldier in the service of William III. of England; b. in Guelderland about 1630. In the revolution of 1688 he showed courage and address in dealing with the Jacobite enemies of the Prince of Orange, and when the latter became king Ginckell proved himself the ablest of his lieutenants in Ireland, where he fought a number of successful battles against the forces of James II. He took Ballymore early in June, 1691, stormed Athlone in the latter part of the same month, and in July attacked Aghrim, held at that time by Saint-Ruth, one of the bravest generals in the service of James. For a time the besieged held their own and Ginckell was twice repulsed with loss, but the death of Saint-Ruth demoralized the defenders, and the British by a vigorous attack carried the town, and, avenging their previous losses by a merciless slaughter, drove out the enemy in confusion. This advantage was promptly followed up by Ginckell, who reduced Galway and besieged Limerick, the last hope of the Jacobites. This city capitulated in October, and Ginckell soon afterward returned to England. Justly regarded as the conqueror of Ireland, he received the formal thanks of the House of Commons, and was rewarded by the king with the titles of Earl of Athlone and Baron of Aghrim. In the war of the Spanish Succession he commanded the Dutch under Marlborough as commander-in-chief, but died at Utrecht

before the war had far advanced or he had added anything to his military reputation, Feb. 10, 1703. F. M. COLBY.

**Ginger** [M. Eng. *ginger*, *gyngevere*, from O. Fr. *gengibre* > Fr. *gingembre* : Ital. *zenzevero* < Lat. *zingiber*, from Gr. *ζιγγίβερις*, viâ Pers. (cf. Mod. Pers. *zenjebīl*) from Sanskr. *cṝngavēra*, ginger, liter., horn-shaped ; *cṝnga*, horn + *vēra*, body]: the prepared rhizome of *Zingiber officinale* (family *Zingiberaceæ*), a plant native to India and Southern China, now extensively cultivated in tropical America and West Africa, as well as in its native lands. The plant has a biennial or perennial, creeping, somewhat tuberous root-stock, which is the part employed. This may be dug when the plant is one year old, and must soon be scalded to prevent sprouting. If it now be at once dried, it constitutes the *black* ginger of commerce, but if it be decorticated also it is called *white* ginger, of which that from Jamaica has the best reputation. Bleaching is sometimes employed to bring the scraped root to the proper whiteness. Calcutta exports the principal part of the ginger of commerce. Canton supplies much preserved ginger-root, which is boiled and then cured with sugar. The West African colonies ship considerable quantities of ginger. Ginger is used as a flavoring for food and medicines, and has valuable stimulant and carminative properties. Good ginger affords 5 per cent. of an oleo-resin (the piperoid of ginger of Beral), which possesses all its active properties, for the residuum is inert. A volatile oil and several resinoids are believed to be combined in the oleo-resin. Ginger in the root (before grinding) is known as race-ginger (*radix*, a root). Ginger generally reaches the consumer in the powdered state, and is liable to very considerable adulteration.

**Gingham** [Germ. *Gingang* : Fr. *guingan* : Ital. *ghingano*, probably from Javanese *gingang*, liter., perishable, fading]: a cotton fabric woven from colored yarn, either plain or in checks or figures. Ginghams were originally made in Asia by hand, but are now made very extensively in Europe and the U. S. by power-machinery. Great Britain is the principal seat of the manufacture.

**Ginkel**: See GINCKELL, GODART VAN.

**Ginkgo-tree′**, gingk′gō-tree′ [*ginkgo* is from Japanese *ginkō*, from Chinese *yin-hing*, silver apricot ; *yin*, silver + *hing*, apricot]: a large tree of China and Japan, the *Ginkgo biloba* (order *Coniferæ*, family *Taxaceæ*), rather common in cultivation in Europe and the U. S. It is very remarkable for having wide flat leaves, a character possessed by very few trees of the order. It is prized for its excellent timber, which resembles that of pine. Leaves of extinct species of this genus are obtained in the Eocene of the U. S. and British America.

**Ginguené**, zhăn′ge-nā′, PIERRE LOUIS : historian of literature and critic ; b. at Rennes, France, Apr. 25, 1748 ; entered the public service at Paris 1778 ; was imprisoned by the Jacobins 1793–94 ; was chosen to the Institute in 1796 ; minister at Turin 1798. Author of poems, reviews, and a great amount of miscellaneous writing ; chiefly remembered for his *Histoire littéraire de l'Italie* (9 vols., 1811–24), a work of high value. D. in Paris, Nov. 11, 1816.

**Ginseng**, jin′seng [from Chinese *jin-tsan*, ginseng, liter., the likeness of a man]: the root of the *Aralia* (*Panax*) *ginseng* of Asia, and of the *Aralia quinquefolia* of the U. S. These two plants resemble each other very much, and are perhaps identical. The root is sometimes exported from the U. S. to China, where it is highly prized as a medicine, though less esteemed than Asiatic ginseng. The prices it formerly brought were very high. It has a pleasant aromatic taste, but its medicinal qualities are not important. Ohio, Minnesota, and West Virginia chiefly export it. In old times the ginseng of Manchuria was considered the most efficacious ; now the ginseng of Korea is preferred. In price it varies from $6 or $12 to $300 or $400 an ounce. The root of the wild plant is preferred. Ginseng is coming into cultivation in the U. S.

**Ginseng Family**: the *Araliaceæ*, a group of trees and shrubs (mostly tropical, rarely herbaceous plants), numbering 375 species, closely related to the *Umbelliferæ*, from which they are separated by their fleshy fruits. The genus *Aralia* includes *Aralia ginseng* of China and *Aralia quinquefolia* of North America, whose roots constitute the ginseng of commerce. Many species of Aralia are ornamental. *Hedera* contains two species, one Australian and the other the common ivy (*Hedera helix*) of the temperate climates of the Old World. CHARLES E. BESSEY.

**Gioberti**, jō-bār′teĕ, VINCENZO : philosopher and statesman ; b. in Turin, Apr. 5, 1801 ; after a boyhood passed in poverty obtained at the age of sixteen a place in the ecclesiastical household of the King of Sardinia. He became an earnest student of the Bible, of ecclesiastical history, and of the Latin and Italian classics. When only eighteen he had already planned a work to be entitled *Della Scelleratezze dei pontifici*, for the purpose of showing that all the misdeeds of the popes had resulted from their temporal power, and all their virtues from their reverence of gospel precepts. In 1823 Gioberti was made doctor of divinity, and two years later he took sacerdotal orders. His dissertations, *De Deo et religione naturali* and *De Christiana religione et theologicis virtutibus*, secured him the chair of Theology in the University of Turin. In 1828 he went into Lombardy, where he made the acquaintance of Manzoni ; and into Central Italy, where he became the friend of Giacomo Leopardi, who predicted great things of the young philosopher. On account of his liberal opinions he was arrested (May 31, 1833), was detained in prison four months, and then sent into banishment. His name was also canceled from the list of doctors of the university on the charge of his being (*like Socrates*) *a corrupter of youth*.

Gioberti went to Paris, where he spent fifteen months entirely in the study of philosophy, then went to Brussels to teach philosophy in a private institution. There he began the publication of his *Teorica del Sopranaturale*, dedicated to the Piedmontese Paolo Pallia, his companion in study, who died in exile, "victim of the cruel severity of an Italian prince." Then followed the publication of the *Introduzione allo studio della Filosofia*, undoubtedly his greatest philosophical work. In 1842 Gioberti was offered the chair of Philosophy in the University of Pisa, but the intrigues of a *Sanfedista* minister of the court of Sardinia rendered his election impossible. In 1843 his most popular work, entitled *Del primato morale e civile degli Italiani*, appeared at Paris. Its object was to magnify the civil and national power of the papacy in Italy, and although the whole idea of the book was utopian, it kindled a zeal for the cause of Italy in many hearts before indifferent, and this enthusiasm hastened the fortunate crisis. The *Primato* was followed by *I Prolegomeni*, a bolder work, in which he was careful to distinguish between the Jesuits and the rest of the clergy, and earnestly insisted that the liberators of Italy should be the Italians themselves. The Jesuits were prompt to attack him, and he defended himself in a work called *Il Gesuita Moderno*, which was the chief instrument in driving out the Jesuits from Piedmont. In 1848 he left Paris for Turin, where he was enthusiastically received. Thence he made a triumphal journey through Lombardy and Tuscany to Rome, and there preached the necessity of a Guelph confederacy of Italian princes, with the pope at their head. The Subalpine Parliament having opened, he was elected president of the chambers, and he and Collegno were afterward named presidents of the new ministry. After the defeat of Custozza (1848) the ministry was obliged to resign, and was succeeded by the Revel cabinet. This again having fallen, Gioberti was recalled, and he selected from among the deputies of the opposition Rattazzi as a colleague. It was this ministry that in the spring of 1849 advised the resumption of hostilities which were to end in the disaster of Novara. After that discomfiture the ministry of Pinelli was formed, and Gioberti was sent to Paris as minister, to secure the good offices of French diplomacy in the negotiations for peace with Austria. He could obtain nothing, but remained there, and wrote at that time his beautiful book *Del Rinnovamento civile d'Italia*, in which he prophesied the greatness of Cavour ; and he prepared his *Protologia*, published after his death, which occurred in Paris, Oct. 26, 1852. His body reposes in the Campo Santo at Turin, where a monument has been erected to him by that city. See the *Opere Inedite* of Gioberti, edited by Massari (11 vols., 1856–63) and the *Vita di Gioberti*, by Massari (1848) ; also Berti, *Gioberti* (1881).
Revised by F. M. COLBY.

**Gioja**, jō′yăă, MELCHIORRE : statistical and philosophical writer ; b. at Piacenza, Italy, Sept. 20, 1767 ; was destined for the Church, but gave up theology for the investigation of social and economic problems. In 1797 he removed from Piacenza to Milan, where he was appointed state historiographer, but lost this position in 1803 on account of a treatise on divorce which was displeasing to the authorities. The liberal ideas that marked the early years of French domination were welcomed with enthusiasm by Gioja, who had

strongly favored the establishment of the Cisalpine republic. During the period of French ascendency he held several official positions, but with the downfall of Napoleon he retired from public life, supporting himself by his writings till his death at Milan in 1829. He placed a high value on the statistical method of study, and his works prove him to have been a man of remarkable learning and industry. Among them are a *New View of the Economic Sciences* (*Nuovo Prospetto delle Scienze economiche*, 6 vols., Milan, 1815–19); a *Treatise on Merits and Rewards* (*Del Merito e delle Recompense*, Milan, 1818–19); and *The Philosophy of Statistics* (*Filosofia della Statistica*, Milan, 1826). F. M. Colby.

**Gioja del Colle**, jō'yăă-del-kol'lā [Ital., jewel of the hill]: a handsome and wealthy commercial town of Italy, in the province of Bari, about halfway between Bari and Taranto (see map of Italy, ref. 6–G). It is believed to have been founded in the sixth century, and in its neighborhood, especially at Monte Sannace and Santa Sophia, ancient vases of great value, as well as Græco-Roman coins, have been found. Pop. 16,573.

**Giordani**, jōr-daa'nĕē, Pietro: prose-writer; b. at Piacenza, Italy, Jan. 1, 1774. He left the Benedictines—an order he had joined in early youth to please his parents—and accepted at first civil employment, and afterward a literary professorship at Bologna. Cardinal Gonsalvi deprived him of his office as secretary of the Academy of Fine Arts on account of his liberal opinions, and he afterward suffered bitter persecution in Florence, in Piacenza, and in Parma, where he died, and where, in spite of the presence of the Austrians, his obsequies were magnificently celebrated. Giordani is regarded as the father of Italian epigraphy, and as the best prose-writer of his day, although he wrote no extensive work, but confined himself rather to inscriptions, eulogies, critical articles, etc. Gussali, in his edition of Giordani's most valuable *Epistolario*, has prefixed to the first volume a full life of the author. It will be a lasting honor to Giordani that he was the first to discover and encourage the wonderful genius of Giacomo Leopardi. D. at Parma, Sept. 1, 1848. His individual collected writings appeared under the title *Opere* (3 vols., Florence, 1851); a complete edition of his works in fourteen volumes was published at Milan (1854–58). See Romani, *Della vita e delle opere di Pietro Giordani* (Mantua, 1868).

**Giordano**, jōr-daa'nō, Luca: artist; nicknamed Fa-Presto (make haste) on account of the rapidity with which he worked; b. at Naples about 1632; studied under Ribera and subsequently under Pietro da Cortona at Rome; became a famous painter, distinguished for the variety of his styles and the surprising amount of his work, which brought him wealth and fame. His works are very numerous, and of unequal merit. They include frescoes (in the Escorial at Madrid and elsewhere) and easel pictures, of which may be named *David with the Head of Goliath* and the *Rape of the Sabines*, at Dresden; the *Slaughter of the Innocents*, at Munich; and *Venus and Mars with the Graces*, in the Louvre. D. at Naples, Jan. 12, 1705.

**Giorgione**, jōr-jō'nā [Ital., liter., big George, deriv. of *Giorgio*, George], properly Giorgio di Barbarelli: painter; b. in the town of Castelfranco, near Treviso, Italy, about 1477. He was a fellow student with Titian in the studio of Bellini, and has long enjoyed the reputation of having developed the art of his companion to such an extent as to be regarded as his master even more than Bellini. This is probably one of the traditions of his day, originated by his having made the designs for the outdoor frescoes which engaged the talent of both at an early period in their lives; but as these works have, with the exception of a small and faded fragment on the Fondaco dei Tedeschi, entirely perished, there is nothing to determine the truth of the conjecture. The authentic works of Giorgione are so few that there has been difficulty in establishing their authentic character; but most of the pictures at first attributed to him have been assigned to other painters. The only one of which there can be no question is the *Enthroned Madonna with SS. Francis and Liberale*, at his native town; but according to C. F. Murray, who is, in identification of the works of the Italian schools, the highest authority now (1894) living, there are eight others which must be accepted, and by whose character all others must be judged. Of these, four are in the National Gallery, London, viz., an *Adoration*, *Enthroned King and Attendants*, a *Nativity*, and the study for one of the saints in the Castelfranco picture. The others are *An Astrologer*, at Vienna, *Figures in a Landscape*, belonging to Signor Giovanelli, a *Nativity*, belonging to Mr. Benson, of London, and a duplicate of this last, belonging to Mr. Beaumont. In addition, the *Concert*, in the Uffizi, is regarded by all the best authorities as most probably genuine. Nothing is known positively of the life of Giorgione except the place of his birth; that he was the illegitimate son of one of the members of the important family Barbarelli by a peasant girl; and that he died of plague at Venice in 1511. The myth of his dying from grief at the loss of his mistress, who deserted him for his pupil Luzzi, need not be taken as history. W. J. Stillman.

**Giottino**, jot-tee'nō, properly Tommaso di Stefano: painter; b. in Florence in 1324. He imitated the manner of Giotto successfully, and was therefore called Giottino. The most noteworthy of his paintings is that of Walter of Brienne, Duke of Athens, whom the Florentines expelled in 1343; this picture was ordered by the chiefs of the insurrection to commemorate the event. He introduced many portraits in this composition. He also painted in Assisi, where his work seems inspired by the same spirit as that of his ancestors. D. in 1356. W. J. S.

**Giotto**, jot'tō (called also Angioletto di Bondone, from his father, or di Vespignano, from his birthplace, which was 14 miles from Florence): Italian painter; b. in 1266. Of the actual details of the life of Giotto little is known, but fortunately of his works many are preserved and so authenticated that one has a clear idea of the powers of probably the greatest genius that was ever devoted to the arts. The story of his having been found by Cimabue drawing sheep on a flat stone has probably no foundation whatever. A commentator of Dante, who was nearly contemporary, says that the boy was sent to a wool-worker to learn his trade, but that, having to pass by the shop of Cimabue, he used to stop and watch the painters at work, and that the father of the boy, learning that he played truant a great deal, was induced to watch him, and finding how he passed his time consented, on the advice of Cimabue, to his adopting the profession of art instead of wool-working. He is much more entitled to the title of the restorer of painting than his master Cimabue, for what he introduced was the renovation of the vital element in art, extinct with the Byzantines for centuries. Cimabue only brightened up religious art, made it more attractive to the eye for color, and gave it an element of decoration more vivid than that which had prevailed before him, but Giotto made it the vehicle of the most powerful dramatic story-telling that painting has ever known; he destroyed the formal rules which had up to his time bound the painter, and though his methods were the same as those of Cimabue, and to a certain extent of Duccio, he threw aside the canons of treatment of the subject which had hitherto compelled the artist to follow certain prescriptions as to the treatment of any story in Scripture. Cimabue only enlivened the Byzantine conception, Giotto set it aside. The works by which he can be best judged are the frescoes in the churches at Assisi, and especially those in the lower church where he displayed his greatest abilities, probably owing to his intensely religious feeling which made him more completely sympathetic with St. Francis than any other painter has ever been. After the work at Assisi, that at the Arena chapel at Padua must be taken as most fully indicative of his imaginative powers. That at Santa Croce in Florence is more injured by the whitewasher and the restorer, perhaps, but is still a splendid example of his powers, fine in composition and in imaginative treatment. Invited to Rome by the pope he executed many works there, and at Boniface's death returned to Florence, afterward accompanying Clement V. to Avignon, returning in 1306. He was architect, sculptor, and painter, and designed the campanile of the Duomo in Florence, directing the work on the lower story, and executing the medallions which ornament it. The tradition that he was condemned for having made a mistake in the construction of the campanile, making its foundations too slight, was probably only posthumous envy, for the foundations have never failed, and the tower was only up to the first story when he died, in 1336, of fever contracted at Milan.
W. J. Stillman.

**Giovanni Bologna**: See Bologna.

**Giovanni da Pisa**, jō-vaa'nĕe-daa-pee'săă, called also G. Pisano: sculptor and architect; b. in Pisa, Italy, in 1240; the son and pupil of Nicolò da Pisa. He constructed the famous Campo Santo at the order of Archbishop Visconti; called to Naples by Charles I. of Anjou, he erected the Castel Nuovo and the Church of Santa Maria Nuova; in Siena the

façade of the cathedral is his work, and in the cathedral of Pisa the great tribune; the most important part of the Prato cathedral was his, as also the convent and the church of the Dominicans in that city; he also executed several works in sculpture, but they are inferior in style to those of his father, Nicolò. D. in 1320. W. J. Stillman.

**Giraffe**, ji-răf', or **Camelopard**, ka-mel'ō-părd [*giraffe* is from Fr. *giraffe*, from Span. *girafa*, from Arab. *zarāfa*, *zurāfa*, giraffe; *camel'opard* is viâ Fr. from Low Lat. *camelopar'dus* (by analogy with *pardus*), from Lat. *camelopar'dalis* = Gr. καμηλοπάρδαλις; κάμηλος, camel + πάρδαλις, pard; because it was fancied to combine the characters of the camel with the spots of the panther or pard]: the *Camelopardalis giraffa*, a ruminant mammal of Africa, whose habitat formerly extended from the Cape of Good Hope almost to Egypt, but has become much more restricted through the colonization of the country and the continued persecutions of travelers and sportsmen. It is the only species of its genus or of the family *Giraffidæ*. The shortness of its body, the length of its legs, the slope of its dorsal line, the excessive length of its neck, the persistent, bony horns covered with skin, and the extensile tongue, are all remarkable characteristics. The giraffe feeds chiefly upon the leaves of trees. It runs with an awkward amble, and is not very swift. The greatest height reported is about 18 feet, so that it is the tallest living animal. It is hunted for its skin, which makes good leather. The flesh of the young giraffe is very palatable. Revised by F. A. Lucas.

Giraffe.

**Giraffe**: a constellation. See Camelopardalis.

**Giral'dus Cambren'sis**, or **Gerald de Barri**: ecclesiastic and author; of Norman descent on his father's side; b. about 1147, at the castle of Manorbeer, near Pembroke, in South Wales. The last seventeen years of his life were spent in studious retirement. He spent about eight years in the University of Paris—four years from 1168 to 1172, and another four years from 1176 to 1180. He was made Archdeacon of Brecknock in 1172. He was a restless, ambitious ecclesiastic, refusing in 1190 the bishopric of Bangor and in 1191 the bishopric of Llandaff in the hope of being made Bishop of St. David's. D. in St. David's, after 1216, perhaps in 1220. He was a witty, brilliant, but egotistical writer. His most famous books, both written in Latin, are the *Topography of Ireland* (1188) and the *Itinerary through Wales* (1191). His complete works, edited by Brewer and Dimock, were published, under the direction of the master of the rolls, in seven volumes (London, 1861–1877).
Revised by S. M. Jackson.

**Girard'**: city; Macoupin co., Ill. (for location of county, see map of Illinois, ref. 7–D); on the Chi. and Alt. Railroad and the Jacksonville S. E. Line; 25 miles S. by W. of Springfield. It is in an agricultural region, and has a coal mine which yields large supplies to the railways. It contains several churches, a bank, and a weekly newspaper. Pop. (1880) 1,024; (1890) 1,524; (1900) 1,661.

**Girard**: city (founded 1868); capital of Crawford co., Kan. (for location of county, see map of Kansas, ref. 7–K); on the Atch., Top. and S. Fé Railroad, the Kan. City, Fort S. and Mem. Railroad, and the St. L. and San Fran. Railway; 126 miles S. of Kansas City, Mo. It is in an agricultural region, with valuable deposits of coal in the vicinity; contains 6 churches, 3 public schools, large court-house, 2 banks; and has 2 zinc-smelters, 3 flour-mills, and foundry and stove-works. Pop. (1890) 2,541; (1900) 2,473.

**Girard**, Jean (*Gregoire*): See the Appendix.

**Girard**, Marc Amable: Canadian senator; b. at Varennes, P. Q., Apr. 25, 1822, and educated at St. Hyacinthe College. He was admitted to the bar of Manitoba in 1871; was treasurer of that province 1870–72; and subsequently held offices of Premier, Provincial Secretary, Minister of Agriculture, and president of the council. He was appointed senior member of the executive council for Northwest Territories in 1872; sat in the Manitoba Assembly for some years, and was called to the senate of Canada in 1871. D. at Winnipeg, Sept. 10, 1892. Neil Macdonald.

**Girard**, Philippe Henri, de: inventor; b. at Lourmarin, France, Feb. 1, 1775; took refuge in Italy during the Revolution, but returned to France after the fall of Robespierre. Napoleon having offered a prize of 1,000,000 francs for the invention of a flax-spinning machine, Girard devoted himself to the task and was declared to have earned the reward. The fall of Napoleon, however, deprived him of the prize, and left him financially embarrassed. In 1815 he went to Austria, where he established a flax-mill at Hirtenberg, and became the pioneer of steam-navigation on the Danube. In 1825 he went to Poland at the invitation of the czar, and there established a flax-mill, around which grew up the village of Girardow. D. in Paris, Aug. 26, 1845.

**Girard**, Stephen: philanthropist; b. near Bordeaux, France, May 24, 1750; became a sailor, and before the Revolution in North America engaged as the master of vessels in the American coasting and West India trade; and during the Revolution was a grocer, sutler, and liquor-seller in and near Philadelphia, where he had already married and separated from his wife. He was again in the West India and coastwise trade in successful partnership with John, his brother, in 1780–90; gained money by receiving valuables from the Haitian planters during the insurrection (1791–1804), for much of this property was never called for, and by leasing property at low rates in Philadelphia when business was dull, and then letting at high rates in times of industrial activity. In 1812 he became a private banker, and was later a director of the second U. S. bank. He was for years by far the wealthiest man in the U. S. He was very eccentric in his habits, a freethinker, ungracious in manner, ill-tempered, and lived and died without a friend; but was always a liberal benefactor of the public charities, and even of churches, which he despised. During several yellow fever seasons in Philadelphia he was active in relieving distress by free expenditure of money and personal care of the sick; and at his death nearly all his estate was bequeathed to various charitable and municipal institutions of Philadelphia and New Orleans, and to the founding of the Girard College for orphan boys. D. in Philadelphia, Dec. 26, 1831.

**Girard College**: an institution in Philadelphia, Pa., founded by the bequest of about $8,000,000, left by Stephen Girard, for the benefit of poor white male orphans, who are admitted between the ages of six and ten, and, according to the will of the founder, are to be apprenticed to some industrial occupation when between the ages of fourteen and eighteen. The buildings are situated 2 miles N. W. of the old State-house, in a fine inclosure of 41 acres. The principal building (169 feet long, 111 feet wide, and 97 feet high, with fine Corinthian columns, each 55 feet high) is by far the best specimen of Greek architecture in the U. S. It is built mainly of white marble, with no inflammable material, as nearly as possible in accordance with the minute directions left by Mr. Girard, according to whose will no minister or ecclesiastic of any sect or Church is allowed to visit the premises on any pretext, or to have any connection with the institution. The construction of the buildings was begun in 1833, and finished in 1848. In 1900 the value of the residuary fund was $15,958,293 and the building accommodated about 2,000 boys.

**Girardeau, Cape**: See Cape Girardeau.

**Girardeau**, John L., D. D., LL. D.: a minister of the Presbyterian Church (South); b. on James island, S. C., Nov. 14, 1825; graduated from the College of Charleston (1844), and from the Columbia Theological Seminary (1848); preached as licentiate in Wappetaw church; pastor of Wilton church 1850–53; labored among the colored people of Charleston 1853–62; chaplain of Twenty-third South Carolina Volunteers 1862 to close of the war; preached in Charleston, mainly to a white congregation, 1865–76; from 1876 Professor of Systematic Theology in the Columbia Theological Seminary. He has published the following works: *A Catechism for the Oral Instruction of the Colored People* (1860); *Instrumental Music in Public Worship* (1888); *Calvinism and Evangelical Arminianism Compared* (1890); *The Will in its Theological Relations* (Columbia, S. C., 1891). Willis J. Beecher.

**Girardet**, zhĕĕ'răăr'dā', Jean: painter; b. at Lunéville, France, in 1709. After learning the beginnings of his art in his native place he spent eight years in Italy. Afterward in the suite of Francis III. he went to Florence and painted in fresco in the gallery there. He became court-painter to Stanislas after a visit to France, and in 1762 painted a room in the palace of Stuttgart in fresco. He left many works in oil and in fresco in Metz, Commercy, Verdun, Lunéville, Nancy. D. at Nancy in 1778.

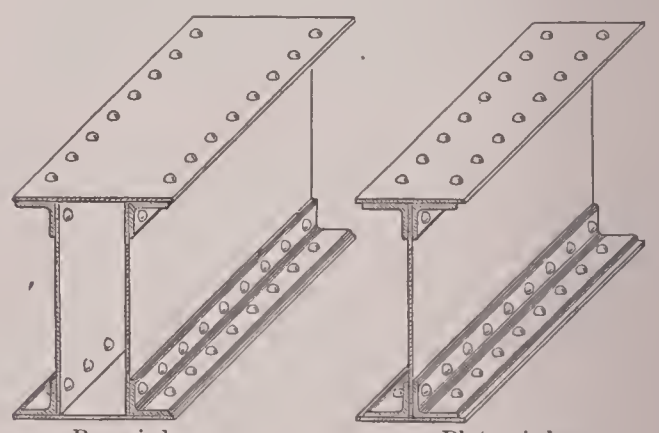
**Girardin**, zhĕĕ'răăr'dăñ', Émile, de: journalist and politician; b. in Paris, France, June 22, 1806; natural son of the Count de Girardin; bore the name of Delamothe until 1827; in 1847 was acknowledged by his father; entered upon journalism in 1828 as conductor of *Le Voleur*, a periodical compiled from other journals, and *La Mode*, a fashion-paper. His *Journal des Connaissances utiles* (1831) and *Journal des Instituteurs* won great success from their exceeding cheapness. He also was very influential in establishing savings-banks and in issuing cheap and good literature and maps for the people. He was concerned also in *Le Musée des Familles*, *Le Journal des Gardes Nationales*, and *Le Gastronome*, a highly successful journal treating of food and cookery. His great distinction, however, was gained as conductor of the *Presse*, a cheap daily, which he edited most of the time from 1836 to 1856. This journal made him one of the great political powers of France. In 1848 he persuaded Louis Philippe to abdicate. Under Napoleon III. he was a vigorous member of the opposition, but in 1870 he was made a senator, although the decree to that effect was never published. He was (1866–70) editor and owner of *La Liberté*, and in 1872 became connected with the *Journal Officiel*. Among his works are many political brochures; *Questions de mon temps* (12 vols., 1858, compiled from his political editorials); *L'homme et la femme* (1872); and *Du droit de punir* (1871). De Girardin was never constant to any political principle except hostility to Great Britain and friendship for Russia. D. in Paris, Apr. 27, 1881.—His first wife, Delphine (b. Jan. 26, 1805; d. June 29, 1855), was a daughter of the novelist Sophie Gay (1776–1852); married M. de Girardin in 1831; was a very talented poet, and author of many clever novels and highly successful plays, besides political essays and effective literary criticisms. Her *Lettres parisiennes*, published in the *Presse* under the pen-name of Vicomte de Launay, produced a deep impression. Her salon was one of the social and political centers of Paris. Her beauty, cleverness, and charming manners contributed much to her husband's success.

**Girardin**, François Auguste Saint-Marc; generally called Marc Girardin: journalist and professor; b. in Paris, France, Feb. 12, 1801. He at first studied law; wrote in 1827 an article in the *Journal des Débats* which made a great sensation, and after that time participated in politics, both as a journalist and as a member of the Legislative Assembly. He was not a politician, however. Very early he turned from the study of law to that of literature and philosophy. In 1822 he received a prize from the Academy for a paper on Lesage, in 1827 another for a paper on Bossuet, and in 1828 a third for his *Tableau de la littérature française au seizième siècle*; in 1844 he became an academician. In 1831 he succeeded Guizot as Professor in History at the Sorbonne, which chair he changed in 1834 for that of French Literature and Poetry; and for more than thirty years he delivered his lectures, often to an audience of 3,000 or 4,000 people. He also took a great interest in all questions concerning education, traveled through Germany to make himself acquainted with its schools, and filled at different times different positions in the Ministry of Public Instruction. His acquirements were enormous. He was thoroughly familiar with all the prominent languages and literatures; in philosophy he was one of the first, and one of the very few Frenchmen who ever understood Hegel; in history nothing was foreign, in science nothing was strange to him. His talent, great by nature and perfect by training, was that of comparative criticism. His principal work is *Cours de littérature dramatique* (1843; 11th ed. 1875–77). In 1869 he retired from his chair at the Sorbonne, but continued as editor of the *Journal des Savants*, and in 1871 was elected a member of the National Assembly. D. in Paris, Apr. 11, 1873. See Tamisier, *Saint-Marc Girardin, Étude littéraire* (1876).

**Girardin**, Jean Pierre Louis: chemist; b. in Paris, France, Nov. 16, 1803; Professor of Chemistry at Rouen 1838–58, and since then in other French towns. Author of numerous handbooks of science for popular use, besides *Leçons de chimie élémentaire* (1835); *Mélanges d'agriculture, etc., et de sciences physiques appliquées* (1852); *Chimie générale et appliquée* (4 vols., 1868, 1869); and other works.

**Girasole**, jir'a-sōl [= Ital., sun-flower, fire-opal, liter., sun-turner; *girare* (< Lat. *gyra're*, whence Eng. *gyrate*), turn + *sole* (< Lat. *sol*, whence Eng. *solar*), sun]: a precious stone of various colors and qualities, but all distinguished by a strong, deep-reflected light. The fire-opal and quartz resinite are among its varieties. Fine specimens bring very high prices. This stone is found in many countries, but good specimens are rare. The same name is given to several other minerals which afford bright tints in a strong sunlight.

**Girder**: a beam or a truss. A simple girder is one supported at its two ends, while a continuous girder is supported at its ends and at one or more intermediate points. Wrought-iron and steel I-beams are extensively used as girders in sizes up to 20 inches in depth and 40 feet in length. Plate girders are made by riveting four angle-irons upon a vertical plate, and then generally adding two narrower cover plates; these are much employed for bridges of from 30 to 100 feet span. A box girder has two web plates which inclose a rectangular space between them; these are less frequently used than plate girders. Solid I-beams and plate girders are extensively employed in the construction of buildings and bridges. For bridges from 100 to 200 feet in length the lattice girder is a favorite form; this consists of angles and cover plates like the plate girder, but the web is made up of diagonal members instead of a solid plate. In Europe lattice girders or trusses are frequently used for long span bridges, while in the U. S. pin-connected trusses are employed, and to these the word girder is not generally applied. In a plate girder the covers and angles constitute the flanges, while in a lattice girder these are generally called the chords. When the girder is supported at its two ends, as is generally the case, the top flange is in compression and the lower flange is in tension, while a solid web is under shearing stress.



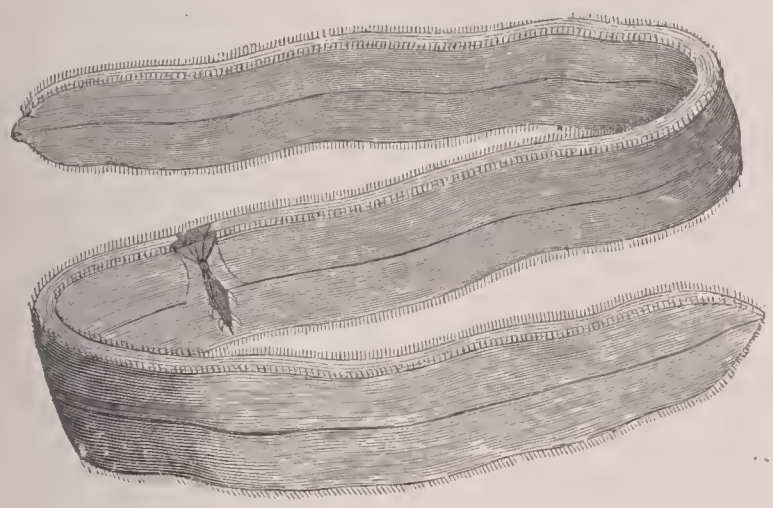
Box girder. Plate girder.

The design of a girder is effected by the application of principles of mechanics, some of which are set forth in the articles Bridges, Flexure, Moment, and Strength of Materials. The cross-section of the flange or chord is determined by dividing the bending moment by the depth of the truss. Thus the deeper the girder the less the material in the chords and the greater the material in the web. The economic depth of a girder is that for which the total amount of material is a minimum, and, in general, this will occur when the flanges weigh about as much as the web. The books mentioned at the end of the articles just referred to treat in general of beams and girders, but on the special topic of plate girders Hiroi's *Plate Girder Construction*

(1888) may be noted. On the theory of continuous girders may be mentioned Merriman's *Continuous Bridges* (1875) and Howe's *Continuous Girder* (1889).

MANSFIELD MERRIMAN.

**Girdle of Venus**: a very aberrant jellyfish (*Cestum veneris*); occurring in the Mediterranean, and belonging to the ctenophores. (See CTENOPHORA.) In its early stages it is



Venus's girdle.

ovoid and resembles its allies, but as it grows larger it elongates at right angles to the major axis of the body, so that when adult it is converted into a ribbon-like organism which may attain a length of 5 feet. D. S. J.

**Gir'geh**, or **Geer'geh** [Coptic, deriv. of *Girgis*, George, the patron saint of the Coptic Church]: an Egyptian town; of Christian origin; on the west bank of the Nile; about 108 miles below Thebes and 12 miles from the ruins of Abydos. It was formerly the capital of Upper Egypt, and a town of fine appearance, with its palm-trees, eight minarets, and Roman Catholic monastery (the oldest in Egypt), standing about a quarter of a mile from the river. The Nile is now rapidly washing it away. Pop. 14,819.

**Girgenti**, jĕĕr-jen'tĕĕ [Ital. < Lat. *Agrigentum* (by analogy of *ager*, field), from Gr. Ἀκράγας, Ἀκράγαντος]: province of Sicily; on the southwestern coast. Area, 1,491 sq. miles. It is mountainous, but extremely fertile, and produces corn, oil, wine, salt, and sulphur in great abundance. Pop. 352,778.

**Girgenti**: town of Sicily; situated near the southern coast in province of Girgenti; 84 miles by rail S. S. E. of Palermo (see map of Italy, ref. 10–E). It was founded 584 B. C. by a Greek colony from Gela, at the foot of an older acropolis called Camicus. Through commerce with Carthage the new colony grew rapidly rich and powerful, though later it suffered greatly from wars with that city. In the days of its greatest prosperity Agrigentum, or (Greek name) Akragas, contained 200,000 inhabitants within its walls, and including suburbs the population is said to have reached 800,000. The government, though sometimes in the hands of a tyrant, was generally free and independent till the time of the Punic wars, when the city became a Roman possession, and soon began to decline. In A. D. 826 it was taken by the Saracens, who held it nearly 300 years; since that time it has shared the changing fortunes of the island. Girgenti stands on a high, steep rock, commanding a glorious view of the Mediterranean, and overlooking rich olive-slopes and luxuriant gardens and vineyards, while conspicuous everywhere rise the vast temples, more or less in ruins, which bear such splendid witness to its former greatness. Among these are the temple of Concord, a beautiful Doric structure, and one of the best preserved of all the ancient temples; the temple of Juno, also in partial preservation; and the temple of Jupiter Olympius, the largest in Sicily, and still imposing in its ruins. Other striking remains of temples, towers, and tombs are seen on every side, and not a few precious objects of art, such as carved gems, have been found in the vicinity. In 1865 water was brought, by an expensive aqueduct, to the highest part of the town; elementary and normal schools have been established; the exports of sulphur, oil, soda, and fruit are considerable; and at its seaport, Porto Empedocle, improvements have been made in the harbor, which, though not good, is the most available on the southern coast of Sicily. Pop. 24,400.

Revised by STILES A. TORRANCE.

**Giron**, *chĕ-rōn'*, FRANCISCO HERNANDEZ: soldier; b. at Caceres in Estremadura, Spain, about 1510. He went to Mexico in 1535; subsequently took a prominent part in the conquest of New Granada, and with Benalcazar joined the viceroy Vasco Nuñez Vela at Quito, 1545; was captured by Gonzalo Pizarro at the battle of Anaquito, Jan. 18, 1546, but was released; and was with Gasca at the final defeat of Pizarro near Cuzco, Apr. 8, 1548. Like many others he was dissatisfied with Gasca's distribution of rewards, and on Nov. 12, 1553, he headed a revolt at Cuzco. At first he was successful, and on May 20, 1554, he defeated the royal army under Alonzo de Alvarado at the river Abancay. The war continued until October, when Giron found himself outnumbered and took to flight. He was captured in the valley of Jauja, taken to Lima, and beheaded Dec. 7, 1554.

HERBERT H. SMITH.

**Gironde**, ji-rond' (Fr. pron., *zhĕĕ'rōnd'*): department of France; situated around the estuary of the Gironde; formed by the confluence of the Garonne and the Dordogne. Its western part is low and flat, consisting of lagoons and sand-dunes planted with pine forests; it is generally called *Les Landes*. The eastern part is hilly and calcareous, and produces the finest claret wines—44,000,000 gal. annually. Area, 3,714 sq. miles. Pop. (1896) 809,902.

**Girondists**, ji-ron'dists [from Fr. *Girondistes*, deriv. of *Gironde*, name of the department of France whence their first leaders came]: the conservative republican party of the French Legislative Assembly from Oct., 1791, to Oct., 1793. When the Assembly was at first organized, the future Girondists, who were cultivated men, full of admiration for the spirit of ancient Grecian liberty and inclined toward the establishment of a republic framed on the model of the U. S., proposed severe measures against the priests and *émigrés*, and opposed the reactionary policy of the court. In Mar., 1792, the king selected four of them for his new ministers, but dismissed them June 13—an act which led to a popular insurrection. On Aug. 11 they were recalled. The party of the Mountain (1792) and the Jacobins (1793) violently opposed them, and the latter (June 2) procured the arrest of thirty-three of their leaders. Throughout the provinces there followed a series of popular uprisings in their favor, but the Convention had the advantage of previous organization and strong leadership, and the armed Girondists everywhere met a fearful overthrow. In October the leaders were arraigned before the revolutionary tribunal, but so strong was their eloquent self-defense, and so conspicuous their patriotism and their innocence, that not even that court could convict them. But by order of the Convention they were sent that very night to the guillotine (Oct. 31, 1793), chanting the *Marseiltaise* while on the way. During the following year great numbers of other real and suspected Girondists perished. The Girondists were looked upon as *doctrinaires*, and were in part victims of the prejudice of the Parisian rabble against educated men; but their greatest offense was their opposition to the mad zeal of the ultra-republicans. See Lamartine, *Histoire des Girondins* (8 vols., Paris, 1847), and Guadet, *Les Girondins* (1889).

**Girouard**, *zhĕĕ'roo'aar'*, DÉSIRÉ, D. C. L.: Canadian legal writer; b. at St. Timothé, P. Q., July 7, 1836; graduated at McGill University. He was admitted to the bar in 1860; one of the founders of the *Revue Critique*; and noted as a commercial lawyer. He was elected to the Dominion Parliament in 1878, 1882, 1887, and 1891; and promoted and carried during the session of 1882 the bill authorizing marriage with a deceased wife's sister. Among his works are *Treatise on Bills of Exchange*, *Laws of Marriage*, *Treaty of Washington*, *The Indirect Alabama Claims*, *Church and State*, and *The Pacific Scandal*. NEIL MACDONALD.

**Girouard**, DÉSIRÉ HOWARD: See the Appendix.

**Girton College**: an educational institution for women at Cambridge, England; incorporated in 1872. The college course occupies three years, half of each year being spent in residence. Instruction is given to a large extent by members of Cambridge University. The organization is essentially similar to that of NEWNHAM COLLEGE (*q. v.*). The college had in 1892 an endowment of about £80,000. The students are admitted to the honors examinations of Cambridge University, and receive certificates stating what examinations they have passed, but do not obtain degrees.

**Gir'van**: a seaport and burgh of Ayrshire, Scotland; at the mouth of the river Girvan; 21 miles S. S. W. of Ayr and 10 miles E. of Ailsa Craig (see map of Scotland, ref.

14–E). Weaving was formerly carried on extensively. The harbor is small. Pop. (1891) 4,081.

**Gisborne**, Francis Newton: Canadian telegrapher; b. at Broughton, Lancashire, England, Mar. 8, 1824. He removed to Canada in 1845; entered the service of the Montreal Telegraph Company in 1847; and from 1849 to 1851 was superintendent of the Nova Scotia Government lines at Halifax. In 1850 he submitted to the authorities of Nova Scotia a scheme for telegraphic communication between Newfoundland and Ireland; and in 1852 laid the first ocean cable on the American side of the Atlantic, connecting Prince Edward island with New Brunswick. He was one of the charter members of the New York, Newfoundland and London Telegraph Company, and in 1856 became the company's chief engineer, and completed the construction of the land line across Newfoundland. He was commissioner for Newfoundland at the International Exhibition in London in 1862; again at the Paris Exhibition in 1867; and was London agent for mines and minerals of Nova Scotia. In 1879 he became superintendent of the Dominion Telegraph Signal Service. D. Aug. 29, 1892. N. M.

**Gisco** (in Gr. **Γίσκων**): the name of three Carthaginian generals: (1) a son of Hamilcar, who, in consequence of the defeat of the Carthaginians by Gelo (*q. v.*) at Himera in 480 B. C., was forced to go to Selinus, where he established himself; (2) a son of Hanno, who distinguished himself in 340 B. C. in the war against Timoleon; (3) the commander of the Carthaginians at Lilybæum (*q. v.*). J. R. S. S.

**Giti'adas** (in Gr. **Γιτιάδας**): a bronze-founder, architect, and poet of Sparta who, according to Hermann, flourished about 536 B. C. He erected the temple and fashioned the statue of Athene Poliouchus (city protector), also called Chalcicœcus (Athene of the brazen house), in Sparta. The walls of the temple were ornamented with bronze reliefs, similar to the marble reliefs now in the Palazzo Spada in Rome, representing the deeds of Hercules, Castor and Pollux, though the most celebrated relief depicted the freeing of Juno from the hidden chains of the golden throne presented to her by Vulcan in revenge for her unmotherly ejection of him from heaven because of his ugliness. He also fashioned bronze tripods ornamented with reliefs for Amyclæ, and for the throne of Apollo at that place a bronze relief representing the chaining of Juno. He composed a hymn in honor of Athene of the Brazen House, as well as a few other poems in the Doric dialect. See Brunn, *Geschichte der Griechischen Künstler*, p. 150; Pauly, *Realencyclopädie*, s. v.; Thiersch, *Epochen der Bildenden Kunst*, p. 150; Sillig, *Catalogus Artificum*; Hirt, in *Amalthea* (i., p. 261); Welcker, *Hyperboreäsch-Römische Studien* (i., p. 262). The *locus classicus* is Paus., iii., 17, 2, which must be compared with Paus., iv., 14, 2. J. R. S. Sterrett.

**Git'schin**: town of Bohemia; 50 miles N. E. of Prague (see map of Austria–Hungary, ref. 3–D); noted for the encounter which took place here (June 29, 1866) between Prince Frederick Charles of Prussia and the Austrian general Clam-Gallas, in which the latter was defeated. Pop. (1890) 8,457.

**Giudici**, joo'dĕĕ-chee, or **Emiliani-Giudici**, *ā*-mee-lĕĕ-aa'nĕĕ-joo'dĕĕ-chĕĕ, Paolo: historian; b. at Mussomeli, in Sicily, June 13, 1812. At the age of sixteen, and against his own will, he entered a Dominican convent, where he devoted himself to the study of design and of literature. These pursuits kindled his patriotism, and, as a first symptom of his love of freedom, he quitted the convent and applied for a chair in the University of Palermo. Not only was this refused, but he was put under surveillance, whereupon he fled from Sicily into Tuscany. There he formed a friendship with the poet Niccolini, and, encouraged by him, began his principal work—*Storia della Letteratura Italiana*, written from a critical and political point of view. About this time he received a handsome legacy from his friend Emiliani—whose name he then took—and was thus enabled to prosecute his studies at leisure. In 1849 he became professor in the University of Pisa; in 1851 he published his *Storia dei Municipii Italiani*, then *Storia delle Belle Arti in Italia*. In 1861 he succeeded Niccolini as secretary to the Academy of Fine Arts in Florence. In 1864 he resigned his professorship, and passed much of his remaining life in England. In 1867 he was elected to the Italian Parliament. D. at Hastings, England, Sept. 8, 1872.

**Giuliani**, joo-lĕĕ-aa'nĕĕ, Giambattista: philologist and commentator on the *Divina Commedia*; b. at Canelli, in Piedmont, June 4, 1818. He entered the religious order of the Somaschi, and between 1837 and 1847 he held various professorships in different schools of learning, occupying himself at the same time with the profound study of Dante. In 1841 he published a much-approved treatise on algebra (*Trattato elementare di algebra*); in 1845 his celebrated *Saggio di un Nuovo Commento della Commedia di Dante Alighieri*; in 1846, before the Scientific Congress of Genoa, he declared that the *Divina Commedia* embodied the earliest and most authentic material for Italian history. In 1847–48, while professor in the University of Genoa, he was named, under the new liberal reforms, censor of the press, the duties of which office he performed with great dignity and liberality. In 1860 he became Professor of Literature and lecturer on the works of Dante at the University of Florence. Among the works of Giuliani the volume entitled *Lettere sul vivente Linguaggio della Toscana* should be mentioned as having contributed largely to his reputation. In 1856 appeared *Le Norme di Commentare la Divina Commedia, tratte dall' Epistole di Dante a Cangrande*, a most important work, which was followed by his *Metodo di commentare la Divina Commedia* (1861); *Il convito di Dante reintegrato nel testo con nuovi commenti* (1874); *Opere latine di Dante reintegrate nel testo con nuovi commenti* (1878–82); *La vita nuova e il canzoniere di Dante* (3d ed. 1883); and other volumes of a similar character. D. in Florence, Jan., 1884.

**Giulio Romano**, joo'lĕĕ-*ō*-rō-maa'nō (properly Giulio Gianuzzi or dei Gianuzzi; called also G. Pippi, as being the grandson of Filippo or "Pippo"): painter and architect; b. at Rome in 1492. As a painter much of his reputation has been due to his association with Raphael, who held him in high esteem, intrusted to him the execution of important works, and, dying, confided to him, along with Gianfrancesco Penni, the finishing of his uncompleted pieces, such as *The Apparition of the Cross to Constantine* and the *Battle between Constantine and Maxentius*, in the Hall of Constantine at the Vatican. His most famous picture is in the Church of S. Stefano at Genoa—*The Martyrdom of St. Stephen*, an important work, and still regarded as a masterpiece of composition and drawing. Giulio Romano's fame rests more on his capacities as an architect and engineer than on his genius as a painter, though his architecture had the same general characteristics with his painting. Leo X. and Clement VII. employed him on the Vatican, and when in Rome he erected two palaces, the Church Madonna del Orto, and other buildings. Called to Mantua by its duke, Federigo Gonzaga, in 1524, he did an immense amount of work in construction and reconstruction, of which the Palazzo del Tê is the crowning achievement. His renown became so great that the pope invited him to return to Rome and undertake the construction of St. Peter's, but death prevented. His most important works are the *Defeat of the Giants* and *Life of Psyche*, in the Palazzo del Tê at Mantua. In the same city his paintings in the Corte Realc or old ducal palace are remarkable. His easel pictures, though formerly admired, are not important. D. in Mantua in 1546. Revised by Russell Sturgis.

**Giurgevo**, joor-jā'vō: town of Wallachia; on the Danube; 40 miles S. W. of Bucharest (see map of Turkey, ref. 2–D). It is one of the principal trading-places on the Danube. Pop. 20,866.

**Giusti**, joos'tĕĕ, Giuseppe: political poet and satirist; b. at Monsummanno, near Pescia, Italy, May 13, 1809. He studied first at Pistoja and Lucca, then in the University of Pisa, where he devoted himself to law, and then removed to Florence, where he practiced his profession for a time. The revolutionary attempts of 1831 roused the patriotic spirit of Giusti, and it found expression in admirable satires, which, far from being imitations, are a new form of that branch of poetry—popular, graceful, and biting. He well merits the name of "the Tuscan Béranger," although, according to the judgment of Italians, and even of many foreigners, Giusti far surpasses the French poet in delicacy of taste, in elegance, and richness of thought. The satires of Giusti remained in manuscript until 1848; but immediately upon their publication they obtained a wide circulation throughout Italy, and everywhere excited great enthusiasm. Subsequently Giusti became a Moderate, and adhered to the policy of Gino Capponi, whom he had already taken for his literary adviser. When the first Tuscan national assembly was convoked, Giusti was elected deputy, and by voting with the conservatives he naturally brought upon himself the hatred of the radicals. The grand duke being restored,

Giusti saw his dearest hopes crushed, and, suffering partly from depressing hypochondria and partly from a pulmonary affection, he died at Florence, Mar. 31, 1850. His principal poetical works are *Il Dies Iræ* (1830), an elegy on the death of Francis I. of Sicily; *Lo Stivale* (1836); *Brindisi di Girella* (1840); *Sant' Ambrogio* (1844). A complete edition of his poems was published at Florence (1868–73; new ed. 1877) and at Verona (1877). A translation in German by Paul Heyse appeared in 1875 (Berlin). Several prose works were published after his death. See his correspondence, *Epistolario* (2d ed. Florence, 1885), and Fioretto, *Giuseppe Giusti* (1877).

**Gizeh**: See GHIZEH.

**Gizzard** [M. Eng. *giser*, from O. Fr. *gesier*, gizzard < Lat. *gize'ria* (neut. plur.), entrails of fowls]: in birds and some invertebrates, a portion of the alimentary canal, which is very muscular and strong, being fitted for grinding up the food, a function performed by the teeth of many animals. Some of the *Bryozoa* have such a gizzard between the œsophagus and the true stomach. Many Gasteropods have gizzards armed with teeth (*Aplysia*) or calcareous plates (*Bulla*), and some Cephalopods have both powerful jaws and strong gizzards between the crop and the first stomach. Many insects and crustaceans have gizzards, in some cases armed with strong teeth. Most birds have a true gizzard, excepting only those whose food is very soft and succulent. The food, unlike that of the invertebrates above alluded to, is acted upon by the gastric juice before it is ground up in the gizzard. This organ is the homologue of the pyloric portion of the stomach of most of the vertebrates. It is lined by a horny epithelium, and most birds swallow pieces of gravel to assist the gizzard in grinding food. See BIRDS.

**Gla'brio**: an important family of the Roman plebeian gens Acilia, of which the most distinguished name is that of MANIUS ACILIUS GLABRIO, who became tribune of the people 201 B. C., a decemvir of sacred rites 200; prætor 196, consul 191, conducted with success the war in Greece against Antiochus III. of Syria and his allies; triumphed in 190, and after 189 B. C. withdrew from public life.—Another of the same name was prætor urbanus B. C. 70, consul 67, proconsul in Cilicia 66, where, after an inglorious campaign against Mithridates, he was succeeded by Pompey; became a pontiff in 57 B. C. He was a grandson of P. Mucius Scævola, and had a high reputation as a jurist.

Revised by M. WARREN.

**Glacial Drift**: See DRIFT.

**Glacial Period**: See PLEISTOCENE PERIOD.

**Glaciers** [Germ. *Gletscher*, from Fr. *glacier*, deriv. of *glace*, ice < Lat. *gla'cies*, ice]: streams or sheets of ice fed by snows on mountains or plateaus, and slowly descending to lower levels where they melt away. Four types of glacial form may be distinguished: (1) *Alpine glaciers*, named from the mountains in which they have been so fully studied, accumulate in high reservoirs separated by sharp ridges, and descend in long, narrowing ice-tongues along steep valleys to lower ground. Ice-streams from several reservoirs sometimes unite in a single glacier. Short glaciers, melting away on the mountain-slopes, are called glaciers of the second order, in distinction from the larger ones of the first order. The Alps possess 249 glaciers of the first order and 906 of the second. The greatest of these is the Aletsch glacier, 15 miles from head of reservoir to end of ice, the glacier proper occupying 10 miles. Glaciers of the Alpine type are found in the Pyrenees, Caucasus, Himalaya, T'ien Shan, Cordilleras of North and South America in high latitudes, and the New Zealand Alps. (2) The *Malaspina glacier* of the St. Elias range of Alaska alone represents the second type of form, in which the upper parts of the feeding glaciers correspond to the Alpine type, but in which the descending streams unite and broaden out in an extensive ice-plain on the flat, lower ground in front of the mountains which gather their snows. This is of interest because it represents the condition of the Alpine glaciers in earlier Pleistocene times, when they descended much below their present limits and became confluent in a broad sheet of ice over the plain of Northwest Switzerland and on similar low grounds. (3) The *Scandinavian type*, in which a broad sheet of ice accumulates on a mountainous plateau without sharp dividing ridges, and gives forth from its margins many ice-tongues which descend into the valleys. The largest snowy ice-field of this kind is the Justedalsbraer, with an area of 350 sq. miles, giving rise to twenty first-order glaciers and many smaller ones. Next is the Folgefond, 100 sq. miles, with three first-order marginal glaciers. (4) The fourth type is found in Greenland, where nearly the whole country is drowned under a heavy ice-sheet. This closely represents the type of continental glaciation which prevailed in Pleistocene time in Northwest Europe and Northeast North America. The area of the Greenland sheet is estimated at 330,000 sq. miles. The inland ice has been traversed by many Arctic explorers, including Nordenskiold, Jensen, Nansen, and Peary. It may be compared to a great shield, broadly level about the middle, where the greatest height found by Nansen in 1888 was 8,900 feet in latitude $64\frac{1}{2}^{\circ}$, and by Peary in 1892 7,320 feet. The surface descends more and more rapidly toward the margin, where it becomes broken and uneven. Rocky peaks, called *nunataks*, occasionally show their heads above the ice near the margin. The dust of various minerals borne by the winds sometimes dulls the surface, but no rocky fragments are seen except when derived from neighboring nunataks. At least a hundred great ice-streams descend into the fiords of the west coast, ending in ragged ice-walls, from which icebergs break away. Water melted on the inland ice rises from beneath the terminal ice-wall as a milky stream, its flow continuing even when the fiord is frozen over in winter. (See GREENLAND.) Many of these coastal features are repeated by the Alpine glaciers of Alaska where they enter the sea, the most famous being the Muir glacier, visited by tourists every summer.

*Structure of Glaciers.*—The Alpine glaciers have been studied most minutely, and may now be described in some detail. In their collecting reservoirs the snow is transformed into a granular mass, called *névé* by the French Swiss and *firn* by the German Swiss, the change being effected by many oscillations of temperature close about the freezing-point, some crystals melting while others grow. The *névé* has a stratified structure, with layers up to 3 feet thick derived from the annual snow supply. The lower layers are icy, but still somewhat granular, and gray from the inclusion of many air-bubbles. The change from *névé* to glacial ice is chiefly a mechanical effect of motion. The ice becomes clearer, firmer, and bluer. There is still a granular structure, the grains of ice having the size of hazelnuts just below the *névé* field and increasing up to 3 or 4 inches at the lower end of large glaciers. The temperature of the whole mass is close to the freezing-point except near the surface in winter, when it is colder and the ice is hard. When the melting-point is closely approached, as near the surface in summer, the grains are loosened by melting along the surfaces of contact. Each grain is found to be a separate crystalline growth, but much deformed by crowding with its neighbors. Glacier ice may therefore be compared to such a rock as marble, consisting of an aggregate of deformed crystals of a single mineral, the crystals being of slow metamorphic development.

*The slow movement of a glacier* is determined by telescopic observation of stakes planted in a row across the ice-stream. The movement is faster in the middle than at the sides; faster in summer than in winter; on steep slopes than on gentle slopes. It may therefore be compared to the movement of a river, but the ice is eighty or a hundred million times more inert than water. An ordinary velocity for an Alpine glacier is from 4 to 16 inches in twenty-four hours, or 120 to 480 feet a year—that is, about as fast as the movement of the point of the hour-hand of a watch. At this rate from fifty to two hundred years would be required for the descent of a particle from the head to the end of a large glacier. Near the end of the great Greenland glaciers a movement of from 10 to 20 feet or even from 50 to 70 feet a day has been observed. The movement of a glacier is accomplished partly by slipping on its bed, but chiefly by internal flowing. This results essentially from the weight of the glacier, which on account of its granular structure behaves as an imperfectly viscous body, yielding under compression, but breaking under tension. Hence besides the very slow slipping on the valley-bottom there is a partial internal melting under pressure, a slight plastic yielding of the mass when near its melting-point, and a fracturing and minute shifting of the parts, followed by partial regelation.

*Features Produced by Movement.*—The forces of compression and tension which the glacier suffers produce various peculiar features. The even stratification observed in the *névé* becomes distorted farther down stream, and may entirely disappear. The planes of greatest compression suffer pressure-melting, followed by regelation into clear

blue ice, thus producing a *blue-veined* structure. These veins stand at right angles to the compression forces, and dip steep up stream in the middle course of descent, but become flatter nearer the end. Where tension stretches the mass it breaks, forming *crevasses*. There is usually a deep chasm of this origin, called a *Bergschrund*, at the head of the *névé* reservoir. Transverse crevasses are produced wherever the slope of descent increases, and the ice may thus be greatly shattered, the disordered blocks being called *séracs*. The transverse crevasses are closed again when the slope decreases; but their place is marked by a slight depression in which dust and sand accumulate, forming a slightly discolored transverse band. As the ice advances, the middle progressing much faster than the margin, the band is bowed more and more sharply down stream. When viewed from an adjacent eminence, the surface of the glacier below a point of steeper descent is therefore seen to be marked by a series of curved *dirt bands*, convex downward. When two or more glaciers join, the combined dirt bands become crenulated. When a new series of transverse fractures is formed on another steeper slope, the first series of dirt bands is obliterated and replaced by a new series, again beginning as nearly transverse bands, and becoming bowed downward as they advance. If crevasses are filled with snow, their subsequent closing compresses the snow into a band of bubbly *white ice*, easily seen in contrast with the bluish ice of the glacier, and still more in contrast with the clearer blue of the compression veins. As the margin of the ice moves slower than the middle, tension strains are exerted obliquely inward and downward, and hence marginal crevasses are opened pointing up stream. At the end of the glacier there is sometimes a spreading by which radial crevasses are produced.

*Melting of Glaciers.*—The melting or ablation by which glaciers are consumed begins on the *névé* fields, where the infiltering water aids in the consolidation of the *névé* ice, but little of it escapes down the valley. Farther down stream much water melted by sunshine, rain, and warm winds sinks through crevasses and forms sub-glacial streams, which unite in a torrent that flows out of an ice-cave at the end of the glacier, clouded milky white by the fine rock flour that has been ground by the glacier from its bed. Much melting is accomplished by the latent heat liberated from dew condensed on the icy surface from moist winds, the weight of the ice melted being seven times that of the dew condensed. Surface-streams descending by crevasses form funnels, and when widened at the mouth these are called *moulins*. Descending currents of air aid the water in melting the ice. The moulins are carried slowly along, and abandoned by the streams when a new crevasse opens higher up in their course. The discharge of water at the end of the glacier is greatest late in the evening, and least in the middle of the morning.

*Moraines.*—A large amount of detrital material is carried in or upon a glacier, or dragged along beneath it, or washed by the sub-glacial streams. The detritus beneath the ice, called the *ground moraine*, is heavily pressed on the valley-bottom, and both the loose material and the rocky floor are smoothed and striated. The material that is carried within or upon the ice is not subjected to strong mechanical action, and therefore frequently retains an angular form; but it remains exposed to weathering so long that it may become disintegrated before it is dropped at the termination of the glacier. The loose material that falls from the valley-slopes, including rock masses of great size, is carried or dragged in a long train, called a *lateral moraine*. When two glaciers become confluent their adjacent lateral moraines unite into a single *medial moraine*. Much of the material of lateral moraines may be beneath the ice surface at their point of union into a medial moraine; it appears farther down stream, not by rising through the ice, but by the wasting away of the overlying ice. Medial moraines thus become more distinct toward the end of the glacier. If the two confluent glaciers are of unequal size, the ice from the smaller one melts before reaching the end of the main glacier, and the medial moraine then becomes a lateral moraine again. A *terminal moraine* is formed by deposition at the end of the glacier; it frequently takes the form of a ridge transverse to the valley. Near the end many glaciers are well covered with morainal material; in the Himalayas sufficient vegetation sometimes grows on the soil upon the ice to afford pasturage; on the Malaspina glacier in Alaska large forests grow over the ice-sheet. The protection from melting afforded by a morainal cover retards ablation; and thus a medial moraine comes to be perched on a ridge of ice even 100 or more feet in height above the adjacent more deeply melted surface. Rocks are shattered by rolling down such ridges, and the moraine is thus widened. Large tabular rocks shield the ice beneath them, and may thus come to be perched on a pedestal several feet above the adjacent surface. They at last fall toward the noon sun so regularly that their slanting attitude may then be used to determine a north and south line. Smaller rock particles or sand grains conduct the heat that they acquire from sunshine to the ice beneath, and thus melt vertical cavities a foot or more in depth into which they sink.

*Periodic Oscillations of Glaciers.*—Long-continued observation of Swiss glaciers has discovered a comparatively regular fluctuation of volume and length, believed to depend on a variation in their supply of snow. During the years of increasing snowfall the *névé* reservoir fills to a greater height, the slope of the glacier increases, it thickens and moves faster, and therefore advances farther down the valley before melting away. The larger the glacier the longer the time required for a change of supply in the reservoir to make itself felt at the lower end. During certain years of a long period of fluctuation all the glaciers of a region, large and small, may be affected in the same way, even the largest having begun to retreat under diminished supply before the smallest begin to advance under the next increase of supply. Thus from 1815 to 1818, from 1848 to 1850, and from 1871 to 1875 all the glaciers of the Alps were retreating; while from 1822 to 1825 and from 1875 to 1880 all were advancing. During the retreating period from 1850 to 1885 the relatively short and steep glaciers were the first to recede, while the longer glaciers did not begin to shorten until 1860 to 1871. Then for four years, 1871 to 1875, all the glaciers of the Alps were retreating without a single exception; but in 1875 the shorter and steeper streams began an advance, which the larger ones adopted in later years.

The many varied features of glaciers are of particular interest, partly because of their curious unlikeness to our usual surroundings, partly because of their association with grand mountain-scenery which inspires outdoor observation and study. Nearly every feature mentioned in the above account of Alpine glaciers may be recognized by the observant traveler during a summer's tour in Switzerland. The study of glaciers is of especial value to the geologist and geographer because of the great extension of glaciers beyond their present limits in Pleistocene time, and their occurrence then over large regions where no vestige of ice now remains. Many of the minor topographic features of the Northern U. S. and of Northwest Europe are explained by former glacial action. The most extended account of existing glaciers may be found in Heim's *Gletscherkunde* (Stuttgart, 1885), from which much of the above statement is condensed. Other works of importance are L. Agassiz, *Études sur les Glaciers* (1840); Charpentier, *Essai sur les Glaciers* (1841); A. Mousson, *Die Gletscher der Jetztzeit* (1854); Seue, *La Névé de Justedal et ses Glaciers* (1870); Sexe, *Om Sneebraeen Folgefond* (1864). For Greenland, see the accounts of Nansen, Nordenskiold, and Peary; for Alaska, see accounts by Reid of the Muir glacier, and by Russell of the Malaspina glacier, both in *The National Geographic Magazine* (Washington, 1891–92); see also Russell, *Existing Glaciers of the United States*, Fifth Ann. Rept. U. S. Geol. Survey. W. M. Davis.

**Gladden**, Washington, D. D., LL. D.: Congregational minister and author; b. at Pottsgrove, Pa., Feb. 11, 1836; graduated at Williams College in 1859; on the staff of *The Independent* 1871–75, and editor of *Sunday Afternoon* 1878–80; became pastor of Congregational churches in Brooklyn, N. Y., 1860; Morrisania, N. Y., 1861; North Adams, Mass., 1866; Springfield, Mass., 1875; and Columbus, O., 1883. Author of *Plain Thoughts on the Art of Living* (Boston, 1868); *From the Hub to the Hudson* (1869); *Workingmen and their Employers* (1876); *Being a Christian* (1876); *The Christian Way* (New York, 1877); *The Lord's Prayer* (Boston, 1880); *The Christian League of Connecticut* (New York, 1883); *Things New and Old* (Columbus, O., 1884); *The Young Men and the Churches* (Boston, 1885); *Applied Christianity* (1887); *Parish Problems* (New York, 1888); *Burning Questions of the Life that Now is and that which is to Come* (1889); *Who Wrote the Bible* (Boston, 1891); *Tools and the Man*; *Property and Industry under the Christian Law*; and *The Cosmopolis City Club*

(1893). Dr. Gladden, both as a preacher and author, is a recognized leader of the thought of his denomination.

C. H. Thurber.

**Glad'iator** [Lat., liter., swordsman, deriv. of *gla'dius*, sword, whence Eng. *glave*]: in ancient Rome a person whose business it was to fight with men or beasts in the arena. This custom is said to have been introduced into Rome in 264 B. C. by Marcus and Decimus Brutus, who on the occasion of their father's funeral exhibited three pairs of gladiators in the Forum Boarium. It was of Etruscan origin, and is believed to have sprung from the old and once quite universal custom of sacrificing captives and slaves on the tombs of distinguished leaders. Gladiatorial shows were at first exhibited chiefly at funerals, but later they were given on the grandest scale as public entertainments or as means of winning the popular favor. When Titus Flamininus celebrated his father's funeral in 174 B. C. he exhibited seventy-four pairs of gladiators, who fought for three days; and when Julius Cæsar was candidate for ædile he had engaged no less than three hundred pairs—a number which actually frightened his opponents and gave occasion to the first statute limitation of the number which might be presented. Augustus provided that public gladiatorial exhibitions should only be given twice a year and with a number of gladiators not to exceed 120. Gladiators were captives, slaves, criminals, or even free citizens, and were trained under the direction of a *lanista* (who might also be their owner) in so-called schools (*ludi*), from which they were loaned or rented to the person desiring to exhibit them. Private bands of gladiators were also frequently kept by wealthy individuals, and served not only to furnish entertainment, but also, especially in the turbulent days of the later republic, as a body-guard to their master, like the armed retainers of a feudal lord.

G. L. Hendrickson.

**Gladi'olus** [Lat., a small sword, dimin. of *gladius*, sword. Named from the sword-shaped leaves]: a genus of plants of the family *Iridaceæ*. Most of the species have bulbs, and are South African. The *Gladiolus segetum* and *communis* of Europe at one time were prized in medicine. The starchy bulbs of some African species are used as food. But the genus is chiefly noteworthy for its beautiful flowers, the ornament of almost every garden. Many splendid varieties have been produced by cultivation and hybridization.

**Gladstone**, William Ewart: statesman, orator, and author; b. at Liverpool, Dec. 29, 1809. His father, Sir John Gladstone, was a wealthy merchant, who sat for some years in the House of Commons as a supporter of George Canning. Both his parents were of Scotch descent. He distinguished himself as a scholar at Eton, and at Christ Church, Oxford, where he graduated as a double first-class in 1831. During his collegiate days he was very prominent as a debater in the Oxford Union, where he appeared as a strong opponent of political reform, introducing a vote of censure on the government of Lord Grey for the Reform Bill and on the Duke of Wellington for his concession of Catholic emancipation. On the passage of the Reform Bill in 1832 the Conservatives sought in every practicable way to counteract the influence of that measure in strengthening the reform party. Mr. Gladstone was put forward by the Conservatives for the borough of Newark, and through the support of the Newcastle family was elected. The new member made a very decided impression by his maiden speech. That he was thought to have unusual parliamentary capacity is evinced by the fact that in 1834 Sir Robert Peel appointed him Junior Lord of the Treasury, and in the following year raised him to the still more important post of Under-Secretary of State for the Colonies. It was four years later that he published his work on *Church and State*, in which he advanced a political philosophy which seemed to make the safety of the Church rest on the dominant influence of the Tory party. The position and the power of Mr. Gladstone at that time were indicated by Macaulay's review of the book, in which he spoke of the author as the "rising hope of the stern and unbending Tories." In 1841 he became vice-president of the Board of Trade and master of the mint; and in the same year was sworn in as a member of the privy council. In 1843, having acquired a firm grasp of the principles upon which a nation's finances must be conducted, he was appointed president of the Board of Trade. But he was approaching the great political and economic struggle which was to revolutionize his political views. Mr. Gladstone was an ardent admirer and follower of Sir Robert Peel, with whose government hitherto he had been intimately associated. But on the question of the repeal of the corn-laws, which was virtually the adoption of the principles and methods of free trade, Sir Robert was led by the reformers to examine the question with great care. He gradually withdrew his opposition and at length supported the measure. In this course he was followed by Mr. Gladstone; but as the repeal was strenuously opposed by the Tories, notably by the Duke of Newcastle, through whose influence he had been elected, he resigned his seat in the House of Commons. That he chose to resign and be out of Parliament when the great battle for free trade was fought and won is evidence of the high sense of honor by which he was governed. In 1847, still accepted as a Tory, he was elected as one of the representatives of Oxford. But the same methods of reasoning which led him to abandon the principles of high protection carried him forward to an attitude of opposition to many of the ways in which the natural development of society was controlled or obstructed by the Government. A startling evidence of the tendency of his mind was the publication in 1851 of a pamphlet arraigning the abuses inflicted upon the people of Naples by King Ferdinand. The death of Sir Robert Peel in 1850, while it deprived Gladstone of the support of his friend and adviser, brought him forward at once into the position of a great parliamentary leader and a master of parliamentary debate. It was in the winter of 1852, during the debate on Mr. Disraeli's budget, that his first really great speech was made in answer to the famous speech of Mr. Disraeli attacking the Liberals.

The downfall of the Tory Government, which now occurred, was followed by the Coalition Ministry, in which Mr. Gladstone took the place of Chancellor of the Exchequer. His great speech on the introduction of his first budget was so clear in substance and so charming in manner that it captivated the house, and gave him a high reputation as a speaker on difficult and complicated financial subjects. Under Lord Palmerston's first government he continued to hold the same office until he found himself obliged to go into the opposition on the Conspiracy to Murder Bill. During the short Derby administration that followed he took no prominent part, but on the return of Palmerston to power in 1859 again became Chancellor of the Exchequer. During the next six years he devoted his energies largely to a readjustment of taxation. On the death of Palmerston in 1865, Lord Russell became Prime Minister and made Mr. Gladstone leader of the House of Commons. It was generally expected that with Russell in the upper house and Gladstone in the lower the energies of the Government would be devoted to a measure for the reform and extension of the suffrage. A moderate bill for this purpose was introduced, but it was defeated largely through the power and influence of Mr. Disraeli. In 1866 the Government resigned and Mr. Disraeli was called into power. The movement in favor of reform, however, was irresistible, and Mr. Disraeli, perceiving the current of public opinion, came forward with a bill for household suffrage in cities and boroughs. The movement was popular and did much to strengthen the Conservatives.

Mr. Gladstone was first called to power as Prime Minister on the fall of the Disraeli ministry in 1868. The majority of the Liberal party was large, and Mr. Gladstone had a powerful support at his back. His purpose had been revealed during the elections. The chronic discontent in Ireland had resulted in 1866 in the Fenian movement (see Fenian), and called loudly for Government intervention. Mr. Gladstone's first effort was directed to the disestablishment of the Irish state Church. The debate was one of great power and interest. Before the merits of the general question were reached Mr. Disraeli resolved to dissolve Parliament and test the opinions of the country. The election took place in November, and in the new Parliament Mr. Gladstone was able to count upon a majority of 120. He was made Prime Minister, and from that time till the fall of his government he had everything in his own hands. He declared that his purpose was to follow out the doctrine announced by Fox in 1797, that Ireland should be governed by Irish ideas. To this end he had made it known in the course of the canvass that he would endeavor to deal with "Ireland's three great difficulties—the state Church, the tenure of land, and the system of national education." The first measure to come forward was the bill for the disestablishment of the Church. The measure as a whole and in detail was fought by Mr. Disraeli and his party with great energy and skill, but the bill was finally carried by a large majority. The bill for

the reform of the Irish land laws immediately followed. The principle of the measure was the claim that the landlord had not absolute and unlimited right. The bill recognized a certain partnership of the tenant in the land which he tilled. If the tenant was to be dispossessed he could claim compensation for improvements. On Aug. 1, 1870, the bill became a law. This was followed by a succession of energetic reforms, such as the Ballot Act for the protection of voters, the abolition of the purchase of commissions in the army, and the creation of a national system of education. The defeat of the Government on the Irish Educational Bill caused the downfall of the Gladstone ministry. Mr. Disraeli, however, declined to undertake the formation of a ministry, and Mr. Gladstone had to remain at the head of the Government. It was soon evident that the cry for reform had spent itself and that a reaction had set in. Mr. Gladstone determined suddenly to dissolve Parliament. At the new election the Conservatives were victorious, and Mr. Disraeli returned to power in 1874. Mr. Gladstone not only retired from the premiership but also from the leadership of his party.

For the next six years he occupied himself very largely with literary and historical studies. But in 1880 the pendulum swung back again, and the Liberal party came in with an overwhelming majority. Mr. Gladstone became Premier a second time. The conditions were not propitious for a peaceful or popular administration, for there were embarrassing troubles in South Africa, in the Sudan, in Egypt, and in Ireland. But these numerous embarrassments did not prevent the Government from dealing with domestic concerns. Mr. Gladstone in 1885 succeeded in carrying a vast scheme of parliamentary reform by which the constituencies were arranged in more nearly proportionate divisions, a number of insignificant boroughs were extinguished, and a near approach to universal suffrage was adopted. But the Irish members were an element of constant turbulence and uncertainty. At length they joined with the Conservative party on one of the clauses of the budget, and the Government was defeated. Though Mr. Gladstone resigned and Lord Salisbury became Prime Minister, a few weeks were enough to show that the new Government had not a working majority. At the general election in 1885 the Liberals were overwhelmingly victorious, and for the third time Mr. Gladstone was called to the head of affairs. Although the Irish, under the leadership of Mr. Parnell, had pursued a policy of the fiercest opposition and obstruction during a large part of the period between 1880 and 1885, Mr. Gladstone appeared to be convinced that further changes in the same direction were now imperatively demanded. On coming into power he shocked and alienated a large number of his friends by introducing, in Mar., 1886, a bill for the establishment of an Irish Parliament. This measure opened one of the most violent periods of parliamentary agitation in the history of the British Government. The defection of Mr. Gladstone's former friends and the formation of the LIBERAL-UNIONIST (*q. v.*) party caused the defeat of the Government. For six years Mr. Gladstone was the leader of the opposition and the persistent advocate of Irish autonomy as against the coercive policy of the Conservatives, but the election of 1892 returned him to power for the fourth time, and on Feb. 13, 1893, he introduced the measure for Irish self-government with a masterly speech. The bill, after various modifications, passed the House of Commons Sept. 1, 1893, by a majority of 34; but on Sept. 8 it was thrown out in the House of Lords by a vote of 419 to 41. (See HOME RULE.) On account of failing eyesight Mr. Gladstone retired from the premiership Mar. 2, 1894. He died at Hawarden, May 19, 1898, and was buried in Westminster Abbey.

The most important of Mr. Gladstone's literary works are *The State in its Relations with the Church* (1838); *Studies on Homer and the Homeric Age* (3 vols., 1858); *Juventus Mundi* (1869); *The Vatican Decrees* (1874); *Gleanings of Past Years* (7 vols., 1879); *The Irish Question* (1886). The most important *Lives* of Mr. Gladstone are those of G. Barnet Smith (2 vols., 1879); Thomas Archer (4 vols., 1883); James Bryce (1898). See also J. H. McCarthy, *England under Gladstone* (1884). C. K. ADAMS.

**Glagolit'ic Alphabet** [*Glagolitic* is deriv. of *Glagol*, Glagolitic alphabet, from O. Bulg. *glagolŭ*, word]: one of the South Slavic alphabets. According to Schafarik, it is older than the so-called Cyrillic, and was itself the invention of St. Cyril (see CYRILLIC ALPHABET), while the so-called Cyrillic is a corruption of this. Others make the Glagolitic much older than the time of Cyril. Still others regard the present Glagolitic as a corruption of the so-called Cyrillic. There is a small Glagolitic literature.

**Glaisher**, glā'sher, JAMES, F. R. S.: meteorologist; b. of Scotch parents in London in 1809; in 1829 served on the Ordnance Survey of Ireland; from 1833 to 1836 was assistant at the Cambridge Observatory; in 1836 became assistant in the astronomical department of the Royal Observatory; from 1840 to 1847 was superintendent of the magnetical and meteorological department; founded the Royal Meteorological Society; became F. R. S. in 1849, in consequence of his meteorological observations made in balloons; attained in 1863 the height of 37,000 feet above the earth's surface; became in 1865 president of the meteorological department of the British Board of Trade; has also been president and secretary of the Meteorological Society, and is president of the Aëronautical Society. Author of numerous works on astronomy, meteorology, and the science of numbers, including *Hygrometrical Tables* (1845); *Report of the Meteorology of India in Relation to the Health of the Troops* (1863); *Travels in the Air* (1870); an edition of Flammarion's *Atmosphere*, and of Guillemin's *The World of Comets*; and the completion of the Factor Tables begun by Burckhardt in 1814 and continued by Dase in 1862–65 (3 vols., 1879–83).

**Glaize**, PIERRE PAUL LÉON: historical and genre painter; b. in Paris, Feb. 3, 1842. Pupil of his father, Auguste Barthélemy Glaize, a genre-painter, and of Gérôme; first-class medals, Paris Expositions, 1878 and 1889; Legion of Honor 1877. His *Conspiracy in Early Rome* (1875) is in the Luxembourg Gallery, Paris. His decorative work is of good quality. Studio in Paris. W. A. C.

**Glamorganshire**, gla-mōr'gan-shir: the southernmost county of Wales; bounded S. and W. by the Bristol Channel, E. and N. by the counties of Monmouth and Brecknock. Area, 856 sq. miles. The southern part, the Vale of Glamorgan, is a plain, very fertile, and well adapted to wheat-growing. The northern part is mountainous, and contains some of the richest coal-fields in the kingdom. Pop. (1901) 601,080.

**Gland** [from Fr. *glande*, gland < Lat. *glans*, *glandis*, acorn (> Fr. *gland*, acorn), but with meaning from Lat. *glandula*, gland, liter., small acorn, dimin. of *glans*; in Germ. *Drüse*]: a term which should be limited to certain vegetal and animal organs concerned in the function of secretion. In plants, glands are integumentary cell-masses sometimes found depressed at the bottom of pits, at others elevated, or even stalked, above the surface of the plant. Some vegetal glands secrete poisonous principles (the nettle), while others contain essential oils (orange leaf). In animals, glands vary greatly in their arrangement and complexity; in the simplest form, represented by the unicellular glands of the lower animals, the entire organ consists of but a single microscopic cell; more complicated are the simple depressions or follicles lined by a single layer of secreting epithelial cells; while in the highest development, great numbers of these simple divisions are associated and grouped to form such glands as the liver, kidney, etc., which rank foremost among the organs of the body.

The glands of man and the higher animals are anatomically divided into two groups—the *tubular* and *saccular*; the former are single or branched cylindrical depressions or pits which form modified extensions of the surface of the mucous membrane with which they are connected. Such tubular glands are found throughout the stomach and intestinal tract, and supply important digestive juices; the kidney and testicle are examples of the highly developed branched or compound tubular type. The saccular glands, as found in man, consist of numerous little sacs or acini grouped around small ducts; the latter join to form larger canals, which, in turn, unite into a single large excretory tube opening upon the free mucous surface and discharging the secretion; such glands are usually designated as *racemose*, from the resemblance of the arrangement of their acini and ducts to that of a bunch of grapes.

The majority of glands possess certain structures in common; the typical construction includes (1) the lining of modified secreting epithelial cells, which rest upon (2) a delicate hyaline basement membrane, outside of which lies (3) the network of capillary blood-vessels furnishing the generous blood supply essential for the secretory function. The epithelial cells are the active elements in secretion, since it is their living cell-substance or protoplasm that possesses the power of separating and taking up certain

materials from the blood, from which, in connection with the chemico-vital changes taking place within the protoplasm itself, the peculiar product of the gland is elaborated and subsequently discharged. When these products are useful as aiding in the physiological functions they are called *secretions*; when, on the contrary, they are composed of effete waste materials, whose retention within the economy would prove harmful, they constitute *excretions*; the fluids of the salivary and gastric glands are important secretions aiding digestion, while urea is the most important of the excretions of the kidney.

It is difficult to determine to what extent the protoplasm of the cells directly participates in the formation of the secretion; whether this results from the elaboration of materials taken up from the blood, through the agency of the protoplasm, or whether the secretion is entirely produced by the conversion of part of the cell protoplasm is often uncertain; in many cases both methods participate in the production of the secretion. The particles of secretion stored up within the cells frequently differ in nature from the discharged product of the gland; thus the digestive ferments furnished by the gastric glands and the pancreas do not exist within the cells of these organs as the pepsin and trypsin which are respectively characteristic of the secretion of these glands, but as zymogen, which is probably transformed into the former substances during its discharge from the cells. The secretions elaborated within the various glands differ in their physical characters, those from the albuminous or serous glands being thin and watery; from the mucous glands, mucoid or slimy; from the sebaceous glands, fatty or oily. These last exist in connection with the integument, contributing an important means of maintaining the skin and hair soft and pliable; the product of the mammary gland is a conspicuous example of a highly fatty secretion, since milk consists of minute oil globules suspended in a clear albuminous fluid, the emulsified fat producing the characteristic color.

The largest gland of the human body is the liver; the pancreas, kidney, testicle, mammary gland, salivary glands, and many other small structures are the additional principal organs devoted to secretion. The sexual glands, the testicle and ovary, are remarkable from the fact that their products are highly specialized living cells—the spermatic filaments and the ova—instead of lifeless secretions.

Many organs commonly called "glands" are not secreting structures, but masses of tissue of entirely different nature; conspicuous among these are the numerous and widely distributed nodules of lymphoid tissue described as lymphatic glands, of which the mesenteric, agminated, solitary, axillary, inguinal, and other "glands" are familiar examples; these structures belong to the lymphatic system, and are closely related to the nutritive cells and tissues.

Likewise, the group of so-called "ductless glands," including the spleen, thymus, thyroid, suprarenal and pituitary bodies, embraces organs of various natures, regarding the functions of most of which little is known. Of those named, the thyroid body alone may be properly called a ductless gland, since this organ, in its mature condition, has lost the duct which, during a part of fœtal life, connected its acini with the free surface. The secretion of this gland after being formed does not escape, but remains stored up within the spherical compartments of the organ as the peculiar straw-colored mucoid substance distending its acini. The detailed account of the minute structure of glands in general, and of the several different larger individual glands, will be found under HISTOLOGY and under the headings of the various organs. G. A. PIERSOL.

**Glanders** [either deriv. of Eng. *gland* or viâ O. Fr. from Lat. *glandula*, gland]: a dangerous and very contagious disease (*equinia*, *malleus humidus*) of the horse, ass, and mule, communicable to man and to other animals. Cattle, however, are peculiarly exempt, and in parts of Europe where it is thought that placing cattle among the glandered horses will cure the latter, it is remarkable that the cattle so placed do not become affected. The disease is caused by a specific bacillus, and is characterized by an inflamed state of the nasal mucous membrane, upon which chancre-like sores appear, discharging a viscid humor. The lymphatic glands are secondarily affected. When the swelling of the lymphatics appears to supersede or exceed in importance the nasal affection, the disease is called FARCY (*q. v.*). Four types of the disease are recognized: acute glanders, acute farcy, chronic glanders, and chronic farcy. They are severe and fatal in the order named, but even chronic farcy, the mildest form, is seldom really cured. The farcy-buds, as the lymphatic tumors are called, are sometimes the seat of profuse or even gangrenous suppuration. Glanders has proved fatal to man in less than a week, but it has been known to last a year or more. A good constitution, a liberal diet, and perfect cleanliness may carry a patient through the disease and restore comparative health if the glanders be of the chronic type; but no curative remedy is known. Every glandered or farcy-budded horse should be killed at once, or reserved for experimental treatment by competent veterinarians.

Revised by WILLIAM PEPPER.

**Glanios'tomi** [Mod. Lat., from Gr. γλάνις, a kind of fish + στόμα, mouth]: an order of cartilaginous fishes containing only the true sturgeons; so named from the barbels around the mouth, which suggest those of a catfish. The maxillary and interopercular bones are present, and the skin is armed with bony shields. F. A. L.

**Glan'vil**, or **Glan'ville**, RANULF, or RALPH, de: an English jurist; b. at Stratford, Suffolk; in 1165 became sheriff of York; was custodian of Queen Eleanor at Winchester 1173–89; captured William the Lion at Alnwick 1174; justice itinerant 1175; chief justiciary of all England 1180; led an army in Wales 1181; was connected with the English Government in Ireland 1185; was removed from office by Richard I. and imprisoned; on his release joined the order of the cross and went to the Holy Land. Died at the siege of Acre 1190. He is the reputed author of the earliest treatise on the Anglo-Norman judicial system, the *Tractatus de legibus et consuetudinibus Regni Angliæ*, first published in 1554, often reprinted, and in 1812 translated by John Beames into English. A new edition, with translation by Sir Travers Twiss, was published in 1890.

**Glarus**, glaa'roos: canton of Switzerland; bounded by the cantons of St. Gall, the Grisons, Schwytz, and Uri. Area, 267 sq. miles. It consists of three valleys inclosed by high mountains—namely, the Klönthal, the Sernfthal, and the Linththal. The last of these is the most important, being formed by the Linth, which from the foot of Tödiberg (11,880 feet high) runs through the whole length of the canton and falls into the Lake of Wallenstadt. The climate is very severe; agriculture inconsiderable; the rearing of cattle is more important, but manufactures of cotton, linen, silk, and paper are the chief business of the inhabitants. Pop. (1888) 33,794; (1894) 33,535.

**Glarus**: the capital of the canton of Glarus, Switzerland; on the Linth (see map of Switzerland, ref. 4–H); shut in by lofty mountains, the Gläruish, rising 6,153 feet to the S., the Wiggis, rising 6,033 feet to the N. W., and the Schild, rising 6,010 feet to the E.; has some breweries and manufactures of cloth and calicoes. It was founded in the fifth century by Fridolin, an Irish monk. The Reformer Zwingli was pastor here from 1506 to 1516. In 1861 more than 500 buildings, including the old parish church, were destroyed by fire, but contributions to the amount of 2,754,606 francs were sent in, and the town was rebuilt in a substantial manner. The inhabitants, most of whom are Protestants, are noted for the primitive simplicity of their manners. Pop. (1888) 5,401.

**Glasgow**: a city in Lanarkshire and Renfrewshire, Scotland; lat. 55° 51′ 32″ N., lon. 4° 17′ 54″ W.; situated on the Clyde, about 22 miles above Greenock where the river broadens out into the noble firth of the same name (see map of Scotland, ref. 12–G). It is the second city in the United Kingdom, and the seventh in order among the cities of Europe.

*General Plan and Appearance.*—The larger and older part of the city stands on hilly ground on the north bank of the river, while the remainder stretches southward over a gently rising slope. Originally a few scattered houses huddled beneath the cathedral walls, or straggling down the ridge of High Street toward the river, Glasgow has gradually absorbed neighboring estates and villages, such as Gorbals, Anderston, Calton, etc., still traceable by their ancient names, till it now covers an area of 11,861 acres. The Kelvin, renowned in song, crosses its western portion in a southerly direction, and joins the Clyde 2 miles below Glasgow bridge. The Molendinar Burn, round which clustered the nucleus of old Glasgow, is now a roofed-in sewer. The river Clyde, once a stream easily fordable on foot, has been deepened till it is now navigable by the largest ocean-going steamer or first-class line-of-battle ship. Here it is lined by hand-

some quays and spanned by nine bridges, six used for ordinary traffic and three by railways approaching the city from the south.

*Streets.*—Glasgow is substantially built, with streets for the most part wide and regular. Argyle Street, the main thoroughfare, running parallel to the river, continues under various names in one unbroken line for about 5 miles. At its eastern end stands the beautiful tower of the old town jail or tolbooth. This tower was spared at the demolition of the jail, and is now known as the Cross Steeple. Here is the site of the Old Town, with High Street to the N., rising to the cathedral and the once aristocratic quarter of the Drygate, the Gallowgate and Trongate leading E. and W., and the Saltmarket and Bridgegate southward to the river. Trongate, now a part of Argyle Street, bears in its name the memory of the privilege of a free "Tron" or weighing-place, granted by James IV. in 1489 to the Bishops of Glasgow. Buchanan Street, leading N. from Argyle Street, and Sauchiehall Street, running westward from the head of Buchanan Street, are the handsomest thoroughfares. They contain many fine shops, the Art Galleries, and two of the theaters, and together form the fashionable promenade. The other principal streets are either parallel or at right angles to Argyle Street, and are all well paved, cleansed, and lighted. Tramway lines run through the city in every direction, the southern suburbs are connected with the center by district railways, and there is one underground railway in use and another in process of construction. A subway traversing the whole city, and crossing under the Clyde at two points, will, when completed, form a unique engineering achievement, and will immensely facilitate intramural traffic.

*Parks and Squares.*—The Green is the oldest and largest of Glasgow's five beautiful parks. It owes its origin to the common lands of the burgh, and lies along the riverside in the heart of the city. Its chief ornament is the Nelson Monument, erected in 1806. The Kelvingrove or West End Park is situated on the south bank of the Kelvin, opposite to the university. The park contains a fine fountain and the old mansion-house of Kelvingrove, now used as a museum. The Queen's Park lies about 1½ miles S. from Glasgow bridge, close to the battle-field of Langside. From the flag-staff on its summit there is on a clear day a magnificent view of the city. The plain of the south side is in the foreground, then comes the line of masts and shipping that marks the Clyde, then the steep central and old town, rising to the heights of the cathedral, St. Rollox and the university, and finally the blue background of the Campsie and Kilpatrick Hills, flanked by Ben Lomond's peak to the N. W. The Alexandra Park, a breathing space in the grimy east of the city, includes a golf-course and an open-air swimming-pond. The Botanic Gardens, N. of Kelvingrove Park, and also on the Kelvin, are now owned by the city. They contain a winter garden and a collection of plants of considerable scientific and educational value. Ruchill estate in the extreme N. W., and the Cathkin Braes to the extreme S. E. of the city, are the latest additions to its parklands. Open-air instrumental concerts are given during the summer months in all the city parks. Among the other open spaces are George Square, with its fine buildings, flowerbeds, and statues, and Cathedral Square, dominated by the cathedral and rich in memories of the Old Town.

*Public Buildings.*—The city chambers, the new official residence of the corporation, stand in George Square. The style is the Italian Renaissance, and the material freestone and granite, with rich interior of marble and alabaster. The building is lighted throughout with electricity, and cost £520,000. The post-office in George Square covers an area of half an acre. It employs 845 officers, and deals annually with about 184,000,000 packets, of which 120,653,884 are letters or post-cards.

The Royal Exchange in Queen Street is chiefly notable for its handsome news-room, 130 feet by 60, which serves as a merchants' exchange. The finest monument in the city, an equestrian statue of the Duke of Wellington, by Marochetti, stands in front of the building, whose Corinthian portico makes a fine background. The Stock Exchange has a commodious building of its own in Buchanan Street. Glasgow possesses 4 theaters, and 3 fine halls for concerts and public entertainments. St. Andrew's Halls, the largest and newest of these, contain a suite of rooms, each capable of seating from 100 to 4,000 persons. In the main hall the Glasgow Choral Union and the Scottish Orchestra Company hold their concerts during the winter months. The Institute of the Fine Arts is in Sauchiehall Street, as are also the Corporation Galleries with their valuable collections of old paintings. A magnificent art gallery is about to be erected in the West End.

*Churches.*—As befits a community whose ancient motto is "Let Glasgow flourish by the preaching of the Word," the city is well supplied with places of worship. The Presbyterian churches number 233, those of other Protestant denominations 77, Roman Catholic 19, with 2 Jewish synagogues. Few of these ecclesiastical edifices have any pretensions to architectural beauty. Glasgow Cathedral, grandly situated on a commanding height, is believed to have been founded on the site of an older building by Bishop Bondington in or about the year 1238. The first holy place on the same site was a Culdee cell founded by St. Kentigern or Mungo, Glasgow's patron saint, in 560, on the banks of the then beautiful Molendinar. The architecture of the present building is Early English. The nave is 155 feet long and 30 feet wide between the aisles; behind the choir are the Lady Chapel and Chapter-house. The crypt is the gem of the cathedral, and the finest of its kind in the kingdom. It is divided into three portions—Jocceline's, Lander's, and Blackadder's crypt. The cathedral contains 147 pillars, and its 157 windows are almost all of stained glass. The Necropolis, the principal cemetery, is opposite the cathedral, on the east side of the Molendinar ravine. A Doric column, surmounted by a statue of John Knox, crowns the burying-ground.

*Colleges and Schools.*—The university, a splendid pile of buildings, stands on the north bank of the Kelvin, opposite the West End Park. It is built round a central quadrangle, and is crowned by a tower and spire 278 feet high. The style is Early Pointed. The principal gateway is formed of the ancient archway and part of the front of the old college in the High Street. There are over 2,200 students. St. Mungo's College, in connection with the Royal Infirmary; the Glasgow and West of Scotland Technical College, and Queen Margaret College, with its recently founded school of Medicine for Women, can only be named. The principal schools are the High School, the Glasgow Academy for Boys, the High School for Girls, and Hutcheson's Grammar Schools for both sexes. The public schools are under the charge of a school board elected by the ratepayers.

The city is exceptionally well supplied with hotels of every rank, and is not surpassed in Great Britain for the number and cheapness of its restaurants and tea-rooms.

*Infirmaries and Charities.*—Glasgow has three large and well-appointed infirmaries, a fever hospital, and numerous smaller institutions for the care of the sick and the treatment of special diseases. The Royal Infirmary is in Castle Street, near to the cathedral; the Western Infirmary meets the needs of the western districts, and the Victoria Infirmary those of the south. Belvidere Fever Hospital, isolated from the city, stands on the eastern outskirts. The old incorporations of the Merchants' House and the Trades' House are active in deeds of benevolence to citizens in need of their assistance; William Quarrier's Orphan Homes deserve special mention for their noble work among destitute and neglected children; and there are numerous other institutions noted for active benevolence.

*Libraries.*—Glasgow has not yet adopted the Free Libraries Act. It has, however, three free consulting libraries, one of which, the Mitchell Library, contains nearly 90,000 volumes.

*Government.*—The municipal government is conducted by a town council, consisting of 75 councilors, of whom one is lord provost and 16 are bailies or magistrates. The city returns seven members to Parliament.

*Finance.*—The corporation revenues for 1891 amounted to £1,286,265, an increase on the revenue of 1881 of £261,658. The City Improvement Trust, instituted in 1865, has pulled down many of the old "rookeries" that were a disgrace and a danger to the community, and erected decent houses in their stead. It has widened old streets and made new ones, improved the drainage system, and carried out an efficient and self-supporting scheme of model lodging-houses. To meet the expenses incident to such thoroughgoing operations the citizens have taxed themselves to the extent of over £500,000, the improvement tax now standing at the rate of one penny per pound of rental.

*Gas and Water.*—Gas is still the almost universal illuminant, though the electric light is in process of introduction, and is now used in several of the principal thoroughfares, railway stations, and public buildings. The city is sup-

plied with water brought from Loch Katrine, 36 miles distant, at a cost of more than £1,500,000. The daily supply amounts to 42,000,000 gal., being 379 gal. for each penny (two cents) paid by the citizens.

*Business Interests.*—Glasgow has great natural advantages, being situated in a region rich in coal and iron, and on a river without a bar and affording a ready outlet for commerce, both coastwise and foreign. Its commercial prosperity dates from its embarkation in the tobacco and sugar trade with America and the West Indies, shortly after the Treaty of Union. Its chief manufactures are textile fabrics (129 factories), chemicals (32 manufacturers), glass and pottery, machinery (127 foundries), and iron and steel steamships. St. Rollox Chemical Works, with their monster chimney, 455½ feet from base to summit, one of the sights of the city, are the largest in the world.

*Ship-building.*—Lord Salisbury describes Glasgow as "the center and crown of the ship-building business of the world." In 1892 a little over one and a quarter million tons of shipping were launched in the United Kingdom, and of this the Clyde (which includes, besides Glasgow, Partick, Govan, Dumbarton, Port Glasgow, and Greenock) produced 336,414 tons, 129,204 tons more than the output for the same year of the Tyne, the next ship-building center in order. The total number of vessels built on the Clyde in 1892 was 300, of which 136 were steamers and 164 sailing vessels. Since 1812, when the pioneer steamer of Europe, Henry Bell's Comet, made its first run between Glasgow and Greenock, the Clyde has been pre-eminent among the rivers of the world for its splendid fleet of steamers. Steel has almost entirely displaced iron in the Clyde ship-building trade, and the manufacture of steel by the Siemens process is carried on in about a dozen large steel-works in the neighborhood. In addition to the immense dock accommodation already provided, the Clyde Trust is constructing three new docks, with a total available quayage of 3,737 lineal yards and a water-space of 35¼ acres.

*Commerce.*—It is impossible to do more than name a few of the chief articles of import and export. Wheat imports for 1890 amounted to 540,843 quarters and exports to 69,880 quarters, the principal contributing countries being the U. S. (four-fifths) and Russia (one-fifth). Sugar imports for 1890 amounted to 219,861 tons, all beet-root sugar, except 928 tons from Java. Pig-iron production for 1890 was 798,833 tons, and the total export 454,333 tons. For 1891 the total money value of Glasgow imports was £12,555,658, and of exports £14,459,866. The money value of iron goods alone exported in 1891 was £1,938,025. The value of exports to the U. S. was £1,283,-141. Glasgow has a large and well-established trade in U. S. and Canadian cattle. The number imported from the U. S. in 1890 was 39,593, and from Canada 40,000. The rapid development of this industry led the authorities in 1892 to provide additional accommodations, on greatly improved plans.

*Banking.*—The Bank of Scotland and the five other leading Scottish banks, with their 110 branches, afford unusual banking facilities to the community. The National Security Savings-bank, the largest in the kingdom, had in 1892 168,292 depositors, with a total amount to their credit of £5,689,872; while in the same year there were connected with it 226 penny banks, with 80,000 young depositors.

*History, Antiquities.*—The earlier history of Glasgow is identical with that of its cathedral, even as in later times its progress has been the offspring of its wealth-bringing river. At the time of Mary Queen of Scots it was but a poor town of about 4,000 inhabitants. During the reigns of Charles I. and Charles II. it suffered grievously for the cause of the Covenant, which perhaps accounts for its taking the Hanoverian side in the rebellions of 1715 and 1745. At an early date the citizens showed the commercial spirit. They took a large share in the unfortunate Darien scheme, and were sadly impoverished by its failure in 1700. For eighteen years afterward no Glasgow merchant owned a ship. The city's modern prosperity dates from the beginning of its trade with the U. S.; since the introduction of steam locomotion and navigation its growth has been phenomenal.

The antiquities of Glasgow seem almost all to have disappeared at the Reformation. There are still some curious, grotesque sculptures in the cathedral crypt, and a MS. copy of one important work of the once rich and extensive cathedral library remains in the Hunterian Museum—a *Catholicon*, or *Great Dictionary of the Latin Tongue*, in two immense volumes. Two sculptured shields, once forming a gateway, and bearing the royal arms, and an oak panel, now in possession of the Archæological Society of Glasgow, are all that remain of the old castle or bishop's palace.

*Population.*—With the exception of London, Glasgow is the most populous city in Great Britain. Its population in 1901 was 760,423. At the census of 1891 it stood at 656,946, an increase of 10·61 on the census of 1881, when the figures were 511,415. In 1801 Glasgow had only 77,385 inhabitants, so that in ninety years the increase in population has been equal to 749 per cent.

*Bibliography.*—Glasgow is peculiarly rich in its bibliography. In the Mitchell Library are stored fully a thousand volumes relating to the city. In its oldest history, that by John M'Ure, published in 1736, the author describes Glasgow as "deliciously situated on the banks of the Clyde," and affirms that "for its bigness it is generally believed to be the most beautiful city of the world." Another valuable work is *Relics of Ancient Architecture and Picturesque Scenes in Glasgow*, a splendid royal folio, with drawings by T. Fairbairn, published in 1849; *Old Glasgow*, by Andrew MacGeorge (1880); *Glasgow, Past and Present* (1884); *The Old Country Houses of the Old Glasgow Gentry* (1878); and *The University of Glasgow, Old and New*, edited by Prof. Stewart, with views and portraits in photogravure, may also be named among the host of beautiful and important books descriptive of St. Mungo's city. J. P. Slowan.

**Glasgow**: town; capital of Barren co., Ky. (for location of county, see map of Kentucky, ref. 5–G); on the Louisville and Nashville Railroad; 90 miles S. of Louisville. It is within 3 miles of the productive coal-oil wells of Kentucky, and makes large shipments of lumber, oil, and tobacco. It contains several saw and planing mills, oil-works, and manufactories of tobacco, wagons, plows, and sash and blinds. It also has several churches and public schools, 3 banks, and 3 weekly newspapers. Pop. (1880) 1,510; (1890) 2,051; (1900) 2,019.

**Glasgow**: city (founded 1844); Howard co., Mo. (for location of county, see map of Missouri, ref. 3–G); on the Missouri river, and the Chi. and Alt. and the Wabash Railroads; 107 miles E. of Kansas City, 158 miles W. by N. of St. Louis. It is in an agricultural, tobacco-growing, and market-gardening region; has several large flour-mills and tobacco-factories; and contains 10 churches, 2 public schools, public library with 5,000 volumes, the Pritchett Institute and Morrison Astronomical Observatory, a bank, and a weekly newspaper. It was the seat of Lewis College and Library till 1891, when the institution suspended. Pop. (1880) 1,841; (1890) 1,781; (1900) 1,642.

Editor of "Missourian."

**Glasgow, University of**: an institution of learning founded in 1451 by Turnbull, Bishop of Glasgow, by authority of Pope Nicholas V. Lord Hamilton endowed a college in 1460. Mary Queen of Scots handsomely assisted the university. Her son, James I. of Great Britain, gave it its present charter in 1577. The splendid Hunterian museum was presented to the university in 1781. The buildings, the older portions of which were erected between 1632 and 1656, were situated on the High Street. These with the adjacent lands were sold in 1864, and new buildings were erected at Gilmorehill, in the western part of the city, in 1870. Besides the regular academical course, there are law, divinity, medical, and scientific examinations, degrees, and professorships. Women students are admitted, but are taught at St. Margaret's College, an affiliated institution. They, as well as other students not attending university classes, are granted certificates of various grades on the results of local examinations. A diploma for teachers has been instituted. In 1898 the teaching staff numbered 80 and the students 1,953. The university joins that of Aberdeen in sending a member to Parliament. The old University of Glasgow is not connected with the Andersonian University. See Anderson, John.

**Glass** [in M. Eng. *glas* < O. Eng. *glæs*: O. H. Germ. *glas* > Mod. Germ. *Glas*]: as defined by Laboulaye, every transparent or translucid body which is brittle and sonorous at ordinary temperature, becomes soft and ductile, finally melting, under the influence of heat, and which presents when broken the peculiar appearance known as the vitreous fracture; also the process of manufacturing this substance. In the arts the term is limited to certain silicates. See *Chemistry of Glass*, below.

### History of Glass-making.

Glass was made by the Egyptians during their earliest historic period. Pictures of great antiquity represent glass-

blowing, and fragments of all epochs exist, as well as many perfect pieces. Throughout the Roman dominion Egypt was a great glass-producing country, and has never lost the art. It has been observed in Egypt that the common blue glaze, such as was used in the earliest ages, is still made for inkstands, buttons, and other articles among the peasants. The curious glass beads called *aggry*, which are valued in Ashantee like diamonds, and which are found in the Dinkira, Akim, Ashantee, Fanti, and other countries, are supposed to be of ancient Egyptian manufacture. "The variegated strata of the aggry beads are so firmly united and so imperceptibly blended that the perfection seems superior to art. The surfaces of some are covered with flowers and regular patterns so very minute, and the shades so delicately softened one into the other and into the ground of the bead, that nothing but the finest touch of the pencil could equal them. The agatized parts disclose flowers and patterns deep in the body of the bead, and thin shafts of opaque colors run from the center to the surface." It is remarkable that these beads bear some resemblance to the celebrated *glain neidyr*, or Druid holy snake beads of glass, found in Wales. The Sidonians and the Tyrians also made very elegant glass-ware.

Venetian drinking-glass.

The Phœnicians at a very early age had made and exported, even to Britain, much glass, and Alexander Nesbitt thinks that the aggry beads are of Phœnician make—a theory which would account for their identity with the British *glain neidyr*. Greenish glass was made in Abyssinia B. C. 722, but probably the colored glass discovered at Nineveh by Layard is Roman. According to Labarte, the beautiful little glass vases called Greek, so often found in tombs on the Mediterranean, are really Phœnician, though of Greek (or more rarely Egyptian) form. Those in the British Museum are very elegant.

Glass for windows was not much in demand in antiquity because of the plan and arrangement of the houses, but Roman window-glass has been found even in England, and in the House of the Faun, at Pompeii, a small pane remains in a bronze sash. A beautiful industry in glass among the Romans consisted in the imitation of gems, seals, and cameos for jewelry. A part of these imitations were cast, but many were cut by hand with great care.

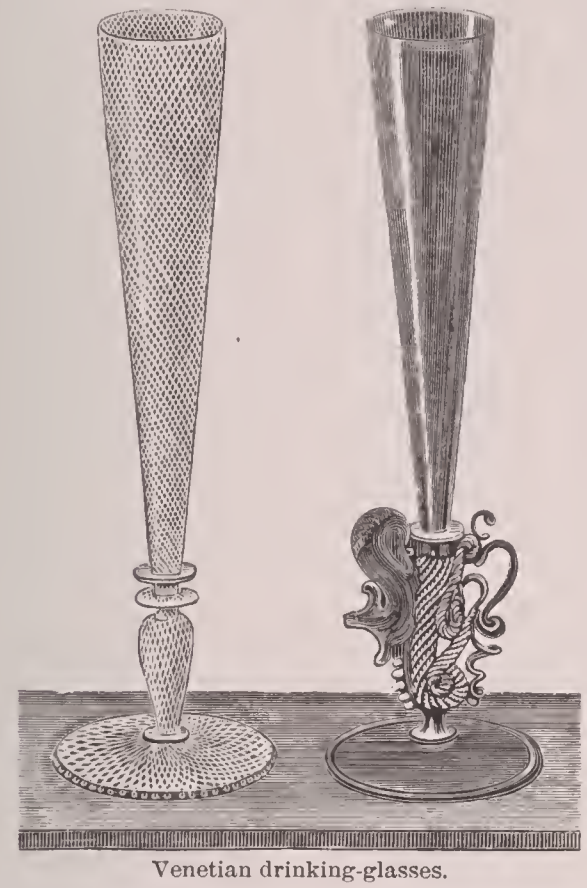
After the fall of the Roman empire glass-making declined, but not so rapidly as other arts. Glass mosaics of good quality were made at Rome from the time of Constantine until that of Charlemagne. Window-glass for churches was made, according to Lactantius, in the fourth century; it is alluded to by St. Jerome early in the fifth, and by Gregory of Tours and Fortunatus in the sixth. In the seventh century workmen were sent from Rome to glaze a church in England. As the art declined in Rome it flourished in Constantinople, and there is every reason to believe that it was cultivated to a considerable extent among the pagan Saxons, the Piets, and Irish, as all had their own peculiarly formed goblets and ornaments of glass. Beads were made by all the Celts, even in the earliest times, with great skill, after the style of the Egyptian or Phœnician aggry type, and it is possible that Ireland learned the art, like Rome, from Egypt. A large bead from an old Irish grave near the Giant's Causeway consists of terra-cotta with inlaid glass. Very little remains of early Byzantine art; it is Roman imperial glass with a new spirit in the design, akin to the other manifestations of the Greek spirit under its new conditions. In the eleventh century glass-making was practiced with great success in Persia and Alexandria, and in 1163 Benjamin of Tudela says there were at New Tyre 400 Jews, "ship-owners and manufacturers of the celebrated Syrian glass." From this time elegant cups, bowls, and lamps of Oriental manufacture became common, enameling having been extensively developed and applied to glass. The treatises of Heraclius, a Frenchman, and of the monk Theophilus, a German, of the eleventh and twelfth centuries, contain full details for making glass in great variety, both for windows and vessels. The art of glass-making was never lost either in France or England. In the former country it was extensively practiced in the seventh century, and the records of Colchester (England) show that three *verrers* or glass-makers were taxed in that town in 1300. Glass for such mosaics was made in Ravenna to the sixth century, in Rome to the ninth, and again in the twelfth and thirteenth. Glass-making in Venice is asserted to date from the seventh century. The immense labor of covering the interior of St. Mark's with glass mosaic in the eleventh and twelfth centuries probably attracted to Venice skilled Byzantine workmen; and as fine sand and plants yielding good alkali abounded there, glass-making soon became a national art. It is evident that not only were the processes extant in the East speedily transferred to Venice, but that careful study of all the Roman devices of the millefiori, filigree, and ribbon work, never perhaps entirely lost, soon revived nearly all that was known of old.

About the year 1860 several persons interested in the development of the industries of the Venetian provinces attempted to revive the then dormant art of glass-making in the island of Murano, where its traditions still lingered, and where lived the descendants of the glass-blowers of the sixteenth century. The persons to whom the merit of this attempt is due were Murenese; but the attempt nearly failed for lack of capital, a large amount of which was lost before the business became self-supporting.

Glass was made during the Middle Ages, especially for windows, in all European countries. In the beginning of the seventeenth century the Bohemians began to produce fine crystal glass, and developed the art of engraving on it. Then Henry Schwanhard invented engraving with hydrofluoric acid. Bohemia has always been able to produce very cheap glass, and even when coarse it has a certain odd character which commands a sale. More than 30,000 persons are engaged in its glass-works. In France oxide-of-lead flint-glass was made in 1784 at St.-Cloud, and other factories were soon after established. Glass-casting and plate-works had previously been established by Thévart. The plate-glass made in France is the best known. In 1485 English window-glass cost much more than any other. Yet the art greatly declined until the middle of the sixteenth century, when a revival took place, and in 1557 window and coach glass nearly equal to the Venetian was produced. In 1589 there were fifteen glass-houses in England, and about this time the manufacture rose to importance. The influx of French Huguenot glass-workers in 1685 gave an impulse to the manufacture, and in 1736 English glass was considered by Dr. Pococke to be superior to that of Bohemia, and only inferior to that made in Prussia, under royal patronage, at unlimited outlay. Plate-glass was made in 1771 at Prescot, Lancashire; the patent plate was introduced in 1840. Perfectly pure glass, free from specks or striæ, is made in Great Britain better than in any other European country except France.

Venetian drinking-glass.

*Optical glasses* probably are almost as old as glass. A lens was found in Nineveh, and the Chinese chronology of Père Gaubil states that the Emperor Shun (2283 B. C.) observed the planets through an optical glass.* In 1303 a French surgeon, Gui de Chauliac, recommended spectacles as well known. A tombstone in Florence declares that they were invented by Salvino d'Armato, who died in 1317. Glass for optical instruments is the most difficult to make. Great advanees in the preparation of optical glass were made by M. Guinand, a Swiss, and by Fraunhofer, of Munich. Guinand was enabled to make larger and clearer lenses than



Venetian drinking-glasses.

any known by agitating the glass while in fusion and annealing it in the pot, a method which has since been greatly improved. From Guinand's son the secret was conveyed to Bontemps, of Paris, by whom the process was further improved, and better and larger pieces were made.

Chemistry of Glass.—Chemically considered glass belongs to the class of compounds known as salts, it being a mixture of two or more silicates. When silica or silicic acid, $SiO_2$, is brought together with a base, such as lime or calcium oxide, CaO, or lead oxide, PbO, a silicate is formed. Many silicates are hard, transparent, difficultly soluble or insoluble in water, and not at all or but slightly attacked by acids, except hydrofluoric acid. They are, in short, glasses. The most common kind of glass is made by melting together silica, in the form of sand, limestone, or calcium carbonate, and sodium carbonate or soda, and the product is a silicate of sodium and calcium. The sodium may be replaced by potassium, either wholly or partly, and the calcium by lead. So also the silicic acid may be partly replaced by boric acid. The relative quantities of the ingredients are determined by experience. In general terms it is known that the larger the proportion of silica in a glass the more difficultly fusible is it, and the less easily acted upon by other substances. Potassium (or potash) glass is more difficultly fusible than sodium glass, and less easily decomposed by acids. An increase in the proportion of lime decreases the fusibility and increases the hardness and luster. Lead glass is much more fusible than lime glass. It is also much softer and much more easily acted upon by other substances. It has, on the other hand, a higher specific gravity than lime glass and a high refracting power for light. It has an exeellent luster, and can be obtained perfectly colorless. The properties mentioned make lead glass exceedingly valuable for certain optical purposes. Introduction of boric acid in place of part of the silicic acid increases the fusibility of glass and gives it high luster.

*Ordinary window-glass* is a sodium-calcium glass. The purer the ingredients the better the quality of the glass. This glass is comparatively easily acted upon by chemical substances. The difference between ordinary window-glass and plate-glass consists essentially in the fact that the former is blown and then cut into pieces, while the latter, when in the molten condition, is run into flat molds and there allowed to solidify.

*Bohemian glass* is a potassium-calcium glass. It is characterized by great hardness, by its difficult fusibility, and by its power of resisting the action of chemical substances. It finds extensive application in chemical laboratories.

*Flint glass* is made by melting together lead oxide, potassium (or sodium) carbonate, and silicon dioxide. The chief properties of this glass and the fact that it is used for certain optical purposes have been mentioned above.

*Iridescent Glass.*—Pieces or objects of ancient glass dug from the ground often are exquisitely beautiful. Sometimes they are like the richest and most varied wings of butterflies or the feathers of peacocks, presenting every shade of every color known, and at other times they resemble metal. The writer has found in the Palace of the Cæsars pieces of a cup which resembled intensely burnished silver, but with a pearl-like tint. This is caused by decay, or, more accurately speaking, by the action of ammonia. In fact, it has been imitated by using this agent. The rainbow-like film which is often seen in glass in stables indicates the beginning of the process. The iridescent scales are a mixture of silica and earthy silicates, the alkaline silicates having disappeared.

*Soluble or water glass* is a simple silicate of soda potash which is perfectly soluble in hot water, but which becomes hard when exposed to the air. It may be obtained by dissolving pure silica, obtained by precipitation, in a boiling solution of caustic soda or potash; but this process is too inconvenient and costly to be practiced on a large scale. It may be made by mixing 30 lb. of pearl-ash, 45 of sand, and 12 of powdered charcoal, and heating for five or six hours. It is then powdered and dissolved in boiling water; 1 part of glass requires 4 or 5 of water. It is boiled until no more glass dissolves. It is used for many purposes—as a glazing which resists water and fire, as a cement for glass, and as glue or isinglass in coloring. It requires to be mingled with aluminous or other bodies when used as a protective glazing. When chalk is treated with a solution of water glass a very hard mass known as *artificial stone* is obtained.

*Strass* is still richer in lead than flint-glass. On account of its luster and its refracting power, it is used in the manufacture of artificial gems. A part of the silicic acid is sometimes replaced by boric acid.

Engraved flagon (Clichy glass-works).

Manufacture of Glass.—There is perhaps no manufacture in which every successive stage requires so much care as glass, and none in which results on so large a scale involve such delicate skill. A puff of smoke or a sudden draught of air, imperceptible to an invalid, may ruin an immense quantity of "metal"; and when the wares are made they are, so to speak, in their infancy, and must be carefully conducted through the process of annealing or tempering by judicious cooling. There are six kinds of glass, each requiring a peculiar fabrication and a peculiar building and furnace. These are bottle, crown, sheet-window, plate, flint, and colored glass. As a rule, glass-houses are conical, from 60 to 100 feet high, and from 50 to 80 in diameter at the base. With the exception of the pot-rooms and cutting-shops, all the processes are conducted on one floor, the prompt removal of the glass in its different stages being a matter of the utmost importance. The whole should be so planned that the crude materials in the course of preparation shall always be moving upward to the fusing-furnace, and when manufactured be drawn downward to the warehouse or packing-shop. All furnaces are buildings of circular or rectangular form, four different kinds being needed, which are built together or separately. Of these one is the main furnace, employed for

* This is a mistranslation. The words of the Chinese text are *yuh-hŭng*, literally "gem transverse," and probably mean simply "alidade."—R. L.

supplying the melted glass from the pots in which it is contained; of the others, one is the annealing-furnace, in which the wares are annealed or tempered when made or while making; and the other is employed for baking the raw materials combined, and called frit or batch. Having to furnish a temperature between 1,800° and 2,700° F., these furnaces are entirely constructed of fire-brick made of infusible clay and a cement obtained from the fusion of old pots made from the same clay. In addition to these is the flashing-furnace, where articles being made are rewarmed or restored to sufficient softness as they cool. The furnace for baking and partly fusing the frit is called a calcar, and that for annealing a leer. For window-glass there is also the spreading-furnace, in which cylinders while soft are expanded into plates, while in a crown-glass factory the blowing-furnace is the principal. A flint-glass furnace is between an air-furnace and an oven—i. e. it must not have too much draught, and yet must be very hot. A large cave extending through the subterranean area of the glass-house, connected with the open air at each end, under the bars of the furnace, receives the fallen cinders, and supplies the oxygen for the combustion of the fuel. At right angles from the large cave are smaller caves, communicating so as to catch the wind from as many aspects as possible. A flint-glass furnace is reverberatory—i. e. with no heat or flame issuing from its center. If the furnace contains ten pots, it will have as many flues

Bohemian glass.

or chimneys, and the flames escape through "linnet-holes," of which there is one in each flue. The smoke passes into the outer brick dome of the building, and thence through the funnel and great chimney. The bottom part of the furnace is called the *siege*, or seat. The fire never goes out in a glass-house; if a part of the arch or crown of the furnace is destroyed by heat, the repairs are made by cramming the entire furnace with coals and cinders, which stops the draught, and on this the workmen rebuild with arch-bricks and fireproof clay. A furnace in England lasts from three to ten years; in France, but one or two years. Between every two adjacent flues in the furnace is an aperture called the working-hole, opposite to and a little above each pot, for the purpose of putting in raw material or taking out melted glass. The pots are from 18 inches to 3 feet high, 2 or 3 inches thick, the bottom 4 inches. They are either round, oval, or rectangular. For crystal made at the coal mine they are shaped like a retort with a very narrow neck, or are hooded—having a mouth in front. Large pots cost £10 = $50, each. When a pot wears away or splits in the furnace, it is repaired as it remains by different methods, and may thus be preserved for several weeks. The breaking away of an old pot and setting a new is a very difficult and sometimes dangerous process. After being kept for nearly a year free from change of air, the pot is annealed or tempered at a red heat for five days, and then carried to and placed in the main furnace. This requires much skill. Filling the pot with new glass is *founding*. It requires constant skimming—an operation confided only to a very skillful workman. The process of making up the hot glass or metal is called a journey (French, *journée*, a day). It is from thirty to forty hours. The shorter the time for preparing the glass, the better. It is, if good, quite liquid. If by delay it becomes thick, it is spoiled, and must be turned into cold water and used as cullet; that is, must be broken up to be remelted. In Great Britain the men generally work from Monday to Friday by piece-work. In France their labor is by the day.

*Annealing* is an important process with glass-ware. If not well done, the articles will, it may be months afterward, break suddenly. An unannealed bottle will be shivered if a bit of flint or grains of sand are shaken within it. This results from a different arrangement of the molecules through the whole mass, caused by a sudden cooling. The furnace for annealing is fed for *plate* with coke, and has different degrees of heat. The time required is from six to sixty hours, according to the size of the articles. Much depends upon the wind. Great losses result when a sudden contrary current drives back the heated air. Very large objects are annealed in heated sand.

A very important invention was announced in 1875 by M. de la Bastie. It consists of plunging hot glass, manufactured in any form, into hot oil or a heated oleaginous compound. When cooled it becomes (it was claimed) almost as tough as metal, so that a cup or mirror made of it may be thrown violently many feet or dropped on a stone floor without breaking. When very violently broken it separates into granulated fragments, without sharp edges, so that the danger of being cut by it is much diminished. The process does not affect the transparency or beauty of the glass in any way.

*Coloring or Staining Glass.*—This is a very important part of the manufacture, involving much skill. At one time dark *massive-colored* glasses were generally used. By color *en masse* is meant that which is tinted all through. At present hues are conveyed by covering a body of pure flint glass with one or more thin coatings of intensely colored glass, whether of blue from cobalt, green from iron and copper, or ruby from gold. The more metallic coloring oxide is employed the less lead must be used, so as to equalize the composition. Massive colors produce a shadowy blackness, which was, however, turned to account by the artists of the Middle Ages, by *leading* their tints of blue, red, yellow, amethyst, and green into windows, either thicker or thinner of solid or *cased* glass as the required effects suggested. The following are approved recipes: Prepare a very fine flint glass—e. g. carbonate of potash, 1 cwt.; minium or litharge, 2 cwt.; sand, washed and burned, 3 cwt.; saltpeter, 14–28 lb.; oxide of manganese, 4–12 oz. Add to this for ruby red, to 6 cwt. of the batch or frit, 4 oz. of oxide of gold; ancient red, use protoxide of copper. The art of making this, though known to Neri and Kunckel, was entirely lost until revived in 1828 by Engelhart, of Zinsweiler. Red schmelz, or smalt, is prepared by a very long and intricate process, given by Labonlaye. Azure blue: to 6 cwt. of batch add 6 lb. of oxide of copper; cobalt blue, by adding oxide of cobalt or smalt. The cobalt forms a transparent glass. Amethyst or purple: 6 cwt. of batch, 20 lb. of oxide of manganese (and a little niter—*Laboulaye*). Yellow common topaz, add to the glass charcoal in powder. Common orange, 6 cwt. of batch, 12 lb. of iron ore, and 4 lb. of manganese. Gold topaz, 6 cwt. of batch, 3 lb. of oxide of uranium. Gold yellow, to a composition for dark violet (peroxide of manganese) add a little oxide of iron, giving a brown violet; increase the iron, it will become a fine yellow, such as is used to spin into gold threads in woven glass. Green (grass), chromic oxide, or a mixture of antimony glass and oxide of cobalt. Emerald, to 6 cwt. of batch add 12 lb.

of copper scales and 12 of iron ore. A far more beautiful emerald is made with the oxides of nickel and uranium. Black, peroxide of manganese, oxide of copper and of cobalt, equal parts, or with a mixture of iron filings, peroxide of manganese and oxide of copper or of cobalt. Soft white enamel, opaque, to 6 cwt. of batch add 24 lb. of arsenic and 6 lb. of antimony. Hard white, 200 lb. of tin and lead-putty. Hyalith is a black glass, so hard that it may be used freely to contain boiling liquids. It is made from the slag of forges, added to the batch of common white glass, and charcoal dust in excess. Basalt or lava may be used for the scoria or slag. It may be made in different colors, but is always brilliant and susceptible of a high polish.

*Working.*—The ordinary tools of the glass-house are nearly the same to-day as those described by Blancourt in 1699. They consist of the pucellas, which resembles a pair of wool-shears, but with dull edges. The spring tool is like sugar-tongs, but straight and without bowls. The shears are exactly what the name indicates. The battledore is a square trowel. The pontee is a solid rod used to support the glass while working, and the blowing-iron is a hollow tube about 4 feet long, which is enlarged at the end to be dipped into the metal. The marver (French, *marbre*, so called from the material once used) is an iron plate an inch thick, highly polished, on which the glass is rolled into even shape. Two kinds of ladles are used to transfer or skim the glass, and also a rake to stir the frit or metal. The chair on which the workman sits is a low flat seat, with two long projecting arms. These are faced with iron, on which the blowing-iron is rolled to give a rotary motion, while the hand with the pucellas shapes the article. If the workman wishes to make a wine-glass, he puts the blowing-iron through a working-hole, dipping the end into the liquid metal. It is removed with a ball of hot glass sticking to it, which is at once blown by the breath into a large bubble, which has one end flattened on the marver to make the bottom of the vessel. In this condition it resembles a bottle without a neck, stopped by an iron rod. On the middle of the flat surface, which is the bottom of the wine-glass, a small ball of hot glass is now put. From this soft ball the stem is shaped with the pucellas while the whole is rolling up and down on the arms of the glass-maker's chair. The moment the glass hardens by cooling the action of the pucellas must cease or the surface will be rough. Another bubble of glass is now blown and attached to the end of the stem, to make the flat disk or foot on which the glass rests. This second bubble or globe is cut open and flattened out with the pucellas, while the whole is being turned as before on the arms of the chair. In this condition the whole resembles a champagne bottle without a neck, but stopped with the blowing-iron tube, while on its flat bottom are the stem and foot of a wine-glass, the other iron rod, a pontee, which has been used to make the foot, in a line with the blowing-iron and stem. The pontee from this time supports the glass, for with a touch and a tap from the cold pucellas a crack is made in and around the bottle or bubble at the place where the rim is to be. This at once makes of it a wine-glass, but with a bowl of the shape of a barrel. The rim is then sheared smooth, and the glass is *flashed*, or rewarmed, at a furnace made for this purpose, and rolled into the ordinary form on the marver or iron slab. When thus finished and ready for annealing, it is knocked off from the end of the pontee by a sharp blow. This process is, with few variations, exactly that which is followed in making all articles of blown glass, whether tumblers, pitchers, dishes, salts, lamp-shades, or jugs. Bottles, vials, and all objects covered with projections, bulbs, letters, ornaments, or, as it is called, "pillar-molding," receive this from being pressed while soft into a mold. These molds are made of metal in two or more pieces, and open and shut. By blowing the glass is pressed against the hollows which form the ornaments or moldings. Workmen acquire great accuracy in taking out on the irons exactly the quantity of glass required—a very important matter in making articles to be of the same size. Tubes for thermometers, etc., are made by drawing out to an incredible length, sometimes 70 feet, the bubbles of glass. *Casing* glass is the laying one very thin coat of colored glass on another, generally white. It is simply effected by blowing a bubble, cutting off half of it, and capping it on the white ball of hot glass. The American invention of pressed glass consists in forcing hot metal into a mold, not by blowing, but by mechanical pressure. Great practice is required to determine the exact quantity of metal, and to keep the molds at a regular temperature just short of red heat. Glass cutting or grinding is simply effected on the lathe and wheel with sand and water, pumice, etc. Beads are made by cutting tubes into segments. The Venetians are still unrivaled in this branch of the manufacture, and supply the greater part of the markets of the world, though immense quantities are made in Germany. The tube is cut into bits, which are filled with a paste of ashes and sand. They are then put with sand into a cylinder which is heated and turned. The motion renders the soft beads globular, the sand keeps them from adhering, and the paste preserves the bore. The wonderful skill which the workmen attain is best shown in making crown-glass in sheets. In this as much as 9 or 10 lb. of melted glass is sometimes taken out at once on the blowing-pipe. This is blown into a long ball, and reheated to expand it. At this stage a solid iron rod charged with glass is made to adhere to the center opposite the blowpipe, which is now detached, leaving an orifice. This orifice enlarges as the ball is *flashed* or heated and rapidly revolved, until it expands suddenly with a flap into a large round plate 4 or 5 feet in diameter, and of uniform thickness except at the center, where it forms, of course, with the pipe a lump or "bull's eye." It is then cut into panes. When the workman's breath is insufficient to enlarge the glass, the growth is effected by blowing in water, which as vapor at once expands the ball, or sometimes by a blowing-machine. Plate-glass is made by pouring the metal on a table covered with copper. On either side is an iron rod or bar the thickness of the proposed sheet, and on these an iron roller passes, reducing the metal to the exact thickness required. In grinding plate-glass, two plates are ground, one on another; one, imbedded in plaster-of-Paris, lies on a table, while the other, cased in the same substance and heavily weighted, is moved uniformly and rapidly over its surface. Sand and water, emery of different grades, and finally tripoli and putty, are employed to polish it. When blown, sheet-glass is expanded into cylinders, which are while warm cut along their entire length with a steel point or glazier's diamond, and thus made into sheets which are flattened. Such glass can not be perfectly flat like plate, neither can it be polished to perfection, as it would break under pressure. To obviate this, James Chance of Birmingham, England, invented the process of laying a sheet on soft leather, while it was polished with another sheet. The elasticity of the glass prevented its fracture. Every year sees great improvements in manufacturing large sheets of glass. As regards all glassware made by hand, success depends entirely on the skill of the individual workman, and the simple description which has been given of the making of a wine-glass applies to every object. The formation of the infinite variety of wares produced in flint-glass houses depends more upon skill, adroitness, and tact than upon the ingenuity of the tools; in truth, the perfection of the product of the furnace, as regards its workmanship, depends chiefly upon the tact and intuition of the glass-blower, who avoids as much as possible the use of tools. Iron tools should be employed only in the earlier processes to produce the crude form, and the wooden tool used but sparingly; while the finishing and intermediate shaping depend chiefly upon the application of centrifugal force by rapid hand-rotation, upon the expansion given to air to widen the forms while reheating at the aperture of the furnace, technically termed "flashing," and upon a skillful final throw.

Works on Glass.—*L'Arte Vetraria distinta in libri sette*, by Antonio Neri (Florence, 1612); German version, with additions, in the *Ars Vitraria experimentalis*, by J. Kunckel, Baron von Lowenstein (1697); translated into English, with curious additions, by A. Merret, in 1662; re-edited and privately printed by Sir T. Phillipps (1826); a French version, with very curious additions, by M. Zimmerman (1756); *De l'Art de la Verrerie*, by François Handicourt de Blancourt (Paris, 1697; the English translation of 1699 is full of useful information, and written in so quaint a style as to make it interesting to the most general reader); *Vitreous Art in the Art-treasures of the United Kingdom, Manchester Exhibition 1848, and Exhibition of Works of Industry of All Nations 1851*; Apsley Pellatt. *Curiosities of Glass-making* (1849); A. de Sauzay, *Marvels of Glass-making in all Ages*; English translation 1870; M. J. Laburte, *L'Histoire des Arts industriels au Moyen Âge et à l'époque de la Renaissance*, Paris; *Inquiry into the Treaty of Commerce with England* (in French, Paris, 1861); M. A. Cochin, *La Manufacture de St.-Gobain* (Paris, 1866); Peligot, *Douze Leçons sur l'Art de la Verrerie*, Paris; *Il Museo di Murano*,

Venice; Howells's *Familiar Letters from Venice*; Alexander Nesbitt, *Notes on the History of Glass-making*; *An Introduction to the Catalogue of the Collection of Glass formed by Felix Slade and presented to the British Museum* (privately printed, 1871); C. Beurath, *Die Glasfabrikation* (1875); Wagner, *Die chemische Technologie* (1888); Wagner, *Manual of Chemical Technology* (translated by Crookes from the thirteenth German edition; remodeled by F. Fiseher, 1892); Gerner, *Die Glasfabrikaiton* (1880); Graeger, *Handbuch der Glasfabrikation* (1868); *Dictionary of Applied Chemistry*, Thorpe, article *Glass*, by W. Ramsay (1891). Revised by Ira Remsen.

### Glass in Artistic Use.

(1) *Glass Vessels.*—Phials, small plates and saucers, open jars of small size, and similar objects are found in ancient graves in all the lands bordering on the Mediterranean. The pieces found in Egypt are certainly the oldest; and besides those aetually found intact, large quantities of fragments of broken vessels have been collected, and also paintings of what are certainly glass vases are to be seen on the walls of tombs and temples. It is then certain that as early as 3000 B. C., and probably 1,000 years earlier, the Egyptians were using vessels of glass both plain and ornamental. Some of these have the most varied colors fused together into the solid mass of opaque material, the colors arranged in zigzags, "comb" patterns, and spirals. Plain uncolored glass was used also, but it does not appear that the Egyptians had perfeetly transparent glass. The Phœnieians used similar glass vessels at least as early as the sixth century B. C., but these need not have been of Phœnician manufacture. The Phœnieians were rather merchants than artisans. It is, however, certain that glass was one of their manufactures at a later time, and that this industry was active in Syria and Palestine from the sixth century B. C. The glass found in tombs of the Græco-Roman period is rarely ornamented with color, but is exquisite in form. And it must be noted here that peoples who were especially careful about form, as the Greeks were, would not have been very eager to secure perfeet transparency for their glass. A very transparent object has no form, or none that can be seen and enjoyed. The glass of even the smallest and most delicate vases and phials was left full of bubbles and flaws and slight wavy and ropy irregularities of texture, and places of uneven thiekness and of non-uniform color, and assuredly this was better liked by the Greeks, and is immeasurably more beautiful than the clear and almost invisible glass produeed in modern times.

The Roman dominion over the Mediterranean brought with it the palmy days of decorative glass. Plain glass vessels of the loveliest Greek forms, jars of coloring as rich as the Egyptians had ever made in the days of their own antiquity, more remote for the Roman rulers than Roman antiquity is for us, and, with these, larger and more splendid vessels, adorned in fantastic ways with eolored material in the mass or added in twisted cords and spirals, buttons, bosses, and masks, were all in use. What we suppose to have been a discovery, new at this time, gave to the Romans objects of clear glass perhaps half an ineh thick in the very body of which, and seen through the transparent medium, were flowers and rosettes of vivid color. Tablets, slabs, and tiles were made in molds, with delieate bas-relief decoration of even elaborate figure compositions. Vessels were made with an outer shell or case of delieate lace-work, or of slender bars of glass forming a net or lattiee, through which the inner and solid shell shows in a prettily contrasting eolor. Solid opaque glass was made in close imitation of porphyry and other valuable stones. And the richest manufacture of all, and that involving the most elaborate and costly process, though not strietly one peeuliar to glass-making, is that cameo-work of which the most famous specimens are the Portland or Barberini vase in the British Museum and the lovely amphora in the National Museum at Naples. In these and similar pieees layers of glass of different colors are superimposed, much as the layers of onyx oecur, alternately blue and white, or black and white, or dark brown and white; the outer shell is then cut through by engraving, with the wheel, etc., as is done in the case of natural gem-cutting on a large seale, and the result is a raised design in one color, as, for instance, in white, on a smooth background of another color. In the two instances named above the raised pattern is an elaborate design of human figures, conventionalized trees, etc., in a charming Græco-Roman manner.

Apart from these rarities, the glass vessels in daily use, and those buried or deposited in *columbaria* with the ashes of the dead, are of wonderful beauty of form, and are an excellent lesson to the moderns whose taste is led astray by the constant presenee all around them of glass made by manufaeturing firms in uninteresting and even ugly shapes. The aneient plain glass when taken out of the ground has often a lovely iridescent surface which is the result of a eurious decay in its substance: the solid and partly transparent glass has turned to thin films, one upon another, so as to have lost much or all of its translueency, and this same change in its substance gives to it the beautiful play of color mentioned above. In many pieces where this change has not gone so far, and some translueency remains, one combination of color is to be seen when it is looked at by transmitted light and another when light falls upon it in the usual ways. The color effect may be generally blue in one light and perhaps orange in the other, having always beautiful gradations and veinings and an opaline play of color. But this is not a result of the glass-maker's art, it is only to be compared with the color of natural minerals, or perhaps the patina of bronze. Imitations of this double effect of color and of iridescence have been made in modern times.

In antiquity these glass vessels and slabs or tiles were made decorative, first, by the facility with which rich and delicate colors can be combined in patterns by means of the plasticity and adhesiveness of the glass when hot; second, by its tenaeity when in thin sheets and slender rods and threads, so that goblets and vases could be made as thin as desired, and could be adorned with the most airy and fragile appendages in the way of network and the like; third, by its fitness to be cast or pressed in a mold, when hot, for it keeps the form of the mold, not indeed as perfeetly as some metals, but still sufficiently; and fourth, by its gem-like hardness when cold, fitting it to be cut like rock crystal or chalcedony. But it was left for the latest days of the Roman empire, or even for the Byzantines, to bring out others of its virtues. Thus what is called enameling on glass is rather a Byzantine than a Roman art; the workmen of the sixth and following centuries brought it to great perfection, and the Saracens took this as they took their other decorative arts, ready made, from their Romano-Greek neighbors whom they were gradually displacing or subduing. Enameling can be done upon glass as well as upon metal, and in the beautiful Byzantine vases and so-called "Arab" hanging lamps of the mosques in Damaseus and Cairo very transparent enamels are generally used, so that a translucent pattern of great beauty and richness of color is obtained by very simple means. Another way of adorning glass is in a curious way identified with the Christian tombs of the fourth and fifth centuries, where many pieees or large fragments have been found. This is the insertion of a piece of gold-leaf between two thieknesses of glass while still hot and partly adhesive and plastic; the pieces of glass being joined the gold is left permanently brilliant in the interior of the mass. Nothing is easier than to engrave or cut the thin film of gold in characters before the glass is joined. This proeess was used also for making the tesseræ of mosaic-work. See Mosaic.

In the Middle Ages Damascus had a name for splendid glass vessels, as it had for rich stuffs and for sword-blades, but some of the cups called Damaseene may well have been either Byzantine or Persian. The Persians developed a speeialty of opaque enameling upon glass, so that very elaborate subjects were given in panels with patterns and traceries betweeu. And in the fifteenth century came the great days of Italian supremacy in art, and all the arts of glass of the ancients and of the Orientals were taken up and used freely and boldly by the Venetians. Glass-makers had followed their trade for several centuries in the eity and its neighboring islands, and especially in Murano, where the chief seat of the industry has always been, but the growth of wealth in Venice came with the growth of the desire of splendor in decorative appliances, and the fifteenth and sixteenth centuries saw the greatest development of art and industry in glass that we know of since the time of the Roman empire. It seems even that certain ways of ornamenting the nearly transparent and very thin glass of bowls and beakers were aetually invented by the Venetians, at least some of these unknown or rare among antique vessels or fragments are common in the more modern work. Thus the powdering and clouding with gold-dust, one of the most effective of all these ornamental proeesses, the well-known *aventurine* or gold-stone, in which particles of copper or brass are thiekly diffused in a brownish-yellow translucent

glass, and *vitro di trina*, in which threads of opaque white glass are embedded in the translucent paste, these being arranged so as to cross one another in different layers or strata; these and other such devices are rather mediæval than antique, so far as modern research has gone. In the sixteenth and seventeenth centuries very large pieces were made at the Murano glass-factories: chandeliers 5 feet high with many branches, mirror-frames most elaborately worked for the famous Venetian mirrors which were then of European fame, and large and tall vases—all of these adorned with sprigs of leafage, blossoms and buds, scrolls, masks in a variety of fantastic form and color impossible to describe, but generally harmonious and tasteful. The full success of the Venetian arts of glass lasted, in spite of the growing vogue of Bohemian glass and the taste for cut glass, until the fall of the republic in 1793.

The ornamental glass of Northern Europe was never at once so tasteful and so rich as that of Italy. In Germany in the seventeenth century very showy and elaborate drinking-glasses and covered tankards were made, some of them enameled in rich figure-subjects. In Holland and on the Rhine serviceable glass bottles and decanters of large size were made ornamental merely by the clear dark green of the glass and the very novel and fanciful forms into which they were modeled. The glass of Bohemia has been celebrated for 200 years, and it has had the merits of great clearness and of great perfection of make as to shaping, attaching the parts, etc., and a splendid red *flash* is freely used, but there is little to admire in its artistic design. In the Bohemian glass especial attention was given to engraving on the surface with the diamond, and etching with fluoric acid. Sometimes this was done on the crimson *flashed* glass, so deeply that the clear glass showed through the engraved lines. Sometimes the background was eaten away with the acid, so that the pattern showed in slight relief and polished, even if not of a different color, while the ground was left slightly rough from the acid. But the artistic merit of these engraved pieces has not been great. They represent a comparatively slight and unimportant art. Beautiful glass was made in Germany in the sixteenth and seventeenth centuries, more in the line of Venetian work, and in modern times constantly catalogued and sold as Venetian. Fine glass was made in France also, and many delicate and beautiful pieces of it remain in private collections; but for some unknown reason ancient French glass has been but little studied. In the latter part of the nineteenth century ornamental glass has been made in close imitation of all the less costly ancient styles, and even cameo glass, like that of the Portland vase, has been made, although with no serious rivalry of the old work. There has been a great deal of beautiful glass made since 1850 in vessels for table use and for pure ornament, and there have been attempts at carrying the work beyond or in different ways from the ancient designs. But the art is burdened by the fancy for inartistic cut glass, heavily gilded thick glass, engraved glass, etc.—tasteless styles, each of which comes in fashion by turns, or, in short, by the strength of the commercial spirit which finds profit in constantly changing fashions and the general demand for the new and the sumptuous.

(2) *Windows.*—Colored glass in thin sheets can be so used for windows that each window will be a beautiful object when seen by transmitted light. Uncolored or very lightly tinted glass can be used also in a highly decorative way by simply arranging the separate pieces in ornamental pattern. In other words, a translucent mosaic of strong colors or of very pale tints is capable of effective use in connection with the architectural decoration of interiors. Such are the windows in some mosques and some private houses of Cairo and other Eastern cities, in which a slab of plaster has been pierced with openings large in proportion to the solid bars left between them, and so arranged as to suggest flowers, cypress-trees, or simply anthemions and scrolls, these openings being then filled each with one piece of glass, the different tints of the pieces of glass producing a vigorous effect of color. Such also are some windows of mediæval Europe and some modern ones. Such windows of European make are, however, always put together with I-shaped strips of lead, which are capable of taking any curve, and are easily secured one to another. This lead sash, being much more slender than the plaster strips, is sometimes ignored in the design, and parts of it cover and interrupt the pattern at will. It may also be used as a strong outline is used in drawing, to aid the design. European work has, however, rarely been limited to a mere mosaic of pieces of glass used without other manipulation than cutting them and fitting them together. From the earliest times that such windows are known to have been in use they have commonly been painted in such a way as to give them a more or less pictorial effect beyond the range of the simple translucent mosaic. Thus although the earliest ornamental windows of which we have any certain record are of the eleventh century, those of the twelfth century, which are the earliest still existing, are quite elaborately painted.

The pigments put upon the glass are of course those capable of being fixed by the heat of the furnace, like those used in painting china and pottery or like enamel. A very ancient recipe for these pigments describes a mixture of powdered glass with copper burned to a powder, i. e. an oxide of copper. This would be sufficiently translucent to allow of a good deal of variety in the modeling. When laid on thinly it would only modify the color in a slight degree; when put on in thick masses it would be practically opaque. This is indeed the character of the modeling color of the twelfth and thirteenth century windows, and a similar quality is required of the pigments used in modern times. Thus in the few undoubted pieces of twelfth-century glass which exist, and in like manner in windows of the last quarter of the nineteenth century, a row of "pearls" or "beads" is often obtained by painting solidly on a narrow strip of translucent glass, leaving untouched only the small circles desired, while a face or a hand is outlined by similar solid painting and then modeled by means of the same paint put on in thin and carefully graded tints. In the twelfth century work the gradation of the tints is of extraordinary delicacy, and it is used with extreme reserve. A panel of that epoch, such as the *Crucifixion* or the *Legend of St. Gamaliel*, of Châlons-sur-Marne, or the *St. Eustache* window of the Cathedral of Sens, shows considerable surfaces of wholly unpainted glass, and the tints used for modeling faces and hands and folds of drapery are all very thin and very delicate in gradation. Where solid and nearly opaque painting is applied it is to throw out a figure or a group of figures by contrast. Thus a *Crucifixion* in a splendid window of the early years of the thirteenth century in the Cathedral of Poitiers has all the figures most elaborately and minutely rendered, with the details of dress and weapons in thin painting, and all this is thrown out in vivid contrast by a nearly opaque background made by putting on the same or a similar pigment in a thick coat. In this way the light comes into the interior through the sacred picture itself, as if the figures themselves were radiant; and we can imagine that this fancy pleased the mediæval designers. The letters of sacred legends and texts were in the same manner taken out in clear glass on an opaque background. These letters are often simply cleaned out with the handle of a paint-brush, as is evident from their appearance, and as, indeed, an early treatise on glass-painting suggests may be done.

A rich window is therefore a mosaic of pieces of glass, varying in size from a square inch to perhaps 2 sq. feet, each piece having its own color either permeating its whole substance or, as in the case of some red glass, put on by *flashing*—that is, a film of the colored glass united to a thicker plate of uncolored glass. Each piece may be and generally is so chosen as to offer a good deal of variety of tint in its own surface. Rich glass for windows is purposely made extremely uneven in texture, with ripples and bubbles in its substance, and of varying thickness and consequently varying depth of color. The translucent mosaic so built up is then commonly painted with the brush, partly in opaque pigment used to stop the light from passing through, partly in pigment of the proper colors put on thinly so as to give a modeling of surfaces, as when flesh or drapery is to be represented. Now it is obvious that no painting on a wall, on a wooden panel, or on canvas is at all of this nature. Even a mosaic of tesseræ of glass (see Mosaic) is wholly different in character. A robed figure in a fresco or a mosaic is intended to be as suggestive as possible of the personage it stands for, while still a fitting part of the decorative design; but a similar figure in a window must primarily transmit light freely, and should have no more modeling, no more solidity of appearance, no more verisimilitude than is compatible with this transmission of light. If we can imagine a mosaic made for a very dark corner, especially designed so as to catch and reflect all the light possible and so illuminate the darkness, we can see in that some slight relation to the figured window. But the mosaic might have

darker figures on a lighter ground or on a gold ground, as in St. Mark's at Venice. The window, on the other hand, must not have dark figures on a light ground. It is and must always be the figures which are relieved in brightness on a darker ground if any such distinction at all is to exist, for how else would the details of the figures, the lineaments, the ornaments, and the folds of drapery be visible? But as the very subject of the design, whether a story with human figures or a merely ornamental pattern, must itself transmit light freely, another very important and in a sense very surprising limitation is found to exist in the power of certain colors to spread or extend in appearance beyond their actual limits, somewhat as bright light seems to eat up the outline of an object seen from the side away from the source of light. Blue is much the most powerful color in this respect. If a piece of vividly blue glass is surrounded by red glass with no separation except the strips of lead, the blue will invade the red on every side and will turn it to a brownish purple of no great beauty, while wholly destroying the apparent shape of the pieces of glass and therefore the character of the design. Similar phenomena exist in the opaque color of a painting, but much less noticeable and much less important. (See PAINTING.) In glass it is so formidable that it has been wisely said that the mediæval development of glass-painting has been a constant study "to control the blue," blue being much the most rayonnant of colors as well as the most important element of light in a translucent color-design. It appears, then, that no primary and obvious reason exists for painting a window as one would paint a picture on plaster or canvas or wood. The essential conditions are different. There are some restrictions which this art shares with other kinds of decoration, such as the absence of cast shadow, which it shares with the painting of miniatures in manuscripts (see ILLUMINATION) and with the mosaic of the great times; and the prohibition of elaborate perspective with distance and middle distance, etc., which prohibition applies equally to bas-relief, to inlay, and to wall-painting where the architectural surroundings require the wall itself to retain its solid individuality. But the other limitations mentioned above are peculiar to ornamental windows. If a figure of life size is to be introduced into a window the first necessity is that the colors of all the drapery and the flesh and hair shall act together in harmony with each other and with the surroundings; and the second necessity is that the different parts shall be so designed that the radiating power of the colors, as this will appear at the average distance of the window from the spectator, shall help rather than hinder the effectiveness of the drawing. As to this second requirement, it may be exemplified in this way: A limb will be drawn more slender than the truth, because the light pouring through the more translucent glass which stands for that limb will eat away the outline and the darker surface all around and give the limb its proper size; moreover, the articulations, as the knee, the knuckles, etc., will be strongly indicated by a few touches and the more delicate details ignored, because the light, transmitted and not reflected, would not allow a more minute rendering to be seen. A fine window seen at a distance of 6 feet ought to look strangely exaggerated and even distorted in the drawing of its figures, and the cartoon for it should look still more exaggerated. No doubt much is done by the artist in the posing of his figures, the avoidance of the relief of a slender light member on a darker ground, and the like, to avoid great seeming oddity of design, and this the more carefully that the window will inevitably be seen from more points than one and also from different distances.

Such work as remains from the later years of the twelfth century and the beginning of the thirteenth shows an almost perfect understanding of the problem, and is in many respects the most admirable of all ancient glass. Besides the pieces named above, there remain others of the twelfth century at St. Remi of Reims, in the choir, some panels at the cathedrals of Strassburg and Le Mans, and three windows in the west front of Chartres. That of the later years of the thirteenth century is sometimes fine; but colored windows were then the most popular of all the means of interior decoration, and an immense number were made of a very inferior style. The Cathedral of Chartres contains the most splendid group of windows of the best character of this period—there are fifty-five of them, and repairs and restorations have not greatly marred their original beauty. At Reims cathedral the northern rose-window and many of the clerestory windows are of this epoch, as are a large number at the cathedral at Bourges; these last are very famous, but are perhaps of a less perfect style. The celebrated windows of the Sainte Chapelle at Paris are peculiar in being composed of a multitude of small panels with diminutive figures, not more than 20 inches high; each panel is a most interesting study of conventionalized action and incident, an admirable school of decorative composition, but the general effect of the windows is less tranquil and dignified than in other pieces of the same epoch. The early part of the fourteenth century brought with it a great increase in the number of uncolored decorative windows, windows in *grisaille*, as they are often called, that is, those in which the uncolored but rough and not perfectly translucent glass is arranged with its lead sash-wire in patterns of some significance, and is then painted with the usual pigments of negative and pale color in such a way as to produce leaf-patterns and the like in the spirit of the decoration of the time, but all in a pale-gray or milky tone. These *grisaille* windows are, however, often adorned with small patches of bright color. There are instances also at this time of a style which became very prevalent later, where panels of figure-subject in full color are set in larger surfaces of *grisaille*. In the fourteenth century, and still more in the fifteenth, designing in glass followed its natural course to agree with the arts of the time. It had been taken up in Italy as a part of the Gothic art brought in from the north; and at a time when full colored glass was rare in France splendid windows were made in Italy, some of them with all the signs of the reviving classic taste of the Renaissance. Examples of this style, dating from the middle of the fifteenth century, are to be seen in the Cathedral of Florence. But in the north there is rather to note a growing desire for more light in the interiors, and, from this reason and for economy, less strong color and more pale tints in the glass. With this came the demand for other than biblical or legendary subjects, and for a realistic treatment of all subjects alike, somewhat in the spirit of the book-decoration of the time. Admirable artistic judgment was shown by the glass-workmen: they had to represent scenes with many figures and a good deal of incident; portraits of the donors of the glass and of dignitaries of the time, and imaginary portraits of kings and saints of former times, had to be included, and in ordinary picture-painting this would involve the use of perspective and of distance seen in the background, in a way not to be followed in glass. So the difficulty was settled by treating the whole as a bas-relief is treated—that is, by design in one plane. The figures, in a generally light tone of color, and most skillfully painted in semi-transparent gradation, are seen upon a light ground, sometimes painted with an elaborate pattern like a piece of brocade, sometimes architectural, and often representing the interior decoration of a hall with pillars and paneling, and even open windows through which tree-tops and sky are shown. Windows of this style are to be seen in the Cathedral of Troyes, in St.-Ouen at Rouen, in St.-Nazaire at Carcassonne, and at Fairford church in Gloucestershire. Sometimes in simpler work the single standing figures of saints or princes are in a mosaic of pale, bright colors, with very little painting, and incrusted in an absolutely unadorned surface of light-gray or pale-green rough glass, set in a simple diaper pattern of squares and lozenges.

When the efforts to revive the art of glass began, about 1840, very false ideas about decorative art prevailed, and little of the work done since that time has been successful. In France some excellent work has been done since 1855 in the way of direct imitation of the ancient glass, as when a window-opening has been filled with new glass to correspond with the old glass in the next one. In Great Britain the efforts to regain the feeling of the mediæval artists, made necessary by the GOTHIC REVIVAL (*q. v.*), resulted at length in some very interesting work of strictly archaic character, the legends and personages of church history being shown in a style as nearly like that of the fourteenth century as was possible to artists of greater knowledge of anatomy and greater technical skill, although of inferior power of ornamental design. It seems to have been reserved for some artists in the U. S., during the period from 1870 to 1893, to make a serious advance in this art. No very large amount has been produced as yet; and visitors to the large cities of the U. S. might fail to meet with any examples of this the best decorative work that has been done, but even a score or two of very elaborate windows and a hundred or two minor examples suffice to show the importance of the new departure. The principles involved are perhaps these: First,

the use of but little applied painting, the work being in the main a purely translucent mosaic; second, the use of a very great number of colors, obtained either by the manufacture of glass of many hues or by *plating*, which will be spoken of below; third, the use of the *leading* or dark leaden sash-wire, as an important help to the design, its strong line serving as a kind of delineation in support of the color-composition, and its opacity serving to re-enforce color and to give effect of shade. A simple specimen of this art would be a group of parrots or macaws or cockatoos variously dispersed over a surface of about 20 sq. feet, with their perches or bars or rings, all relieved upon a ground of mottled and irregular grayish blue, the whole design one blaze of intense and vivid color, and yet so translucent as to serve as a window for lighting an interior. An elaborate specimen would be a large circular window in which is represented the *Ascension*, the Savior surrounded by a glory of angels, no painting whatever being visible except in the faces, the naked arms, etc., and the whole elaborate color-composition, covering perhaps 300 sq. feet, worked out by means of a thousand different colors of translucent glass. For this modern work glass is made in a great variety of colors; irideseence is obtained in what is called opaline glass, not highly translucent, milky in appearance, and showing different colors by transmitted light from those which it has in reflected light; small projecting bosses of vivid color are used to make strong points in the design by means of their high refracting power. Plating, alluded to above, was done in the sixteenth century by fixing thin layers of colored glass to one another in the furnace, as the red flashing is applied to a plate of uncolored glass. The workmen would take such a red flashed piece, and apply to it a very thin layer of blue, this producing a purple of almost any desired tint. This with all other known devices has been used in recent times; but plating, as generally practiced, consists in fixing thin pieces of glass one over another in the lead sash. The artist who is composing the window, with his cartoon before him, takes up piece after piece of glass from among the hundreds of different colored sorts which he has at hand, and combines two, three, or four of them, until he finds the exact color he is in search of. These pieces are then handed to the workmen to be mounted up in the window in exactly that combination. This device, which gives an almost infinite freedom to the designer, has perhaps the fault of lack of durability, but of that we can not yet be certain. It allows of such unexampled splendor of effect that every possible expedient for its protection would be justified, even to the setting of a complete window of clear glass outside to protect the colored window from the weather.

Bibliography.—For glass vessels, see the works on classical archæology and on decorative art named under Ornament; see also Deville, *Histoire de l'Art de la Verrerie dans l'Antiquité* (1873); Labarte, *Les Arts Industriels*; *Catalogue of the Collection of Glass formed by Felix Slade* (1871), containing an introduction and notes; W. Froehner, *La Verrerie Antique* (1879); *La Collection Spitzer*, 6 vols. folio. For windows, see Langlois, *Essai sur la Peinture sur Verre Ancienne et Moderne* (1832); F. de Lasteyrie, *Histoire de la Peinture sur Verre d'après ses Monuments* (1852); Winston, *Inquiry into the Styles of Ancient Glass Paintings, especially in England* (1867); Magne (Lucien), *L'Œuvre des Peintres Verriers Français*, a valuable work with latest and safest conclusions clearly stated in its introductory pages; Viollet-le-Duc, *Dictionnaire Raisonné de l'Architecture Française*, article *Vitraux*; and for illustration, see besides the above Decloux and Doury, *La Sainte Chapelle du Palais*; Martin and Cahier, *Vitraux Peints de Saint-Étienne de Bourges* (1841–44); Hucher, *Vitraux Peints de la Cathédrale du Mans*; *Monographie de la Cathédrale de Chartres*.

Russell Sturgis.

**Glass-blowing**: See Glass.

**Glasschord**: See Harmonica.

**Glass-crab**: a name given to the young of the spiny lobsters (*Palinurus*, etc.) on account of its transparent character. These young are very thin and leaf-like, and formerly were regarded as adults and described as belonging to a genus *Phyllosoma*. J. S. K.

**Glass'ites**: the followers of John Glass (1695–1773), a Scottish minister; b. at Auchtermuchty, Sept. 21, 1695; graduated at St. Andrews; became pastor at Tealing, Forfarshire, 1791. Identifying the Church with the kingdom of heaven, and inferring that the Church ought to consist only of truly spiritual Christians, he formed a society (1725) separate from the multitude; and this *ecclesiola in ecclesia* continued to cling to its "overseer" even after his deposition by the assembly (1730), and in course of time developed quite a number of peculiarities in doctrine, discipline, and worship. In 1730 he removed to Dundee. His followers were called Glassites. In 1733 he removed to Perth, and there he was joined by Robert Sandeman, who was destined to be his son-in-law and to give his own name to the sect (see Sandemanians). D. in Perth, Nov. 2, 1773. His works were published in Dundee (5 vols. 8vo, 1782–83).

**Glasson**, Ernest Désiré: See the Appendix.

**Glass-snake**: a name applied to a peculiar lizard (*Ophiosaurus ventralis*) of the Southern U. S. The outward resemblance to a serpent is very striking, owing to the total absence of external limbs and the very elongate body, but the animal is nevertheless a true lizard, and has no affinity with the snakes. The tail is readily broken by a blow, or even by rough handling, and from this fact and its snake-like appearance the popular name is derived. As in other lizards the tail may be reproduced, but the lost backbone is represented by a granular, cartilaginous rod. The glass-snake attains a length of 2 or even 3 feet, is green above, with black markings, and yellowish below. The name is sometimes given to limbless lizards of the genus *Pseudopus*, found in Southern Europe and Asia. F. A. Lucas.

Glass-snake.

**Glass, Soluble**: See Water-glass.

**Glass-sponges**: various species of sponges belonging to the genera *Hyalonema*, *Holtenia*, *Pheronema*, *Euplectella*, etc., of the family *Hexactinellidæ*. They form a firm skeleton of hyaline six-rayed siliceous spicules (see Sponges), which, when the fleshy portions are washed away, remain hanging together, forming a framework resembling the finest spun glass. In some forms there is in addition a cable formed of long siliceous spicules which serve to anchor the sponge to the bottom of the ocean. *Euplectella aspergillum* of the Philippines is the Venus flower-basket sponge of dealers, while *Hyalonema sieboldii* of Japan is the most common glass-rope sponge. All the glass-sponges are inhabitants of deep water; they are related to the fossil sponges (*Ventriculites*) of the chalk. J. S. Kingsley.

**Glass Staining** and **Painting**: See Glass.

**Glas'tonbury**: town of England; county of Somerset; 36 miles S. of Bristol (see map of England, ref. 13–F); with some interesting remains of a once celebrated Benedictine abbey. Joseph of Arimathea is said to have journeyed to Britain and built a church at Glastonbury. The abbey was certainly one of the earliest ecclesiastical institutions of England, and it flourished uninterruptedly down to the time of the Reformation. Many writers believe that the mythical isle of Avalon was originally identical with the peninsula where Glastonbury stands. The river Brue flows by the old town, which was anciently an episcopal city. There are manufactures of pottery, mats, rugs, and gloves. Pop. (1891, with its registration district) 11,897.

**Glatz**, glăats, or **Glas**, glăas: town of Prussia, in the province of Silesia, on the Neisse; 58 miles by rail S. S. W. of Breslau. It is strongly fortified, and has extensive manufactures of damask, linen, ribbons, plush, leather, and cigars. Pop. (1890) 13,501.

**Glauber's**, glaw'berz, **Salt** [Germ. *Glaubersalz*, named from the German chemist J. R. Glauber (d. 1668), who first prepared it]: called formerly *sal mirabile*, the neutral sulphate of soda ($Na_2SO_4.10H_2O$), a salt found native in sea water, in mineral springs, and especially in the alkaline soils and waters of the Western plains and mountains of the U. S. It was formerly much used in medicine as a cathartic, but is now so employed chiefly in veterinary practice. In the arts its formation takes place on a very extensive scale during the production of carbonate of soda from common salt. The sulphate is converted into the carbonate of soda by various methods. See Soda-ash.

**Glauchau**, glow'khow: town of Saxony; on the Mulde; 20 miles by rail W. of Chemnitz (see map of German Empire, ref. 5–G). It is picturesquely situated, and has very extensive manufactures of woolen goods, carpets, paper, and different kinds of machinery and hardware. Pop. (1895) 28,133.

**Glau'cias** (in Gr. Γλαυκίας): a bronze-founder of Ægina; flourished about 490–470 B. C.; celebrated for his statues of combatants in the games. He cast the chariot and a statue of GELO (*q. v.*), the tyrant of Syracuse and conqueror in the chariot-race at Olympia in 485 B. C.; made statues of the wrestlers Philo of Corcyra, and Glaucus of Carystus (the exact date can not be fixed), and also of Theagenes the Thasian, conqueror at the Olympic games in 480 B. C. See Brunn, *Geschichte der Griechischen Künstler*, i., p. 83 (Brunswick, 1853).—A physician of the Empiric school; teacher of Heraclides of Tarentum, and one of the earliest interpreters of the writings of Hippocrates, the difficult words in which he arranged in a sort of lexicon, in alphabetical order, but too much in detail, as EROTIAN (*q. v.*) implies in referring to the work in his own glossary, still extant. J. R. S. STERRETT.

**Glauco'ma** [Gr. γλαύκωμα, glaucoma, deriv. of γλαυκός, bluish green, light blue, gray—so called from the greenish or bluish tint of the pupil in this disease]: a disease characterized by increased intraocular tension, caused by the augmented volume of the vitreous and aqueous humors. It is marked by a gradual loss of sight and by pain, often very intense. It is acute or chronic. The ophthalmoscope affords the surest tests of its existence. It is a disease of advanced life, and very frequently leads to complete blindness. The best treatment begins in the early performance of iridectomy, which sometimes arrests, and almost always palliates, the symptoms. Revised by WILLIAM PEPPER.

**Glauconite** [deriv. of Gr. γλαυκός, bluish green, gray]: a mineral of green color occurring abundantly in Secondary and Tertiary greensands and chloritic marls, and composed of silica 46 to 56 per cent., ferrous oxide 20 to 25 per cent., potash 5 to 13 per cent., alumina 4 to 14 per cent., and water 0 to 10 per cent.

**Glaucus** (in Gr. Γλαῦκος): the name of several personages. (1) A bronze-founder of Chios, according to Herodotus, though others assign him to Samos. He was said to have invented the art of soldering bronze and of tempering it by fire and water. His most famous work was the celebrated bronze base, on which was placed a silver vase, dedicated by Alyattes II., King of Lydia (617–561 B. C.), to Apollo at Delphi. The work was spoken of with admiration by Herodotus, and Pausanias (x., 16, 1) gives an accurate description of it (the silver vase had disappeared in his time—180 A. D.). The base was of such superior workmanship that it gave rise to the proverb Γλαύκου τέχνη. (See Brunn, *Geschichte der Griechischen Künstler*, i., pp. 29–30, Brunswick, 1853.) (2) A sea-god, who followed after the ship Argo and prophesied to the heroes on board. Originally he was a fisherman of Anthedon in Bœotia, and was one day assorting his fish on a grassy bank that had never been trodden by man nor grazed by cattle. Suddenly the dead fish leaped up and sprang into the sea. This was due to a life-giving weed of which Glaucus had no sooner eaten than he too sprang into the sea. The gods of the sea purified him from mortality and made him immortal. He fell in love with the mortal maiden Scylla, who repulsed him. He consulted Circe, who fell in love with him, and to rid herself of Scylla mixed poisons in the water of the sea where Scylla bathed daily. Scylla waded in only up to her thighs; her legs were changed by the poisoned water into horrid dogs, while her upper body remained that of a beautiful maiden. (See Gädechens, *Glaukos der Meergott*, Göttingen, 1860; Vinet, *Recherches et conjectures sur le Mythe de Glaucus et de Scylla*, Paris, 1843; Roscher, *Lexicon* under *Glaukos*.) (3) Son of Minos, King of Crete, who when a child fell into a vessel of honey and was drowned. Minos compelled the seer Polyidus to restore Glaucus to life, and to instruct him in the art of prophecy. Polyidus did this under compulsion, but he also caused Glaucus to forget his instructions. (See Höck, *Kreta*, Göttingen, 1829; Roscher, *Nektar und Ambrosia*, Leipzig, 1883; Gädechens in *Arch. Zeitung*, 1880, p. 69 f.) (4) Son of Sisyphus, King of Corinth and father of Bellerophon, who in defiance of the laws of Venus tried to make his horses strong by preventing them from copulating. Venus caused him to be torn in pieces by his horses, whom she had made mad by the water of a sacred fountain, or by a weed. The spirit of Glaucus afterward made horses shy during the Isthmian games. The myth was treated by Æschylus. (See Hermann, *De Æschyli Glaucis dissertatio*, 1812; and Welcker, *Die Äschylische Trilogie Prometheus*, p. 561; Völcker, *Mythologie des Jap. Geschlechtes*, p. 126 f.) (5) A companion of Sarpedon, nephew of Bellerophon, leader of the Lycians and one of the bravest of the allies of the Trojans. When Glaucus and Diomedes were about to fight they discovered that ancestral ties of hospitality bound them together, so that they separated in peace after exchanging their armor, Glaucus giving his priceless golden armor in exchange for the bronze armor of Diomedes, which gave rise to Homer's χρύσεα χαλκείων, words destined to become proverbial for all time. Glaucus is finally killed by Ajax. (6) Glaucus, the author of six small poems in the Greek *Anthology*. (7) A famous athlete of Carystus, who won numerous victories in all four of the games of Greece. The exact date of his victories is not very certain, the chief determining factor being the fact that his statue as Olympic victor was made by GLAUCIAS (*q. v.*). J. R. S. STERRETT.

**Glaux** [Mod. Lat., from Lat. *glaux* = Gr. γλαύξ, used by analogy of γλαύξ, owl, instead of the more correct γλάξ, milk-vetch]: a genus of primulaceous plants, represented on the North Atlantic shores of Europe and America by the *G. maritima*, a little fleshy perennial, which also grows beyond the Mississippi, to the northwestward. Its fleshy leaves make good pickles.

**Glazebrook**, RICHARD TETLEY: See the Appendix.

**Glazier**, WILLARD: See the Appendix.

**Glazounoff**, ALEXANDER: See the Appendix.

**Gleason**, FREDERICK GRANT: musician; b. at Middletown, Conn., Dec. 17, 1848. He early developed a talent for music, and by his sixteenth year he had written two works, an oratorio, *The Captivity*, and a Christmas oratorio, which, though crude, showed talent. He studied at Hartford, Conn., under Dudley Buck, and then went to Leipzig, and in 1870 to Berlin. He also studied English music in London. Returning home, he became an organist in Hartford, Conn., and in 1876 went to Chicago, where he has since remained, teaching, composing, and acting as music critic for *The Tribune* of that city. His compositions include two operas, *Otho Visconti* and *Montezuma*; three cantatas, *God our Deliverer*, *The Culprit Fay*, and *Praise of Harmony*; several trios, sonatas, and other works, as well as many songs and other smaller pieces. D. E. HERVEY.

**Glebe** [from O. Fr. *glebe*, glebe < Lat. *gle'ba*, clod, lump of earth]: in English and Scottish ecclesiastical law, the land which belongs to a church. It constitutes a part of the revenue of a benefice, and is vested in the incumbent. By statute certain commissioners have power to ascertain and define the boundaries of the glebe-lands of any benefice, or, with consent of the ordinary or patron, to exchange them for other lands, either in the same or an adjoining parish.

**Glede** [M. Eng. *glede* < O. Eng. *glida* ( : Icel. *gleða*), kite, deriv. of *glīdan*, glide]: a bird mentioned in the authorized English version of the Bible under this name; generally believed to be the common kite (*Milvus regalis*) of the Old World, though some authorities make it some species of vulture.

**Gledit'sia**, or **Gledit'schia** [Mod. Lat., named for the German botanist J. G. Gleditsch (1714–86)]: a genus of trees of the family *Leguminosæ*, represented in the U. S. by the honey-locust (*G. triacanthos*) and the water-locust (*G. aquatica*). Although it shares the name of locust with the *Robinia pseudacacia*, it differs widely from that tree, especially in its more compound leaves, small leaflets, compound thorns, large flat pods filled when ripe with a sweet honey-like substance, and its inconspicuous flowers. It is a good hedge-plant and an ornamental tree. Its timber is very heavy, resembling that of the common locust, but coarser. The water-locust is a small tree growing in swamps in the West and Southwest. There are one or two North Asiatic species. (See LOCUST.) Linnæus spelled the name as given first, but many botanists follow the second spelling.
Revised by CHARLES E. BESSEY.

**Glee** [M. Eng. *glee*, *gleo* < O. Eng. *gle'o*, joy, mirth, music < Indo-Eur. *ghleu-* > Gr. χλεύη, jest, joke: Russ. *glumitŭ*, to jest; Lith. *glaudas*, amusement]: a species of musical composition in three or four parts, and usually of two or more movements; originally written for voices without instrumental accompaniment. It is of English origin, and appears to have sprung from the old part-songs and madrigals which were furnished in abundance by the composers of the sixteenth and seventeenth centuries, and were commonly used on occasions of joy and festivity, as well as for social entertainment in private circles. By degrees the distinctive marks of these several classes of compositions have been

more or less obliterated, and the name *glee* is given, in a broad sense, to almost any secular part-song.

Revised by Dudley Buck.

**Gleet**: See Gonorrhœa.

**Gleichenia'ceæ**: See Fernworts.

**Gleig**, gleg, George Robert, M. A.: author; b. at Stirling, Scotland, Apr. 20, 1796; son of the Bishop of Brechin; educated at Glasgow and Balliol College, Oxford; entered the army in 1812; served in Spain against Napoleon 1813, and in the U. S. in 1814, and was badly wounded near Washington, D. C.; took orders in the Church, and after receiving several preferments was made chaplain-general of the British army in 1846, which office he resigned in 1875. In 1848 he became a prebendary of St. Paul's. Author of many historical and other works, among which are a novel, *The Subaltern* (1825); *History of British India* (4 vols., 1831–33); *Family History of England* (3 vols., 1836–54); a one volume *History of England*; a laudatory *Memoir of Warren Hastings* (1841); *Military History of Great Britain* (1845); *Campaigns at Washington and New Orleans* (1847); *Life of Clive* (1848); *Life of Wellington* (1862), etc. D. near Winchfield, Hampshire, England, July 9, 1888.

**Glencoe**, glen-kō': a valley of Argyleshire, Scotland; the scene of the massacre of a number of the Macdonalds. The Highlanders who had favored James II. and showed great reluctance to submit to the rule of William III. and Mary were promised full pardon if their submission were tendered before Jan. 1, 1692. The Macdonalds had shown themselves particularly offensive, but finally submitted. Sir John Dalrymple, Master of Stair, taking advantage of a technical irregularity in the form of their submission, obtained a warrant from King William to extirpate the tribe. Accordingly, Capt. Campbell, of Glenlyon, with 120 men, quartered in Glencoe, and was hospitably received by the Macdonalds. A fortnight later, Feb. 1, 1692, he attacked his hosts without warning, and sixty men were slain. About three-fourths of the tribe escaped under cover of a violent storm, but many of the women and children perished from exposure to the piercing cold.

**Glencoe**: village (founded 1854); capital of McLeod co., Minn. (for location of county, see map of Minnesota, ref. 9–D); on Buffalo creek and on the Chi., Mil. and St. P. Railway; 60 miles W. of St. Paul. It is in an agricultural region, and has several flour-mills, but no other manufactures. It also has 7 churches, 3 denominational and 2 public schools, 3 banks, and 2 weekly newspapers. Pop. (1880) 1,078; (1890) 1,649; (1900) 1,780. Editor of "Register."

**Glendive**: town; capital of Dawson co., Mon. (for location of county, see map of Montana, ref. 5–L); on the Yellowstone river and on the North Pac. Railroad; 55 miles N. E. of Miles City. It has become an important shipping point for a large agricultural and stock-raising region, and contains 2 banks and 1 weekly newspaper. Pop. township (1900) 1,435.

**Glen'dower**, Sir Owen (*Owain Glyndwr Du*): great-grandson of Llewellyn, the last Welsh monarch; b. in Merionethshire, Wales, about 1350; studied law; was made a barrister of London, became an esquire of Richard II.'s guard, and in 1387 was knighted. He was present when Richard surrendered himself to Northumberland, but after the deposition of the king he retired into private life. Hardly, however, had Henry IV. ascended the throne before Reginald took forcible possession of a piece of waste land which had been settled by the court to be the property of Owen, and neither the king nor the Parliament, to whom Owen appealed, was found willing to do him justice, though the Bishop of St. Asaph solemnly warned them that all Wales might rise in rebellion. Henry IV. had a grudge against Owen, and on an unfounded suspicion he even went so far as to deprive him of the estates he held from the crown and give them to Reginald. But when the latter tried to take possession of the estates, Owen mustered all his followers to offer resistance, and when the king took the side of Reginald, all Wales rose in rebellion in behalf of Owen. In 1400 Owen struck the first blow by burning Ruthin, and the king's invasion of Wales with a large army had no effect, as Owen retired into the mountain-fastnesses. His great victory over Mortimer (June 22, 1402), his formal proclamation as Prince of Wales, and his alliance with France made the king much alarmed. But in 1403 Prince Henry—afterward Henry V.—at the head of a large army defeated Percy at Shrewsbury. In the spring of 1405 Prince Henry defeated Owen twice. Nevertheless, when, in July, a considerable French force under the command of Huguenville landed at Milford Haven, Owen was able to join them with a respectable number of troops. The allied force moved toward Worcester, where the king stood; but no battle was fought, and the French troops returned home without having done anything. Owen, however, continued the war, and, though his power greatly decreased, he never submitted. Henry V. finally offered him full pardon. Authorities disagree as to the time of his death, which occurred in Monmouthshire probably after 1415. Revised by C. K. Adams.

**Glenelg'**: a river in Victoria, Australia. It rises in the Grampian Mountains, passes into South Australia, and after a course of 281 miles falls into the Southern Ocean E. of Cape Northumberland.

**Glen Roy**: a deep valley in the Highlands of Central Scotland, Inverness-shire; drained S. W. by the Roy into the Spean. On the slopes of the glen are several distinct shore-lines, known as the "Parallel Roads of Glen Roy"; the uppermost is 1,149 feet above sea-level, the others are somewhat lower. These "roads" mark the shores of a temporary lake, formed when the mouth of the glen was closed by a great stream of ice during the glacial period; the higher shore-line agrees closely with the level of the pass (1,151 feet) at the head of the glen, by which the waters of the lake were discharged E. into river Spey. Glen Gloy, next N. W. of Glen Roy, has a similar shore-line at 1,165 feet, and Glen Spean has less distinct lines at a height of 857 feet. W. M. Davis.

**Glens Falls**: village; Warren co., N. Y. (for location of county, see map of New York, ref. 3–J); on the Hudson river, between Saratoga Springs and Lake George, and on the Delaware and Hudson Canal Company's Railroad; 50 miles N. of Albany. It is noted for its water-power, mills, lime, black marble, canal, water-works, beautiful fountain, handsome soldiers' monument, and cave. It has a large iron-foundry, machine-shop, gas-works, paper-mill, stone sawing-mill, brick and terra-cotta works, several large sawmills run by water-power, a number of lath-mills, steam saw and planing mills, plaster-mills, and about thirty lime-kilns, which turn out more than 480,000 barrels of lime annually. It also contains Glens Falls and St. Mary's Academies, a union school, an electric street railway, 2 electric-lighting plants, opera-house, 3 banks, and 3 daily and 4 weekly newspapers, and a permanent summer school for teachers, for which the citizens erected a fine building. Pop. (1880) 4,900; (1890) 9,509; (1900) 12,613. Editor of "Star."

**Glenwood**: city (settled as a town 1846; made county-seat 1853); capital of Mills co., Ia. (for location of county, see map of Iowa, ref. 7–D); on the Chi., Burl. and Q. Railroad; 20 miles S. E. of Council Bluffs. The principal industries are farming, fruit-growing and shipping, and canning of vegetables. The city has a court-house, city-hall, armory and hall, water-works with supply from artesian wells, and electric street lighting, and contains 6 churches, 2 public schools, the State Institution for Feeble-minded Children (which has an annual average of 450 inmates), 2 banks, and 3 weekly and 1 semi-monthly periodicals. Pop. (1880) 1,793; (1890) 1,890; (1900) 3,040.

Editor of "Opinion."

**Gleyre**, glār, Charles Gabriel: figure-painter; b. at Chevilly, in Switzerland, May 2, 1806. Pupil of Hersent, Paris; medals, Salons, 1843 and 1845. He was a good draughtsman and popular instructor in Paris. Important works by him are in the museums at Basel and Lausanne; *Lost Illusions* (1843) is in the collection of W. T. Walters, Baltimore, Md. D. in Paris, May 5, 1874. W. A. C.

**Glinka**, glin'kăă, Michael Ivanowitch: composer; b. at Smolensk, Russia, May 20, 1804. He is one of Russia's greatest composers. His opera *Life for the Czar* is his greatest work, and is highly popular in Russia. It contains some national Russian melodies. D. in Berlin, Feb. 15, 1857.

D. E. H.

**Glio'ma**, plur. **Gliomata** [Mod. Lat., deriv. of Gr. γλία, glue]: a tumor of the brain substance, or more rarely of other parts, representing in its structure the *neuroglia* or connective tissue of the nervous system. It consists of a finely reticulated material containing many roundish nuclei. It produces symptoms merely by mechanical pressure. Treatment is of no avail. William Pepper.

**Gli'res** [Lat., dormice]: the name given by Linnæus to that group of mammals usually called Rodentia (*q. v.*).

**Glis'an**, Rodney, M. D.: b. at Linganore, Frederiek co., Md., Jan. 29, 1827; graduated in the medical department of the University of Maryland, Baltimore, Md., Mar., 1849; assistant-surgeon U. S. army in May, 1850; ten years' service in the army—five being on plains, and five in Oregon during her territorial Indian wars; practieed medieine in Portland, Ore.: delegate to Seventh International Medical Congress in London 1881; member Ninth International Medical Congress 1887; emeritus Professor of Obstetrics, Willamette University. Author of *Journal of Army Life* (1874); *Text-book of Modern Midwifery* (Philadelphia, 1881); *Two Years in Europe* (New York, 1887).

**Glis'son**, Francis, M. D.: physiologist; b. at Rampisham, Dorsetshire, England, 1597; took the master's degree at both Cambridge and Oxford; took the degrees in medicine at Cambridge (M. D. 1634); in 1636 became Professor of Physic there; and in 1639 Professor of Anatomy in the College of Physieians, London. He wrote learned Latin treatises on the anatomy of the liver (1654), on rickets (1650), on the intestines (1677), and other works; practieed at London and Colchester; had a wide fame as a subtle and profound philosopher and a skillful anatomist. His fame is perpetuated in "Glisson's capsule," a constituent of the liver first discovered by him. D. in London, Oct. 14, 1677.

**Gloag**, glōg, Paton James, D. D.: a minister and scholar in the Church of Scotland; b. in Perth, Scotland, May 17, 1823; educated at Perth Academy and the Universities of Edinburgh and of St. Andrews. He was minister of Dunning 1848–60, of Blantyre 1860–71, and of Galashiels 1871–92, and living in Edinburgh 1892. He published *Assurance of Salvation* (Edinburgh, 1853; 2d ed. Glasgow, 1869); *Justification* (Edinburgh, 1856); *Primeval World, or Relations of Geology to Theology* (1859); *The Resurrection* (London, 1862); translation of Lechler's *Commentary on the Acts* (Lange Series, New York and Edinburgh, 1864); *Practical Christianity* (Glasgow, 1866); *Commentary on the Acts of the Apostles* (2 vols., Edinburgh, 1869); *Introduction to the Pauline Epistles* (1874); translation of Meyer on the Acts (Edinburgh, 1877); *The Messianic Prophecies* (Baird Lectures, 1879); translation of Lünemann on the Thessalonians (Lange Series, 1880); translation of Huther on James and Jude (1881); *Life of Paul, Bible Primer* (Edinburgh, 1881); *Commentary on the Epistle of James*, in Schaff's *Popular Commentary* (New York and Edinburgh, 1883); *Exegetical Studies* (Edinburgh, 1884); *Introduction to the Catholic Epistles* (1887); *Introduction to the Johannine Writings* (London, 1891); *Subjects and Mode of Baptism* (1891); *The Life of St. John* (Edinburgh, 1892). Willis J. Beecher.

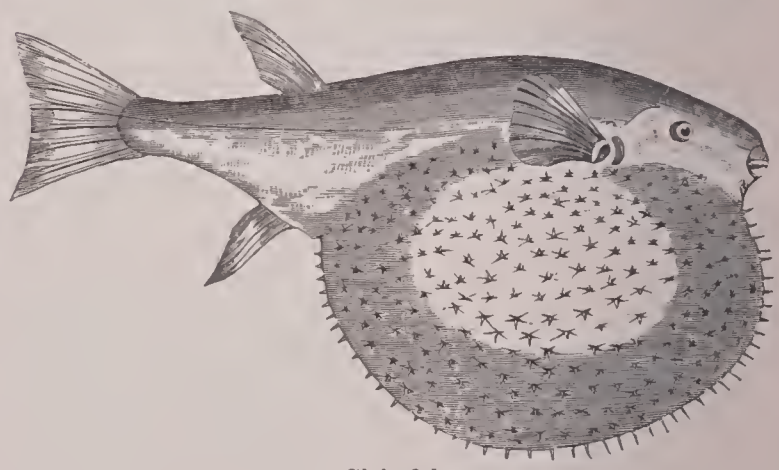
**Globe Amaranth**: the *Gomphrena globosa*, an annual flowering plant of the Amaranth family, well known in cultivation for its globose purple or white heads of imperishable flowers—one of the kinds known as *immortelles*. This species is East Indian. Many of the South American species (herbs or shrubs) are prized for their medicinal virtues, especially *Gomphrena officinalis* and *macrocephala*.

**Globe, Artificial** [viâ Fr. from Lat. *globus*, ball, sphere]: a sphere on which is a Map (*q. v.*). Globes set forth the earth or heavens, and are terrestrial or celestial. On the latter the stars appear as they would if seen from the center of the earth, while the former is a literal copy of the earth itself, with the addition of lines or circles to enable one to determine the position of places and the movements of the sun and planets. In schools globes are invaluable as a step in object teaching, since by familiarity with them young people obtain far better ideas of general geography than they can from plane charts, as appears from the spherical map. The oldest globe in existence is that in the Museum Borgia at Velletri, probably from the year 1225. Celestial globes of gold, on which the stars were represented by pearls, were made by the Arabs. But the impetus which the Arabs gave to astronomy and geography was discouraged by the Church, which opposed the theory that the world was round. The first modern globe-maker was Johann Schöner (b. 1477 at Karlstadt, in Franconia), a distinguished mathematician and astronomer. Tycho Brahe also made many globes; one of these, 4 ft. 7 in. in diameter, made of copper, was seen by Picard at Copenhagen in 1671.

The process of making globes is simple, but requires great accuracy. A ball of iron or of wood, to serve as a base on which to make the globe, is first made, with stout wires projecting from the poles. It is covered with a coating of dry paper, and on this are laid as many sheets of coarse soft or hard paper, damped, as are necessary to the requisite thickness, which is generally half an inch, more or less, according to the size. This of course, when dry, makes a hollow ball of *papier mâché* or thick pasteboard. When dry it is hung by the wires in soekets, and made to turn rapidly, and while so revolving the edge of a sharp knife cuts the globe into two hemispheres. A round stick for an axis and support is placed within, and a stout wire projecting from either end forms the poles. The two segments are then united and joined with glue. This is placed in a semicircular disk or band of steel, and being coated with whiting and size is made to revolve. The edge of the steel band removes any excess of size, the process being in fact turning. The equator and ecliptic and lines of latitude and longitude are then marked with great care. The two crossings of the equator and ecliptic, or the points of the equinoxes, are usually the line of the first meridian, and from the point of the vernal equinox the degrees on the equator and ecliptic begin. The maps, which are generally made in twenty-four pieces, with two circular pieces for the poles, are now fitted and pasted on. They are then dried and highly sized before being varnished. The brass circle in which most globes hang by their poles is called the universal meridian, since any given place on the earth's surface may eome within it. This brass meridian is held within the broad flat circle of wood called the horizon by sliding in two grooves. The horizon in some globes is so constructed as to revolve with ease. This horizon is supported by two arms and a base forming a stand, on which it rests. By sliding the meridian the poles of the globe can of course assume any point from the horizon to the vertical. The brazen meridian is divided into 360 equal parts called degrees. On one side of the meridian or the *lower semicircle*, they are numbered from 1 to 90 from the poles to the equator, to give the elevation of the former. In the upper semicircle the same numbers from the equator to the poles are used to ascertain the latitude of any point on the earth's surface. An interesting feature of the U. S. Government's exhibit at the World's Columbian Exposition at Chieago in 1893 was a model of the earth, 63 feet in circumference, believed to be the largest globe ever constructed. It was designed and constructed by A. L. Pitney, of Washington, D. C., as an exhibit of the General Land Office, with which he was long connected.

Revised by M. W. H.

**Globefish**: a name applied to several marine fishes of the family *Tetraodontidæ*. Like other fishes of the family, they have the power of puffing themselves up by swallowing air.



Globefish.

In this condition they sometimes lose their balance, and float in a helpless state upon the water. The belly is proteeted by sharp spines. There are many species in the tropical seas, and one is found as far north as Cape Cod. The one figured, *Lagocephalus lagocephalus*, is European.

**Globeflower** [so named from the almost spherical shape of the blossom]: the common name of perennial herbs of the genus *Trollius*, family *Ranunculaceæ*. *Trollius europæus* and *asiaticus* are cultivated ornamental plants. *T. laxus* is a rather rare plant of the U. S., and the only American speeies. The name is also applied to eertain amarantaceous plants of the genus *Gomphrena*, sometimes used for the same purposes as "everlastings" or *immortelles*.

Revised by L. H. Bailey.

**Globigeri'na** [Mod. Lat., deriv. of Lat. *globus*, ball + *ge'rere*, carry]: a genus of *Foraminifera* (*Reticularian Protozoa*), which receives its name from the roughly globular shape of the organism. The different members of the genus abound

at the surface of the sea far from land, and their dead calcareous shells which are continually falling to the bottom form there the so-called globigerina ooze, which is gradually being converted into modern chalk. J. S. K.

**Globulins** [deriv. of *globule*]: albuminoids which are soluble in dilute solutions of neutral salts of the alkali metals, and are precipitated from these solutions by the addition of water. By long contact with water, they are converted into substances very similar to the coagulated albumens. Among the globulins are *vitellin*, *myosin*, *serumglobulin*, and *conglutin*. W. P.

**Glogau**, glō'gow, or **Gross-Glogau**: town of Prussia; in the province of Silesia, on the left bank of the Oder; 60 miles by rail N. N. W. of Breslau (see map of German Empire, ref. 4–H). It is strongly fortified, and has large breweries and manufactures of agricultural implements, pottery, beet-root sugar, tobacco, woolen and linen fabrics, and paper. It has a cartographical institute. Pop. (1890) 20,529.

**Glom'men**: the largest river of Norway; rises in lat. 62° 40′ N. and lon. 11° 16′ E., at an elevation of 2,339 feet. After joining the Vormen it is called the Stor-Elv, and after a course of 350 miles falls into the Skagerack. Its course is about 400 miles long, and its volume of water very considerable, but its navigation is much impeded by falls, of which the Sarpsfos, 7 miles from its mouth and 74 feet high, is the most remarkable.

**Glonoin Oil**, or **Glonoin**: See EXPLOSIVES and NITROGLYCERIN.

**Glo'ria** [Lat., glory]: in music, one of the principal divisions of a Roman Catholic or liturgical mass, being the music to the words of the hymn *Gloria in excelsis Deo*, etc. In masses of a diversified and elaborate character the Gloria frequently embraces several movements, consisting of solos, duets, etc., and choruses. The word is also used for the doxology *Gloria Patri*, Glory be to the Father, etc., and the *Gloria Tibi*, Glory be to Thee, O Lord.

**Glo'ria in Excel'sis De'o** [Lat., glory to God on high, liter., glory in the heights to God]: the title of the greater doxology, being the first words of that formula. It is also called the Angelic Hymn, because the first words were sung by the angels on the plains of Bethlehem (Luke ii. 14). With slight differences it is used by the Greek, Latin, Lutheran, Anglican, Wesleyan, Methodist Episcopal, and some other churches, being a part of the office for the Holy Communion. It dates from the second century, and was originally the morning hymn of the Greek Church. It originally consisted of only the few gospel words, but in the course of time additions were made to it, first in the Greek Church, afterward also in the Latin Church (by Hilary, Bishop of Poitiers, d. 366), and its form was finally fixed by the fourth Council of Toledo 633. Down to the twelfth century it was used only by the bishop, except on Easter, when it was also used by the priest.

**Glo'ria Pa'tri** [Lat., glory to the Father]: the lesser doxology, a very ancient ascription of praise to the Holy Trinity —a brief hymn which is believed to have taken its present form about the time of the origin of the Arian controversy. As the translation of the words *Gloria Patri et Filio et Spiritui Sancto in sæcula sæculorum* was left free, the Arians translated them either "Glory to the Father in the Son and the Holy Spirit" or "Glory to the Father through the Son and the Holy Spirit," thus introducing their views of the Holy Trinity into the doxology, until the Church forbade the use of those translations as heretical, and prohibited them by an addition which made them impossible. In the Roman Catholic Church it is recited, as a rule, after each psalm in the office and after the "Judica" psalm in the mass.

**Glorio'sa** [Mod. Lat., fem. of Lat. *glorio'sus*, glorious]: a genus of liliaceous flowering plants (remarkable for having the leaves tipped with a short tendril or hook), of which the best known is the *Gloriosa superba*, a tuberous East Indian perennial herb, with very fine red and yellow flowers, seen in greenhouse culture.

**Gloriosa Islands**: a group of small islands about 125 miles W. by N. of the northern point of Madagascar (Cape Amber), not permanently inhabited. Their importance is due to the fact that while claimed by Great Britain they were occupied in 1892 by France. As by the treaty of 1815 Great Britain relinquished all islands W. of Cape Amber, it would appear that the French title will not be disputed. M. W. H.

**Glory** (in meteorology): See HALO.

**Gloss** [from Lat. *glossa* = Gr. γλῶσσα, obsolete or foreign word requiring explanation, liter., tongue, language]: an explanation written upon a MS. between the lines, along the margins, or upon a separate parchment, designed to explain foreign, obsolete, provincial, or technical words or obscure phrases. The Greek, Hebrew, and Vulgate texts of the Bible and the canon and the civil law were the subjects of many and often important glosses. Sometimes the gloss is more than a verbal explanation, and takes the form of a logical elucidation. The marginal glosses to the Bible were first collected in the ninth century by Walafried Strabo, which collection—known as the *Glossa Ordinaria*—formed the basis for all the mediæval exegesis. The *glossæ interlineares* were not collected until the beginning of the twelfth century, by Anselm of Laon. Both collections were afterward generally printed together. The first collection of glosses to the canonical law was made in 1212 by Johannes Teutonicus, and called the *Apparatus* or *Glossa Ordinaria*. That collection referred, of course, only to the *Decretum Gratiani*; but similar collections were afterward made of the decretals of Gregory IX., the *Liber Sextus*, the Clementines, and the Extravagantes.

**Glossary**: See DICTIONARY.

**Glos'sop**: town of England; in Derbyshire; 13 miles E. S. E. of Manchester (see map of England, ref. 7–G). Its cotton and woolen manufactures are important, and it has iron-foundries, paper-mills, dye-works, print-works, and bleaching-fields. Pop. (1891) 22,414.

**Glot'tis** (*rima glottidis*): See LARYNX.

**Gloucester**, glos'ter: city of England; the capital of Gloucestershire, on the left bank of the Severn (see map of England, ref. 11–G); 114 miles by rail W. N. W. of London. It is well built and laid out, its four main thoroughfares crossing each other at right angles in its center, and with its docks and wharves conveniently situated for a speedy communication between the harbor and the railways. The Gloucester and Berkeley Canal, 17 miles in length, enables vessels of 600 tons to ascend to the city from Sharpness Point, on the Severn. Its cathedral, begun in 1088, is one of the finest in England, especially its square tower, 225 feet high. As it was not finished until 1498, it exhibits examples of every form of Gothic architecture developed in England. The nave is Norman with an Early English roof, the south transept is perpendicular, the north decorated, etc. The central tower contains the Great Peter bell, weighing 3 tons 2 cwt. Gloucester, Worcester, and Hereford form together a choir which gives celebrated annual concerts. The see-house is at Gloucester, but there are separate cathedral establishments. Among institutions are the infirmary, the county asylum for lunaties, the King's or College School, the Bluecoat hospital, and a theological college. The manufactures are important, and include agricultural implements, railway material, soap, chemicals, and matches. There are ship-yards, foundries, and ropeworks. The exports consist of agricultural produce and minerals; the principal imports are grain and timber. The city returns one member to Parliament. Gloucester derives its name from a town or village called Caergloui by the Britons. It became a Roman station under Aulus Plautius, and in the time of the Venerable Bede was a city, and was called Gleauanceastre. A nunnery was established here in 681, a monastery in 821, and a Benedictine abbey in 1022. Pop. (1901) 47,944.

**Gloucester**: city and seaport (named from Gloucester, England; settled 1623; incorporated a town 1642; made a city 1874); Essex co., Mass. (for location, see map of Massachusetts, ref. 1–I); on Massachusetts Bay near the extremity of Cape Ann, and on the Boston and Maine Railroad; 30 miles N. E. of Boston. It comprises the villages of Magnolia, East Gloucester, West Gloucester, Riverdale, Annisquam, Lanesville, Bay View, and the "Harbor"; is a port of entry, with large foreign and domestic commerce; and is the center of the cod and halibut fisheries. The fisheries and granite-quarrying constitute its distinctive industries. It is the largest fishing-port in the U. S., having more than 400 vessels and about 5,000 men employed in that interest. One of the fish-culture stations of the U. S. Fish Commission is located here. According to the U. S. census for 1890 there were 84 industrial establishments, with a capital of $3,059,898, giving employment to 2,110 persons, at an annual wage of $900,491. The cost of materials used was $3,077,998, and the value of products was $4,622,722. Granite-quarrying is

carried on in the villages of Lanesville and Bay View. Other industries are ship-building and fish-canning, and the manufacture of cotton goods, clothing, cigars and cigarettes, grease and tallow, and awnings, tents, and sails. The city contains a city-hall, court-house, U. S. custom-house, public library, several handsome church and public-school buildings, including one newly erected for the high school, waterworks, gas and electric-light plants, 5 banks, and 1 weekly and 2 daily newspapers. The city is also noted as a popular summer resort, having an excellent beach 2 miles long, about 600 feet wide between tides, and very hard. There are large hotels and many boarding-houses for summer guests. Pop. (1880) 19,329; (1890) 24,651; (1900) 26,121.

EDITOR OF "TIMES."

**Gloucester**: city; Camden co., N. J. (for location of county, see map of New Jersey, ref. 6–C); on the Delaware river, and on the Atlantic City and the W. Jersey and Seashore Railroads; 5 miles S. of Camden. It is connected with Philadelphia by a steam-ferry, has manufactories of cotton, iron, and terra-cotta goods, and contains several churches and schools, a bank, and a weekly newspaper. Pop. (1880) 5,347; (1890) 6,564; (1900) 6,840.

**Gloucestershire**: county of England; situated around the estuary of the Severn. Area, 1,258 sq. miles. The eastern part is occupied by the Cotswold Hills. Here the soil covering the rocks is thin, yet affords excellent pasturage, especially for sheep. The central part is a valley formed by the Severn, with very rich soil and a peculiar climate, which ripens all fruits very early. The western part is the Forest of Dean, of which 23,015 acres (11,000 of which are enclosed) belong to the crown. The Forest division is now limited to the Forest of Dean, but anciently included all Gloucestershire W. of the Severn. Besides agriculture and dairying, many branches of manufacture, especially that of woolen goods, are pursued. Coal-mining and the iron industry are also extensively carried on. The county returns five members to Parliament. Pop. (1901) 331,515.

**Gloversville**: city (incorporated a village 1851; made a city 1890); Fulton co., N. Y. (for location of county, see map of New York, ref. 4–I); on the Cayadutta branch of the Mohawk river, and on the Fonda, Johnstown and Gloversville Railroad; 44 miles N. W. of Albany. It derives its name from the extensive manufacture of gloves, and it is the center of the glove-trade of the U. S. In 1900 it had 150 glove manufactories, whose output for the year was valued at $20,000,000. For the manufacture of shoe leather, a comparatively new industry, there were 10 factories, which yielded products valued at $3,000,000. Other manufactures had an aggregate value of $1,000,000. The city has electric and horse railways, gas and electric plants for light and power, water-works with supply by gravity from the Mayfield mountains; city-hall, public library, 13 churches, 8 public and several private schools, newly erected Littauer Hospital (named after the founder), 2 opera-houses, 2 banks, and 2 monthly, 2 daily, and 2 weekly newspapers. Pop. (1880) 7,133; (1890) 13,864; (1900) 18,349.

W. B. COLLINS.

**Gloves and Glove-making** [M. Eng. *glove* < O. Eng. *glōf*, akin to Icel. *glōfi*, glove, prob. deriv. of *lōfi*, palm of the hand]: articles for covering the hands and the processes of their manufacture. A glove, as distinguished from a mitten, is a covering for the hand in which each finger is separately inclosed, with the part above the hand varying in length according to fashion or convenience. In remote historic times they were used only for protection against cold, or thorns in harvesting crops. During the Middle Ages their use became more diversified, and consequently quite common. They were worn by knights, priests, and ladies, and expressed different symbolical significations, of love, challenge, submission, etc. During the reign of Louis XIV. the glove came to be considered an article necessary to a complete toilet, and during his reign special laws were enacted for the protection and benefit of Paris glove-makers.

Gloves are now an article of general commerce and everyday use in every walk and vocation of life, and are made of a variety of materials—viz., leather, wool, cotton, silk, fur, linen thread, worsted, woven or knitted, and sometimes fulled. Leather is the most common material used in their production. Developments in the process of tanning have brought into use the skins of many animals heretofore regarded as of no value to the glove-trade. Deer, sheep, kid and calf skins at one time were used exclusively; now the list embraces the skin of the dog, cat, rat, fox, and bear, besides that of the horse, cow, colt, kangaroo, hog, and almost every hair animal. Some of the finest gloves are made from real kidskin and from ratskin, while coltskin has a prominent place, the fine grain deceiving everyone but an expert. The wide range of skins used enables the glove-manufacturer to draw his supply from every country of the globe. Australia furnishes nearly all the kangaroo skins, many of which are used in the shoe-leather trade. Calfskins are exported from Europe, and the U. S. also yield large numbers; lambskins are supplied by many parts of the world, including France, Spain, Austria, Turkey, and compete with the real kidskin which comes largely from the same localities, but also from the East Indies, Switzerland, and Ireland. The general term "kid glove" does not any longer convey the idea of a real kid or the young of a goat, but any leather "kid dressed." In the dressing of skins great improvement has been made; less time is consumed, and with the modern improvements and the use of electricity the same work is done in less time and more satisfactorily. The machinery now employed enables one man to do work which formerly required the services of several. The advantage derived has been very great, for the cost of production has been materially reduced, and the glove industry has been proportionately increased. In the U. S. especially are these results clearly seen.

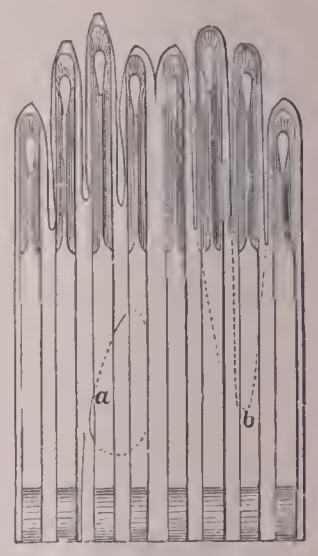


FIG. 1.—Caliber or glove pattern.

The dressing of the raw skin into leather is the work of an expert, and involves several changes which must be made at just the right time to procure the best results. After being thoroughly soaked in clear water the skins are bathed in lime-water to loosen the hair, which, with any particles of flesh, is then removed by a process of "beaming" and "frizzing"; finally, a "tan" is used which converts the "skin" into "leather." The cold liquor process formerly used has been superseded by hot liquor, which is quite as satisfactory. To produce the finish large quantities of eggs (the yolks only), alum, salt, flour, and white lead are used, the last mostly in producing undressed kid or castor. During the several processes of dyeing the skins are staked or stretched, rubbed with pumice-stone to remove irregularities, and "mooned," doled, or split to reduce them to uniform thickness. Every shade or tint obtainable in any fabric is produced in skins for gloves. France claims superiority in color and fiber, but finds sharp rivals. Yeovil, Taunton, Worcester, and other places in England furnish large quantities, and Gloversville, N. Y., produces most of the domestic supply in the U. S.

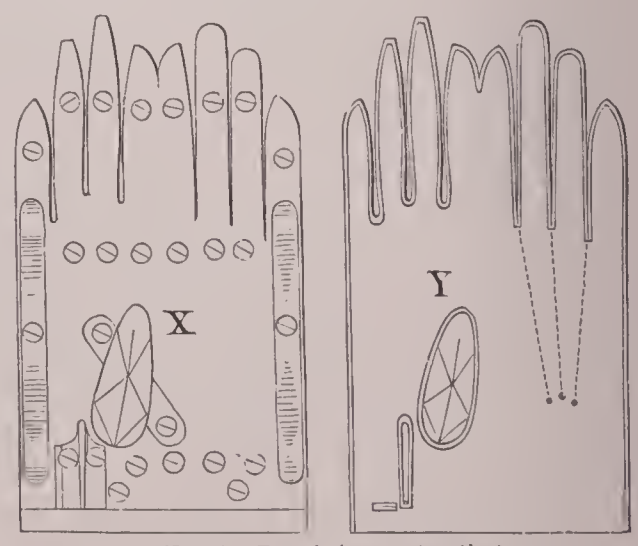


FIG. 2.—Punch (*emporte-pièce*).

Glove-making has developed wonderfully since 1834, but the greatest progress has been made since 1850, for prior to that time the art was not studied, and the article produced was coarse and ill-fitting. The cutting was done with long shears, and a fit was largely accidental, depending some-

what upon the stretch that was in the leather and the skill of the maker.

About the year 1819 Vallet d'Artois, a French glove-manufacturer, invented a style of pattern by which the gloves were punched or cut from the leather. It was not very much used, and about the year 1834 Xavier Jouvin, of Grenoble, and Niles Fairbanks, in Gloversville, N. Y., perfected a set of dies, which, with some modifications and improvements, are now in use in every glove-factory. The French set of patterns was arranged for five styles of hands, viz., very broad, broad, medium, slender, very slender; each style was divided into two classes, and the thirty-two sizes for each class made 320 different numbers, which proved many more than was needed for the demands of the finest trade. While the French maker reached beyond the demands of the trade, the U. S. maker was below it, but gradually, as the call for finer goods made a demand for more perfect patterns, they were produced, and the American make and the European are now very much alike, Europe, however, and especially France, still producing the finest lines. The dies used in cutting skins (see Figs. 1 and 2) are made of fine-tempered steel blades fastened to a back of cast iron. For the heavier grades of gloves the die is struck with a heavy mallet, cutting only one thickness at a time, the leather being placed upon a block. Only one piece is cut at a time, for in many of the skins it is necessary to avoid the holes made in killing the wild animal, or in dressing the leather. The thumbs and gussets, or fourchettes, are cut with separate dies from pieces not large enough for the body of the glove, thus utilizing the material. This grade of goods is known as block cut. In Fig. 2 X and Y indicate where the thumb-hole is cut. The tracing in Figs. 1 and 2 shows where the embroidery is put on the back of the glove. In table cut (so called) the leather is tranked out and shaped for certain sizes, and by means of a power-press many pairs are cut at once. The greater part of the work consists in getting the leather in proper shape. Different sizes are often cut with the same pattern by estimating accurately the elasticity of the leather. Figs. 3 and 4 represent the original pattern used before the introduction of the die in Figs. 1 and 2; *a* represents the thumb and *b* the "Plymouth" fourchette patterns. They were made from thin boards. The pattern was laid on the leather and marked with a lead-pencil. This marking and cutting was originally done by women, but now all the cutting of the gloves, as well as the tanning of the leather, is done by men, while the making is done by women, excepting some of the heavier grades.

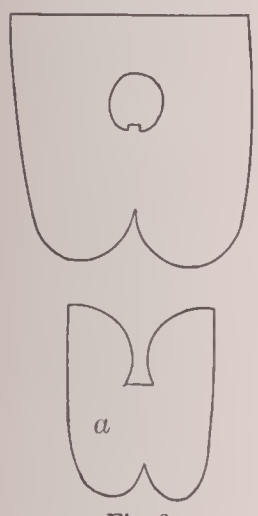


Fig. 3.

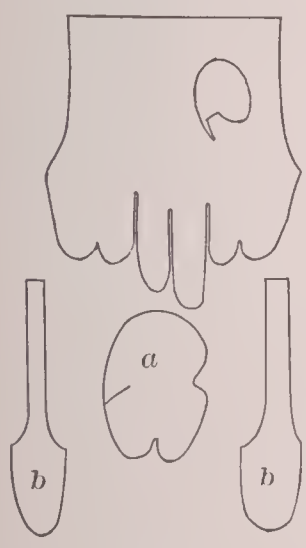


Fig. 4.

Gloves were originally made wholly by hand, and under very many difficulties. The length of the stitch on fine goods was regulated by the teeth of the clamps of a machine which was held together by a spring. The embroidery on the back or the drawing of the cords was done with very great care, and necessarily consumed much time. The modern facilities for making gloves are the results of some of the wonderful inventions of the nineteenth century. The sewing-machine has wrought a great change, and the work which formerly consumed much time and taxed the patience is now done almost automatically, the mere guiding of the glove being necessary. The ingenuity of the inventors of the U. S. has brought to perfection labor-saving machines, and the result is artistic work that surpasses the best possible hand-work. The French and Germans have also invented machines that do superior work. Among notable glove-working machines are the two, three, and four needle machines which do the embroidering of the back, the zigzag stitch, the ornamental, and the over-stitch which closes the edges of the seam from the outside; and an automatic trimmer which is attached to the head or needle-bar of the machine, and trims the leather better than can be done by shears, was brought out in 1893.

The work of making gloves is done by women and girls. Gloves are generally made in factories, where long tables are fitted up attached to which are sewing-machines run by steam or electric power. Gloves are made in parts by several operators. When they come from the cutters they are all fitted and the parts numbered, and must be so kept that the weight and colors may not be interchanged. After the backs are corded or embroidered the end of the silk is pulled and tied, then the glove is closed, by beginning either at the upper end of the long seam and sewing toward the little finger, or with the end of the index-finger and finishing with the long seam. The gussets or fourchettes and thumb having previously been put in, the gloves are bound or hemmed or banded; sometimes the button-hole is made after this process; if lacings instead of buttons are used they are then adjusted; the buttons are next put on; after this the gloves are "laid off," usually on steam-heated forms, then tied and boxed and thus made ready for the market.

The glove industry gives employment to many thousand wage-earners. The best-paid workers are those in the U. S., where the average wages exceed $2 per day. The lowest wages are paid in Italy, where but a few cents per day are earned by each worker. The other countries of Europe grade upward toward the wages in the U. S. In gentlemen's gloves the U. S. are taking a leading place, and in some few lines of ladies' gloves, especially the Mocha and undressed kid, but aside from these the finest grades are still made in Europe, principally in Paris, Grenoble, Chaumont, and Niort in France: London, Worcester, Yeovil, Ludlow, and Woodstock in England; and Milan and Naples in Italy; while Germany, Austria, Denmark, Sweden, and Belgium furnish many goods of high grade, large quantities of which are exported to the U. S. The last-named country finds slight competition in the heavier grades of gloves and mittens, and produces them in immense quantities. Gloversville, with Johnstown, 3 miles distant, produces nearly nine-tenths of the gloves made in the U. S. In this center of the industry there are now more than 200 firms, producing annually some $10,000,000 worth of gloves. There are also a large number of skin-mills for the dressing of leather, giving employment to the inhabitants of that flourishing city which has been built up by the glove industry. Some of the other materials of which gloves are made are treated in much the same way as leather, aside from preparation of the raw material. Woven or knitted gloves are made from the thread fiber on machines specially adapted for the work.

D. C. Durfee.

**Glow-lamp**: See Lamps (electrical, etc.).

**Glowworm**: the wingless and nocturnally luminous female of *Lampyris noctiluca*, and other fireflies of Europe. The winged male emits a very feeble light, not at all comparable for brilliancy with the common fireflies of the U. S.; while the female has a pale bluish and rather faint luminosity, which, it is supposed, serves to attract the male. In the U. S. luminous larvæ of various fireflies are named glowworms. For the supposed origin of the glowworm's light, see Fireflies.

**Gluci'num**, or **Beryl'lium** [*glucinum* is Mod. Lat., deriv. of Gr. γλυκύς, sweet, named from the taste of some of its salts; *beryllium* is Mod. Lat., deriv. of *beryl*, into which it enters as a chemical constituent]: a metallic element (symbol, G; atomic weight, 9·3) whose oxide (GO) is known as glucina, and is considered an earth. Glucinum in nature commonly occurs as a silicate of glucina, as in the beryl, of which gem this earth constitutes 14 per cent., or as an aluminate, as in the chrysoberyl. The glucinum chloride ($GCl_2$), when vaporized and passed over melted sodium, yields metallic glucinum, a white malleable metal (specific gravity 2·1) which can not be burned, even in pure oxygen.

**Gluck**, glŏŏk, Christoph Wilibald Ritter, von: composer of music; b. at Weidenwang, Bavaria, near the borders of Bohemia, July 2, 1714. His father was a huntsman and forester in the service of Bohemian nobles. Besides receiving a good school education and part of a course at the University of Prague, the boy was well instructed in music under the direction of the Jesuits, who cultivated the art for religious purposes. At the age of twenty-two his ability had attracted the attention of a noble patron, who gave him opportunity to study music at Vienna under the most

favorable auspices. A Lombard prince, hearing him there at his patron's house, took him to Milan and placed him under the tuition of the then celebrated Sammartini. He was only twenty-six years old when he received an order to compose an opera for the court theater. This was the *Artaserse*, and it was a triumph in spite of the innovations of style which the author introduced; for the new spirit which later effected a complete reform in operatic compositions was already born in the young master. Other operas followed—*Demofoonte*, *Demetrio*, *Ipermnestra*, *Artamene*, *Siface*, *Fedra*, *Poro*—all for Italian cities. Invited to the Haymarket, London, he produced there in 1746 *La Caduta dei Giganti*, which was not a flattering success. In London he became acquainted with English composers and with Händel. In Paris he was attracted to the works of Jean Philippe Rameau, then at the height of his fame. Full of new ideas, Gluck gave his whole mind to his new theory of opera, and after producing many pieces more or less significant at Paris, Vienna, Rome, Naples—two of which, *Il trionfo di Camillo* and *Antigono*, won for him from Pope Clement XIII. the order of Knight of the Golden Spur—he returned to Vienna and established himself as *Capellmeister* of the imperial opera. During the whole of this period, lasting till 1762, Gluck's genius, though copiously and variously productive and widely recognized, had not fully unfolded its powers or justified itself to its possessor. He was forty-eight years old when, from a libretto by a new author, Calzabigi, poet and statesman, he composed the *Orfeo ed Euridice*, which was first performed in Vienna Oct. 5, 1762. This opera marked a new era. The fame it acquired at once it has never lost. It was followed in 1767 by the *Alceste*, and in 1769 by the *Paride ed Elena*, the texts for the three being by the same author. Still Gluck was not satisfied without the ratification of the judgment of Paris. This, after great effort, he was able to secure in 1774. On Apr. 19 of that year the *Iphigénie en Aulide*, finished at Vienna in 1772, was brought out in Paris under the direction of the composer himself, who had bestowed immense labor on all the details of its scenic production. A controversy raged over it between the champions of the old and new schools. Gluck carried the day, and in 1779 he enjoyed the triumph of witnessing the successful representation of his great opera, the *Iphigénie en Tauride*, in the French capital. He was sixty-four when he wrote it, but it ranks among the foremost of his compositions; by many is deemed his very best, as being the most complete and splendid vindication of the new school. The aim of this school was to make music expressive of the emotions implied in the action of the drama. Gluck, though possessing immense industry, energy, and determination, the mind of a critic, and the soul of a reformer, lacked the affluence of genius that distinguished his successors in operatic composition, Mozart and Beethoven. His aims were lofty, his ambition was great. He demanded a theme of deep sentiment and elevated character. A tender dignity and pathos were native to his mind, and were enhanced by the simplicity and singular purity of his method. His greatest compositions are penetrated with a feeling religious in its character, yet his religious compositions are very few and of small account. His last opera, produced in Paris, was *Echo et Narcisse* (1779). D. in Vienna, Nov. 15, 1787. See the *Life* in French by Desnoiresterres (1872), and in German by Marx (1863) and Reissmann (1882).

**Glu'cose** [deriv. of Gr. γλυκύς, sweet]: in chemistry, the name of a number of isomeric sugars having the composition $C_6H_{12}O_6$; in commerce in the U. S., the name given to the liquid varieties of the sugar made from corn-starch, the solid varieties being known as grape-sugar. The different glucoses are fully described under SUGAR.

The manufacture of dextro-glucose, or dextrose, from corn-starch has become an important industry in the U. S., and in 1884 a *Report on Glucose* was published by the Government, giving the testimony of a committee appointed by the National Academy of Sciences to investigate the processes employed in the manufacture, as well as the commercial products, to ascertain whether there is any danger attending their use as articles of food. From the report of this committee the following statements are taken:

"THE MANUFACTURE OF STARCH-SUGAR.—In France and Germany potato-starch constitutes the only available material for the manufacture of this sugar, but in the U. S. the starch of Indian corn, or maize, is invariably employed. The process consists, first, in extracting the starch from the corn in a state of sufficient purity, then transforming this into sugar by treatment with dilute acid, and subsequently neutralizing the acid, purifying, and then concentrating the product. The details of the various steps differ in different establishments, but the general character of the process is the same as when first proposed in 1811 by Kirchhoff.

"A. EXTRACTING THE STARCH. 1. *Steeping.*—The corn is placed in large wooden vats or tanks holding from 500 to 1,000 bush. It is covered with hot water having a temperature of about 160° F. in summer and 185° F. in winter. The corn immediately reduces the temperature of the water to about 140° or 145° F. Every six hours the water is drawn off and replaced with fresh water at about 130° or 135° F. If signs of fermentation appear, the water is changed oftener, the object being to soften the corn without permitting it to become sour. From two to four days' steeping is required, the time depending on the hardness of the corn. Some manufacturers add to the water a little sulphuric acid, sulphurous acid, or caustic soda.

"2. *Grinding.*—The softened corn is next ground between buhrstones, a stream of water continuously running into the eye of the mill. As it is ground the thin paste is carried by the stream of water upon the shakers or sieves. Some manufacturers pass the paste through a second mill before it is sent to the shakers; others send it from the first mill to the shaker, and submit the husks to a second mill, employing a second shaker.

"3. *Separation of the Starch.*—The paste or pulp from the mill is passed over shakers or starch-separators. These are inclined sieves of silk bolting-cloth, which are kept in constant motion and sprayed with jets of water. The starch passes through the bolting-cloth with the water as a milky fluid, while the coarser cellular tissue or husk of the corn is left behind. This residue is pressed to remove water and sold as cattle-food.

"4. *Cleansing the Starch.*—The water from the shakers, holding the starch in suspension, is run directly upon the tables, or it is run into wooden vats, where the starch settles, and the water is drawn off and discarded. The starch is next thoroughly agitated with fresh water, to which a small quantity of caustic soda or carbonate of soda has been added. The object in adding the alkali is to dissolve and remove the gluten and other albuminoids, oil, etc.

"5. *Collecting the Starch.*—The mixture of starch and alkaline water is allowed to flow upon long wooden runs or tables which are from 1 to 2 feet wide and 125 feet long. Twenty-five or fifty of these runs are required for the treatment of 1,000 bush. of corn daily. These runs have a slight incline, and as the stream flows slowly upon the upper end the starch is deposited, while the alkali-wash, bearing lighter particles of cellular tissue, gluten, etc., flows off from the lower end. Some manufacturers prefer to treat the starch with alkali after it has been collected on the runs; some both before and after.

"6. *Washing the Starch.*—The starch is next shoveled up from the runs and mixed with water, and then again allowed to settle. The water is drawn off and the washing repeated, sometimes with a slight addition of hydrochloric acid; finally the thoroughly purified starch is mixed with the proper amount of water for the converter. The yield varies with the quality of the corn; a fair average would be, per bushel, starch, 30 lb.; cattle-food, 14 lb.; waste, 12 lb.; total, 56 lb.

"B. TRANSFORMING THE STARCH INTO SUGAR. 7. *Conversion*, as it is termed, is accomplished in either open or closed converters, and in some establishments the process is partially executed in open and finished in closed converters. The open converters are wooden vats, generally of 3,000 or 4,000 gal. capacity, sufficient for the treatment of the starch from 1,000 bush. of corn. They are provided with banks of copper steam-coils, either closed or perforated. The closed converters are generally of copper. They are provided with safety-valves, and are made of sufficient strength to withstand with safety a pressure of six atmospheres. Sulphuric acid is generally employed in the conversion, though other acids have been used. The quantity of acid employed varies with the object of the manufacturer. For the production of 'glucose'—a liquid product which contains much dextrin—a smaller quantity is used than when solid 'grape-sugar' is to be produced, in which the conversion into dextrose is much more complete. The proportion varies from ½ lb. of oil of vitriol to 1¼ lb. per 100 lb. starch. When the *open converter* is used a few inches of water are introduced and the acid is added, or half the acid

may be added to the starch-mixture. The acid-water is brought to a boil, and the starch, previously mixed with water to a gravity of from 18° to 21° Baumé, is slowly pumped in, keeping the liquid constantly boiling. When all the starch has been introduced, the whole is boiled until the iodine test ceases to give a blue color and shows a dark-cherry—or, better, till it shows an orange—color. The boiling is usually continued for from two to four hours. When the *closed converter* is used the starch is mixed with water to a gravity of from 11° to 16° Baumé. This with the acid is introduced into the converter, and the whole is heated under a pressure of from 25 to 75 lb. per square inch. The time required for the conversion is much shorter than in the open converters. The use of open and closed converters successively is often resorted to. The starch and water, of a gravity of 15° or 16° Baumé, are first boiled in the open converter for from one to two hours, then transferred to the closed converter and boiled under a pressure of from 45 to 75 lb. per square inch. The time of this boiling varies from ten minutes to half an hour."

Other acids have been used in conjunction with sulphuric acid, as nitric acid, proposed in 1871 by C. Kröttse. As substitutes for sulphuric acid, oxalic acid was proposed by R. Wagner in 1858, and E. Delarue & Co. patented the use of oxalic and tartaric acids in 1879. The use of phosphoric acid has also been patented.

"8. *Neutralization.*—When the starch has been sufficiently converted for the desired product, the liquor is run into the neutralizing vats. Here a sufficient quantity of marble-dust is added to neutralize the sulphuric acid completely, converting it into sulphate of lime. Some complete the neutralization with whiting. A little fine bone-black is generally added just before and just after neutralization. It is then allowed to cool and to deposit the sulphate of lime. A small portion of this sulphate of lime is retained in solution, and, although most of this will be removed by the subsequent filtration through bone-black, a minute quantity is always found in the finished product.

"9. *Bag-filtration.*—The liquor, having a gravity of 12° to 20° Baumé (light liquor), is next filtered through bag filters of cotton cloth, or filter-presses, or both.

"10. *Treatment with Sulphurous-acid Gas.*—In many establishments this is resorted to at this point in the process to prevent fermentation, and probably to some extent as a bleaching-agent.

"11. *Bone-black Filtration.*—The liquor is now passed through bone-black filters, by which it is decolorized, and at the same time freed from other soluble impurities.

"12. Concentration is effected in the vacuum-pan at a temperature of from 130° to 140° F. until it has a gravity of from 28° to 33° Baumé. This is called 'heavy liquor.'

"13. *Second Bag-filtration.*—During the concentration a certain quantity of sulphate of lime separates, and it is found advisable to remove it when the liquor reaches the gravity of 28° or 30° Baumé. It is therefore filtered through the bag filter or filter-press.

"14. A second treatment with sulphuric acid is resorted to in some factories, the acid being added in the vacuum-pan, or to the liquor as it comes from the bag filters.

"15. *Second Bone-black Filtration.*—The heavy liquor is now filtered a second time through animal charcoal, to secure a further decolorization and purification.

"16. The final concentration is accomplished by boiling the liquor in a vacuum-pan till it exhibits a gravity of from 40° to 42° Baumé while hot. It is then let down from the pan and subjected to—

"17. A third filtration, through a filter-press, to remove the sulphate of lime, which separates during the final concentration.

"In some establishments the liquor is passed but once over bone-black; in fact, all the steps which have been mentioned are followed only by those manufacturers who desire to produce the best products.

"18. *Final Treatment.*—The resulting product will vary in character according to the amount of acid used and the duration and temperature of the conversion. The variety in which the conversion has been least complete is called 'glucose' in the trade, and remains liquid; that in which the conversion is more complete, and which solidifies in the packages in consequence, is called 'grape-sugar.'

"An ingenious process for causing the grape-sugar to crystallize was invented by Dr. Arno Behr. While it is still liquid there is added to it a very small quantity of crystallized anhydrous dextrose. Molds are filled with the mixture, and in about three days it is found to be a solid mass of crystals of anhydrous dextrose. The blocks are then placed in a centrifugal machine, to throw out the still liquid sirup, and the anhydrous dextrose remains as a crystalline mass."

Starch-sugar appears in commerce in a great variety of grades under the following names: (*a*) liquid varieties: *glucose, mixing-glucose, mixing-sirup, corn-sirup, jelly-glucose, confectioners' crystal glucose, maltose, maltose-sirup, maize-sugar, maize-sirup*; (*b*) solid varieties are all called *grape-sugar*, and are distinguished as *solid, clipped, granulated, powdered, anhydrous, crystallized, brewers'* or *confectioners' grape-sugar.*

*Composition of Starch-sugar.*—The following analyses were made of commercial samples:

| DESCRIPTION. | Dextrose. | Maltose. | Dextrin. | Ash. | Water. |
|---|---|---|---|---|---|
| I. *Grape-sugar* (solid). | | | | | |
| Anhydrous grape-sugar | 99·40 | .... | .... | 0·03 | 0·60 |
| Cakes from centrifugal | 93·20 | .... | .... | 0·22 | 7·30 |
| Confectioners' grape-sugar | 87·10 | 0·30 | .... | 0·14 | 12·40 |
| Grape-sugar | 73·40 | 1·30 | 9·10 | 0·75 | 14·00 |
| Brewers' grape-sugar | 72·70 | 1·80 | 4·20 | 0·38 | 15·10 |
| Grape-sugar | 72·10 | .... | 9·10 | 0·33 | 16·60 |
| Grape-sugar | 72·00 | 3·60 | 6·40 | 0·50 | 17·50 |
| II. *Glucose* (liquid). | | | | | |
| Glucose | 36·50 | 19·30 | 29·80 | 0·32 | 14·20 |
| Glucose | 39·80 | 4·70 | 42·10 | 0·52 | 16·10 |
| Glucose | 34·30 | 4·60 | 45·30 | 0·33 | 17·20 |
| Mixing-sirup | 42·80 | 1·30 | 38·40 | 0·37 | 17·40 |
| Glucose | 37·00 | 6·50 | 38·80 | 0·33 | 19·20 |
| Maize-sirup | 39·00 | .... | 41·40 | 0·81 | 19·30 |
| Maltose | 41·50 | 0·60 | 38·80 | 1·06 | 20·60 |
| Mixing-sirup | 38·60 | 1·10 | 38·80 | 0·89 | 22·60 |

It thus appears that starch-sugar in its various forms consists of:

| | | | |
|---|---|---|---|
| Dextrose, or dextro-glucose | from | 99·40 | to 34·30 |
| Maltrose | " | 0·0 | " 19·30 |
| Dextrin, or starch-gum | " | 0·0 | " 45·30 |
| Ash, mineral salts | " | 0·03 | " 1·06 |
| Water | " | 0·60 | " 22·60 |

The mineral salts were those which are found in spring-water and in all vegetable and animal substances—potassium and sodium chlorides, calcium, and magnesium sulphates, and a little oxide of iron. Nothing objectionable was found in any of the samples.

*Uses.*—Starch-sugar is used (1) for the manufacture of table-sirup, for which purpose it is mixed with the molasses of the cane-sugar refineries; (2) as a substitute for barley malt in brewing ale and beer; (3) as a substitute for cane-sugar in confectionery; (4) for the adulteration of cane-sugar; (5) as a substitute for cane-sugar in canning fruits; (6) for making artificial honey.

*Healthfulness.*—The committee made experiments with the starch-sugars made from corn, both in their original form and after they had been fermented, but in no case did any evil effects follow their use. Nor could the committee obtain from others any evidence of ill effects.

The following is the conclusion of the report: "In conclusion, then, the following facts appear as the result of the present investigation: First, that the manufacture of sugar from starch is a long-established industry scientifically valuable and commercially important; second, that the processes which it employs at the present time are unobjectionable in their character and leave the product uncontaminated; third, that the starch-sugar thus made and sent into commerce is of exceptionable purity and uniformity of composition, and contains no injurious substances; and fourth, that though having at best only about two-thirds the sweetening power of cane-sugar, yet starch-sugar is in no way inferior to cane-sugar in healthfulness, there being no evidence before the committee that maize-starch sugar, either in its normal condition or fermented, has any deleterious effect upon the system, even when taken in large quantities." The appendix of the report of the committee appointed by the National Academy of Sciences contains a list of references to articles on glucose, etc., from 1790 to 1883, and a list of all patents relating to its manufacture. The report is signed by G. F. Barker (chairman), W. H. Brewer, Wolcott Gibbs, C. F. Chandler, and Ira Remsen. For further information on the subject of glucose, see SUGAR, BEER, BREAD, FERMENTATION, DIASTASE, and DEXTRIN.

Revised by IRA REMSEN.

**Glu'cosides** [deriv. of *glucose*]: a term applied to substances yielding when treated with dilute acids (or certain

ferments) glucose or a sugar of similar composition, and another substance not belonging to the group of carbohydrates. They occur in various plants, most frequently in the bark. Among the more important glucosides are arbutin, found in the leaves of wintergreen and of *arbutus uva ursi*; ruberythrin, in madder root; salicin, in willow bark; æsculin, in the bark of horse-chestnut; amygdalin, in the oil of bitter almonds; sinalbin, in white mustard seed; myronic acid, in black mustard seed. Helicin, which is obtained by oxidation of salicin, can also be made artificially by treating salicylic aldehyde with acetochlorhydrose, a compound derived from glucose by treating it with acetyl chloride, and tannic acid, which yields glucose and gallic acid.

Revised by Ira Remsen.

**Glue** [M. Eng., from O. Fr. *glu* < Lat. *glus, glūten*, glue: Gr. *γλοιός*, gum, oily substance]: a hard, brittle, glassy form of dried gelatin, containing impurities which give it a brownish color. It is the most important of the animal cements, and is usually obtained from the scraps of hides, the hoofs of animals, etc., by first thoroughly cleansing with lime, then washing and airing so as to slake the remaining caustic lime, and then boiling in rain-water, by which the albuminoid elements of the animal matter are changed into gelatin. The latter is removed and carefully dried in nets, care being taken to avoid too much or too little heat, for the first will melt the glue, while cold may cause the pieces to crack. Bone-glue (bone-gelatin) is prepared from fresh bones, either by digesting them with superheated steam, or with dilute hydrochloric acid, followed by boiling, the latter process affording the best results. "Fish-glue" is an inferior isinglass made from the offal of the fisheries. Glue is used in joinery, cabinet-making, in preparing size for dressing paper, silk goods, etc., in calico-printing, in making rollers for inking type, in fresco-painting, in paper-hanging, in stiffening hat-bodies, and for many other uses in the arts. For use as a cement, glue is generally dissolved with a gentle heat in a water-bath, and is then fit for use. "Prepared" or liquid glue is the ordinary solution kept liquid by the addition of a fluid ounce of strong nitric acid for every pound of dry glue; or commercial acetic acid, 3 parts to 1 of the dried and powdered glue is used, for this acid will dissolve the glue without heat. Six parts glue, 16 parts water, 1 part hydrochloric acid, and 1½ parts sulphate of zinc also give excellent results as an imputrescible liquid glue. Marine Glue is a cement formed by dissolving 1 lb. of india-rubber in 5 gal. of oil of turpentine, or preferably in coal-naphtha, and then adding after some days a quantity of shell-lac equal, or sometimes much exceeding, the previous solution in weight. The mixture is heated over a gentle fire and thoroughly mixed by stirring. It is then run into plates and dried. When used, it is melted by heating. It is insoluble in water, and will hold pieces of tough wood together so strongly that they may be broken across the grain sooner than parted at the place where glued. Glass and metals may also be glued with it.

**Glume**: See Grasses.

**Glu'ten** [Lat. for gluc]: a nutritive subtance obtained by kneading flour, especially wheat flour, in a stream of water, when the gluten remains behind as a sticky, adhesive mass. Gluten as such probably is not contained in flour, for when this is washed with cold water (2° C.) no gluten is formed. The flour contains two substances—vegetable myosin and an albumose—which undergo changes when mixed with water and are converted into gluten. It is believed that these changes are brought about by the action of a ferment, though the ferment has not been isolated. The quantity of gluten in wheat flour varies somewhat, but in general it is present to the extent of 11 to 13 per cent. Rye, oats, and barley flour contain very little gluten. The chief value of gluten in bread-making is as a means of retaining the carbonic acid gas and thus of facilitating the process of "raising." But little is known in regard to the nutritive value of gluten. It appears, however, to rank with the other albuminoids. To some extent a bread is made from gluten alone, after its separation from the starch contained in the flour. Such bread is made for use by diabetic patients, the object being to diminish the amount of starch in the food of these patients.

Ira Remsen.

**Glutton**, or **Wolverene** [from Fr. *glouton* < Lat. *glutto, gluto*, glutton, deriv. of *gluttus, gluttire*, gulf]: the largest member (*Gulo luscus*) of the weasel family (*Mustelidæ*); distinguished from its relatives by its greater size, massive build, and bear-like appearance. The glutton is from 3 to nearly 4 feet long, clad in shaggy, dark-brown fur, with a much lighter band beginning just behind the shoulders and running along the side upward to the base of the tail. It is an inhabitant of the wooded northern portions of Europe, Asia, and North America, and preys upon the smaller mammals, although it will attack and kill sick or wounded deer. It is savage, gluttonous, crafty, and persevering, and is the pest of the trapper, stealing the animals caught in his traps and often destroying or carrying off the traps themselves. A complete history of the animal, including many interesting anecdotes, may be found in Coues's *Fur-bearing Animals*.

F. A. Lucas.

**Gly'cas** (in Gr. Γλυκᾶς), Michael: a Byzantine historian; flourished in the first half of the twelfth century. Author of a chronological history of the world (*Βίβλος χρονική*) in four books, comprising the period from the creation to the death of the Emperor Alexios Komnenos (1118). He was thrown into prison and blinded in 1156. The work was first published in a Latin translation by Leunclavius (Basel, 1572); then the first part in Greek by Meursius (1618); the whole Greek text by Labbé (Paris, 1660); best edition by Bekker (Bonn, 1836); and in Migne, *Patrol. Gr. CLVIII.* (1866). Cf. K. Krumbacher, *Geschichte der Byzant. Literatur*, p. 146 ff. (Munich, 1891).

Alfred Gudeman.

**Glycerin** [deriv. of Gr. *γλυκερός*, sweet, deriv. of *γλυκύς*, sweet]: a substance belonging to the class of alcohols, obtained by the decomposition of ordinary Fats (*q. v.*). Fats are ethereal salts (see Ether) of the so-called fatty acids, especially palmitic, stearic, and oleic acids. When these ethereal salts, or the fats, are treated with alkalies, such as caustic soda or caustic potash, they are decomposed, and one of the products formed is glycerin. So also superheated steam decomposes the fats, the products being glycerin and the free fatty acids. The decomposition of the fat, stearin, by caustic potash takes place as represented in the equation:

$$C_3H_5\begin{cases} O.C_{18}H_{35}O \\ O.C_{18}H_{35}O \\ O.C_{18}H_{35}O \end{cases} + \begin{matrix} KOH \\ KOH \\ KOH \end{matrix} = C_3H_5\begin{cases} OH \\ OH \\ OH \end{cases} + 3C_{18}H_{35}O.OK.$$

Stearin or glyceryl stearate. Glycerin. Potassium stearate.

The decomposition with water is represented thus:

$$C_3H_5\begin{cases} O.C_{18}H_{35}O \\ O.C_{18}H_{35}O \\ O.C_{18}H_{35}O \end{cases} + \begin{matrix} HOH \\ HOH \\ HOH \end{matrix} = C_3H_5\begin{cases} OH \\ OH \\ OH \end{cases} + 3C_{18}H_{36}O_2.$$

Stearin. Glycerin. Stearic Acid.

While glycerin is always made from fats, it can be made by other methods that have a scientific interest. It is formed, for example, in the alcoholic fermentation of sugar (see Fermentation), and is therefore always contained in fermented liquors. Pure glycerin is a colorless, inodorous, viscid liquid with a marked sweet taste. Its specific gravity is 1·2665. It solidifies to an amorphous mass when kept for a time at a temperature below that of freezing water, and this mass gradually becomes crystallized if kept for a long time at or below the freezing-point of water. The crystals melt at from 62° to 97°, according to different observers. When free from water it boils at 554° F., but the addition of a little water changes the boiling-point very markedly. It is an excellent solvent. It mixes with water in all proportions, and if freed from water and exposed to the air it absorbs half its weight of water again. When heated alone or with a dehydrating agent, glycerin yields the pungent substance Acrolein (*q. v.*). Treated with a cold mixture of fuming nitric and concentrated sulphuric acid, glycerin is converted into nitroglycerin. (See Explosives and Nitroglycerin.) At a temperature of 320° F. glycerin dissolves two-thirds of its weight of boric acid, forming a compound of the formula $C_3H_5BO_3$, or glyceryl borate, which has been patented, and finds application as a preservative agent under the name "boroglyceride." Glycerin is necessarily formed as a by-product in the manufacture of candles and of soap. Formerly all the glycerin that came into the market was obtained from the candle-factories, but now much comes from the soap-factories. In the candle-factories the method commonly employed for the separation of the glycerin consists in heating the fat in a closed vessel with one-third its volume of water and 2 per cent. of lime to a pressure of 8 atmospheres for four hours. The liquid that separates, which is largely a solution of glycerin in water, is known as "sweet-water." This is concentrated by evaporation until its specific gravity is 1·22. The product thus obtained is sold as

"raw glycerin." To purify it further it is treated with animal charcoal and distilled repeatedly. Sometimes purification is effected by freezing. When a water solution of glycerin freezes the solid portion contains more water than the liquid. In the soap-factories large quantities of glycerin are recovered from the spent lye, which was formerly thrown away. A large part of the glycerin manufactured is used in the manufacture of nitroglycerin. The largest dynamite-factory in the world is at Ardeer, Scotland. About 8 tons of explosives are manufactured there daily, the chief constituent of which is nitroglycerin. Glycerin is, further, an important ingredient of cosmetics, toilet soaps, and pomades. It is used for various purposes in brewing, in photography, and in the preparation of objects for microscopic examination. In 1880 3,178 tons of glycerin were produced in the U. S., and about half of this was converted into nitroglycerin. In the year 1900 about 14,000 tons of glycerin, valued at $2,155,414, were imported into the U. S. The total production of nitroglycerin in Europe is about 25,000 tons per annum. IRA REMSEN.

**Gly'co** (in Gr. Γλύκων): a sculptor of Athens (date unknown, but probably under the early Roman emperors), by whom the celebrated colossal statue of Hercules known as the Farnese Hercules was made. This was taken to Rome probably in the time of Caracalla, and placed in his baths, where it was discovered. The statue is supposed to be a copy from an original by Lysippus, and represents Hercules leaning on his club. See Müller, *History of Greek Art* (§ 129, 2); Brunn, *Geschichte der Griechischen Künstler*, i., 549 (Brunswick, 1853). Revised by J. R. S. STERRETT.

**Gly'cogen** [from Gr. γλυκύς + Eng. *gen*, a suffix formed with meaning of Gr. γεννάειν, produce, and Lat. *genera're*, generate, produce]: a white, amorphous, starch-like, tasteless, odorless substance, found by Claude Bernard in the liver of man and the lower animals, and known to exist in other tissues, especially during fœtal life. It may be dissolved by water out of the tissues where it exists, and then precipitated with alcohol. DIASTASE (*q. v.*) and saliva convert glycogen into maltose, a little glucose, and one of the modifications of dextrin. When boiled with dilute mineral acids it is converted into glucose. Its composition is represented by the formula $C_6H_{10}O_5$. The glycogenic function of the liver is discussed under LIVER (*q. v.*). Revised by IRA REMSEN.

**Glycosuria** [Mod. Lat., from Gr. γλυκύς, sweet + οὖρον, urine]: a symptom of disease in which sugar is present in the urine. It is the prominent sign of the disease DIABETES (*q. v.*), but may occur in a variety of other diseases as a temporary condition, or may follow ingestion of certain drugs like chloral, chloroform, and morphia. It is a quite frequent occurrence in the puerperal state, where its appearance indicates normality rather than disorder. W. P.

**Glycyrrhiza**: See LICORICE.

**Glyoxalin**: See EXPLOSIVES.

**Glyphography**: See STEREOTYPING.

**Glyp'todon** [Mod. Lat.; Gr. γλυπτός, carved, deriv. of γλύφειν, carve, engrave + ὀδούς, ὀδόντος, tooth, named for its fluted teeth]: a gigantic extinct armadillo-like animal. In a restricted sense the typical genus of the family *Glyptodontidæ*, or HOPLOPHORIDÆ (*q. v.*); also used as a popular name for any member of the group. F. A. LUCAS.

**Glyptothe'ca**, or **Glyp'tothek** [Mod. Lat. *glyptothe'ca*; Gr. γλυπτόν, carved image, neut. of γλυπτός, carved + θήκη, receptacle, deriv. of θεῖναι, put]: a modern term of which the English form is usually *glyptotheca*; a building for the reception of works of sculpture. The term Glyptothek is generally applied only to the sculpture gallery at Munich, built by King Ludwig I. R. S.

**Gmelin**, gmā'lin, JOHANN GEORG, M. D.: b. at Tübingen, Germany, June 12, 1709; educated in the University of Tübingen; took his medical degree in 1727; became Professor of Chemistry and Natural Science at St. Petersburg 1731; journeyed in Siberia 1733–43; was made Professor of Botany at Tübingen 1749; died there May 20, 1755. Author of *Travels in Siberia* (4 vols., 1751–52) and *Flora Sibirica* (4 vols., 1749–70).—His nephew, JOHANN FRIEDRICH GMELIN, M. D., b. at Tübingen, Aug. 8, 1746; graduated in medicine 1769; became Professor of Botany, etc., at Tübingen 1771, of Medicine 1775; Professor of Medicine at Göttingen 1778. Author of many works on botany, chemistry, and toxicology. D. at Göttingen, Nov. 1, 1804.—SAMUEL GOTTLIEB GMELIN, M. D., also a nephew of J. G. Gmelin; b. at Tübingen, June 23, 1745; took his medical degree 1766; became professor of botany at St. Petersburg, and traveled (1768–74) in South and Southeastern Russia; was taken prisoner in the Caucasus, and died July 27, 1774, in consequence of the ill-treatment he received. His *Historia Fucorum* (1768) and some volumes of travels have been published.—LEOPOLD GMELIN, M. D. (son of J. F. Gmelin); b. at Göttingen, Aug. 2, 1788; studied at Göttingen, Tübingen, Vienna, and in Italy; was titular and ordinary professor of chemistry and medicine at Heidelberg 1817–51. Author of *Handbuch der Theoretischen Chemie* (3 vols., 1817–19) and a *Lehrbuch der Chemie* (1844), and also made famous experiments upon digestion. D. at Heidelberg, Apr. 13, 1853.—Other distinguished members of this family were JOHANN CONRAD (1707–59), a physician, author, and pharmaceutist of Tübingen, elder brother of J. G. Gmelin; and PHILIPP FRIEDRICH, younger brother of the same (1721–68); held professorships of Botany, Chemistry, and Medicine in Tübingen, and was author of many scientific monographs. The botanists of this name are commemorated by the Linnæan genus *Gmelina*, plants of the order *Verbenaceæ*.



**Gmünd**: town of Würtemberg; on the Rems; 30 miles by rail E. of Stuttgart (see map of German Empire, ref. 7–E); in a beautiful, fertile, and well-cultivated valley; formerly a free imperial city. It is surrounded by old walls flanked with towers, and has a considerable number of ancient buildings. It has an asylum for the blind and for deaf mutes, and celebrated manufactures of jewelry, silver, copper, bronze, and brassware; also of silk, cloth, tobacco, wax, etc. Pop. (1895) 17,282.

**Gnat**, năt [M. Eng. *gnat* < O. Eng. *gnæt*, gnat]: any one of various small two-winged flies of the family *Culicidæ*, the most familiar being that commonly known as mosquito (*Culex pipiens*). Gnats differ from other two-winged flies (Diptera) by the long and slender mouth-parts (Figs. 1 and

FIG. 1.

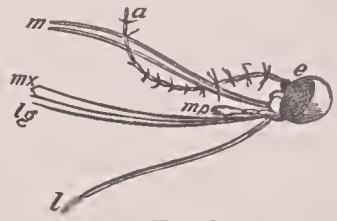



FIG. 2.

Dorsal (Fig. 1) and side (Fig. 2) view of the head of the female, enlarged: *a*, antennæ; *m*, mandibles; *mx*, maxillæ; *lg*, lingua; *l*, labium, in which the other parts are ensheathed.

2). These are adapted for probing and puncturing the flesh of its victim. The young, or larvæ (Fig. 3), are aquatic, living in pools. They are cylindrical, with the head and succeeding segment much enlarged, and breathe by means of a bunch of hairs radiating from a long tubercle situated at the end of the body, and connecting with the internal respiratory tubes (tracheæ). They remain most of the time at the bottom, feeding upon decaying matter, and are thus very beneficial as scavengers. In the pupa state they take no food, and breathe by a respiratory tube (Fig. 3, B, *d*) situated on the greatly enlarged thorax. They are very active in this state, jerking up and down in the water, aided by a pair of broad caudal leaves (Fig. 3, C). The long cylindrical eggs are laid in little packets which float on the surface of standing water. In four weeks after hatching the insect passes through its transformations and arrives at maturity. The females alone bite. The males, which may be distinguished from the other sex by their bushy antennæ, seldom visit houses, and do not bite. It is a question whether the bite of the mosquito is poisonous. No poison-gland has yet been found in the head, and it is generally thought that the inflammation and swelling following the bite of one of these insects are due to the irritation set up by the slightly barbed jaws and perhaps to the saliva, which is slightly acrid. About thirty American species of *Culex*, the genus to which the gnat belongs, are described in various works. The buffalo gnat (*Simulium pecuarum*) belongs to quite another family, the *Simuliidæ*. This minute insect is an inhabitant of the Southern and

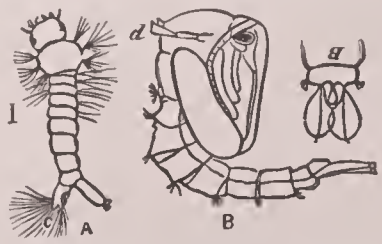



FIG. 3.—A, larva; *c*, respiratory tube and radiating hairs; B, pupa; *d*, thoracic respiratory tube; C, lamellæ at end of body of the pupa, enlarged.

Western U. S., and occurs at times in countless myriads, becoming a great scourge of cattle, rendering them frantic by its persecutions. For the gall-gnat, see GALL INSECTS.

Revised by F. A. LUCAS.

**Gnathos'toma**: See COPEPODA.

**Gneisenau**, AUGUST WILHELM ANTON, Count NEIDHART von, nīt'hăart-fōn-gnī'ze-now: soldier; b. at Schildau, Saxony, Oct. 27, 1760; served for a short time with the German mercenaries in the American Revolutionary war; became in 1789 a captain of Prussian troops; in 1807 was placed in command of the fortress of Colburg, which he held against the French till the Peace of Tilsit; was dismissed in 1809 at the suggestion of Napoleon I.; was chief of staff and chief quartermaster to Blücher; conducted the retreat after Lützen 1813, and after the Leipzig campaign was made lieutenant-general; served in France 1814, and was made a count; contributed much to the final success at Waterloo by his strategic skill after the affair at Ligny; was made governor of Berlin 1818; general field-marshal 1825; led an army in Prussian Poland during the Polish insurrection of 1831. D. in Posen, Aug. 24, 1831.

**Gneiss**, nīs [Germ.]: a foliated or banded holocrystalline feldspathic rock—i. e. a rock of granitic composition, but with a more or less pronounced parallel arrangement of its constituent minerals. As most GRANITE (*q. v.*) shows some tendency to such a banded structure, gneiss must be regarded as the oldest, most widespread, and most fundamental of all the rocks of the earth's crust. There is a difference of opinion among geologists as to how far the banded structure of gneiss represents original stratification. Some maintain that such a parallel arrangement of constituents is always proof of sedimentation, and therefore that gneiss is always a metamorphosed aqueous deposit. Conclusive evidence, however, shows that the gneissoid structure may originate in igneous rocks, either primarily as the result of movement in a partly solidified magma, or secondarily as the result of shearing in a mass already solid. Without doubt some gneisses have originated by the metamorphism or recrystallization of former sediments, but since it has been shown that similar, if not identical, rocks may also be produced from igneous rocks, the gneissic structure can no longer be regarded as a proof of sedimentation. Each occurrence must be studied for itself, as no single theory can account for the origin of all gneisses. This fact removes one of the strongest arguments for the metamorphic origin of granite, inasmuch as a gradation of this rock into gneiss implies no definite proof of sedimentary origin for either rock. There is a tendency to employ the term gneiss for feldspathic, holocrystalline rocks, purely as a structural term, and to have it imply nothing in regard to either constituent minerals or genesis. In this way other rock-names implying definite mineral composition may be united with it, and one may speak of granite-gneiss, syenite-gneiss, diorite-gneiss, gabbro-gneiss, etc. Gneiss is the most abundant and most widely distributed member of that group of rocks known as the CRYSTALLINE SCHISTS (*q. v.*), which are for the most part of pre-Cambrian age and quite universally developed, at the lower horizons, over the entire earth's surface.

GEORGE H. WILLIAMS.

**Gneist**, gnīst, RUDOLPH, von, Ph. D., LL. D.: Professor of Jurisprudence in the University of Berlin; b. in Berlin, Aug. 13, 1816; became professor in the university 1844; member of the Prussian Chamber of Deputies 1867–84; of the Imperial Parliament 1875–77; appointed instructor to Prince William in matters of political science. Author of *English Constitutional History* (1882); *Administrative Law in England* (1884); *History of the English Parliament* (1886); and numerous other important historical and constitutional publications. He was ennobled in 1888. D. in Berlin, Germany, July 22, 1895. C. H. THURBER.

**Gnesen**, gnā'zen: town of Prussia; in the province of Posen: 31 miles by rail E. N. E. of Posen (see map of German Empire, ref. 3–I). It has a splendid cathedral, and is the residence of the Archbishop of Gnesen-Posen. Polish kings were crowned here till 1320. Pop. (1890) 18,088.

**Gneta'ceæ**: See GYMNOSPERMS, JOINT FIRS, and PLANTS, FOSSIL.

**Gnoli**, DOMENICO: Italian poet and critic: b. in Rome in 1839. In 1870 he published, under the pseudonym of *Dario Gaddi*, a volume of verse entitled *Poesie*. Becoming a teacher, he was made Professor of Italian Literature in Turin. Later he went to Rome, where he is (1893) prefect of the National Library Vittorio Emmanuele, and where in 1888 he founded the *Archivio Storico dell' Arte*, of which he is editor. He published in 1879 his *Odi Tiberine*; in 1885 *Nuovi Odi Tiberine*. He has translated from the German and published various critical essays, chief among which are his *Studi letterari* (Bologna, 1883).

A. R. MARSH.

**Gnomic** (nom'ik) **Poets** [*gnomic* is from Gr. γνωμικός, dealing in maxims, sententious, deriv. of γνώμη, judgment, maxim, deriv. of γνῶναι, observe, judge, know]: in Greek literature, a name applied to those didactic poets whose compositions are characterized by aphorisms and short, proverb-like moral precepts (*gnomai*). Pre-eminent among the gnomic poets are Theognis, Solon the lawgiver, Phocylides, and Simonides of Amorgos. Among the best-known editions of the gnomic poets (of some of whom considerable fragments remain) are those of Boissonade (1832), Bekker (1815), Brunck (1784), and Sylburg (1651).

**Gnosticism**, nos'ti-sizm: the religious and metaphysical system of the GNOSTICS (*q. v.*).

**Gnostics**, nos'tiks [from Gr. Γνωστικός, Gnostic, liter., one who knows, noun use of γνωστικός, knowing, deriv. of γνώστης, knower, deriv. of γνῶναι, know, judge < Indo-Eur. *gnō-* > Lat. *(g)nos'cere*: Eng. *know*]: a name applied to the adherents of numerous schools of heretics in the early Christian Church. In the New Testament *gnosis* is simply (as in 1 Cor. xii. 8) the more profound apprehension of Christian truth. In Pseudo-Barnabas (107–120 A. D.) it means allegorical interpretation. Finally, it came to denote a system of excessive and fanciful religious speculation. As to its origin, it was in part a reaction of the freer pagan mind against the narrowness and poverty of Ebionism, but also, and more essentially, an inevitable product of the speculative genius of the Gentile world in its first exciting contact with the stupendous facts and doctrines of Christianity. Its elements were derived from three sources: Hellenistic idealism, Oriental pantheistic naturalism, and the Christian revelation. It did not begin as a heresy, but soon became such in undertaking to answer unanswerable questions. These questions are suggested by Tertullian (*De Præscriptione Hæreticorum* (On prescription against heretics) § 7): "Unde malum, et quare? et unde homo, et quomodo? et quod proxime Valentinus proposuit, unde Deus?" ("Whence is evil, and why is it? and whence is man, and how came he? and then there is the question Valentinus proposed the other day, whence is God?") Its grand leading question was in regard to the origin of evil. But this question was only one of several. Its theme was really the whole "world-process." This process embraces the three problems of creation, sin, and redemption. The solutions offered were in form exceedingly diversified, the systems many and various. In classifying these systems the ingenuity of critics has been severely taxed. The more noted classifications are as follows:

I. GIESELER'S.—(1) The Alexandrian Gnostics: Basilides, Valentinus, Ophites, Antitactes, Prodiciani; (2) Syrian: Saturninus, Bardesanes, Tatian; (3) Marcion and his school. This geographical classification is not at all felicitous.

II. RITTER'S.—(1) Dualistic: Saturninus, Basilides, Hermogenes, and others; (2) Idealistic: Valentinus, Marcus, Ptolemæus, and others.

III. NEANDER'S.—Originally, (1) Judaistic; (2) Anti-Judaistic. Subsequently modified by sub-dividing No. 2 so as to stand, (1) Judaistic: Cerinthus, Basilides, Valentinus and his school, Heracleon, Ptolemæus, Marcus, and Bardesanes: (2) Anti-Judaistic: (*a*) in sympathy with paganism, the Ophites, Pseudo-Basilidians, Cainites, Carpocratians, Prodicians, Antitactes, Nicolaitans, Simonians; (*b*) dissevered from all earlier systems, Saturninus, Tatian, the Encratites, Marcion and his school.

IV. BAUR'S.—(1) Those who brought Christianity into closer connection with Judaism and heathenism: Basilides, Valentinus, Saturninus, Bardesanes, the Ophites; (2) those who made a strict separation of Christianity from Judaism and heathenism: Marcion and his school; (3) those who identified Christianity with Judaism, and opposed both to heathenism in the form of gnosis: the Pseudo-Clementines.

V. NIEDNER'S.—(1) Those who gave Christianity at once a place, and the highest place, among the religions of the world: (*a*) in its original form, Basilides, the Ophites, and the closely allied Cainites and Sethites; (*b*) in its perfected form, Valentinus, Heracleon, Ptolemæus, and Marcus; (2) those who separated Christianity from its historic connec-

tion, and made it the first true revelation of God: (*a*) Marcion and his school; (*b*) the Syrians, Saturninus, Bardesanes, Tatian, and Apelles: (3) those who identified Christianity (*a*) with heathenism, the Carpocratians, Antitactes, and Prodicians, all licentious; (*b*) with Judaism, the Pseudo-Clementines.

On four points these systems all, or nearly all, agree: (1) God is incomprehensible. (2) Matter is eternal and antagonistic to God; or, as Basilides taught, if created by God, still conditions and limits the divine efficiency. (3) Creation is the work of the Demiurge, according to some, only subordinate—according to others, totally opposed to God. (4) The human nature of Christ was a mere deceptive appearance. The most elaborate system was that of Valentinus. The historic order was as follows: (1) the Simonians, 37 A. D. (Acts viii.); (2) the Nicolaitans, 96 A. D. (Rev. ii. 6); (3) Cerinthus, near end of first century; (4) the Ophites, very early; (5) Basilides at Alexandria, 125–140 A. D.; (6) Valentinus, 138–160 A. D.; (7) Marcion, 150 A. D.; (8) Bardesanes, 170 A. D.; (9) Hermogenes, about 200 A. D. Gnosticism reached its highest bloom about 150 A. D. In the third century its creative energy was gone; in the fourth century it was powerless; in the sixth century only remnants of it remained. Severe laws against the Gnostics were enacted in 530 A. D. (See *Cod. Just.*, 1 : 5 : 18, 19, 21.) The rapidity with which the system waxed and waned is explained by the fact that it was an aristocratic heresy. The masses neither relished nor understood it. It was only a speculation of the few, and the aim was not to found sects, but schools. Only the Marcionites organized separate churches. The principal original sources of information are—Irenæus, *Adversus Hæreses*, 182–188 A. D.; Tertullian, *Adv. Marcionem* and *Adv. Valentinianos*, c. 200 A. D.; Hippolytus, *Philosophoumena*, 222-235 A. D.—the greater part of it recently recovered (these three are found translated in the Ante-Nicene Library); Epiphanius, *Panarium, circa* 400 A. D.; also quotations in Eusebius, and the *Pistis Sophia*, a Gnostic book dating from the third century, preserved in a Coptic translation which was discovered in the eighteenth century, and first published complete (ed. by F. H. Petermann), Berlin, 1851, and Latin trans. separately, 1853. Cf. A. Harnack, *Ueber das gnostiche Buch Pistis Sophia* (Leipzig, 1890). Able monographs on the subject have come from R. A. Lipsius, *Der Gnosticismus* (Leipzig, 1860); C. W. King, *The Gnostics and their Remains* (London, 1864; 2d ed. with bibliographical appendix by J. Jacobs, 1887); H. L. Mansel, *The Gnostic Heresies of the First and Second Centuries* (ed. by J. B. Lightfoot, 1875); and others.

Revised by S. M. Jackson.

**Gnu**, nyu [Hottentot]: either of two species of South African antelopes belonging to the genus *Catoblepas* (or *Connochætes*). The body of the animal is stout, the legs

The gnu, or horned horse.

slender, the neck bears a short, stiff mane, and the tail is long and flowing like that of the horse. The muzzle is wide, and the horns, which are largest in the male, curve at first downward, then upward and forward. From their peculiar appearance the gnus are often popularly termed horned horses, while the Dutch colonists christened them wildebeests on account of their savage looks and actions. The white-tailed gnu (*Catoblepas gnu*) is dark brown or blackish, with considerable white in the tail, and stands about 4 feet high at the shoulders. The brindled gnu (*C. gorgon*) is larger, of a bluish-gray color, and marked on the shoulders with vertical stripes. It is sometimes placed in a separate genus.

F. A. Lucas.

**Goa**, gō′ăă: the name of a territory of Hindustan; on the Malabar coast; situated between lat. 14° 54′ and 15° 45′ N., and belonging to Portugal. Area, 1,080 sq. miles. It produces rice and pepper, and has many navigable rivers and noble forests. Pop. (1891) 561,384. Capital, Panjim or New Goa.

**Goa**: town of Hindustan; on the Malabar coast; in lat. 15° 30′ N. (see map of South India, ref. 4–C). It was formerly the capital of the Portuguese dominions in India and a magnificent city, but it is now decayed. In the beginning of the eighteenth century it was deserted on account of cholera. Pop. about 1,800.

Nova Goa, or Panjim: 6 miles W. of Goa is a walled and strongly fortified city, on the Mandavi; the residence of the Portuguese governor-general and of the Archbishop of Goa. It has a good harbor, handsome churches, a national lyceum, and a college for practical sciences and other public buildings, and has been the capital since 1758. Pop. about 15,000.

**Goajira**, gwăă′hcĕ-răă: a peninsula of the northern coast of South America; forming the west side of the Gulf of Maracaibo, and crossed by the boundary between Venezuela and Colombia. It contains about 5,800 sq. miles, and is connected with the mainland by an isthmus 37 miles wide. The greater part is low, but in the interior there are considerable hills with extensive forests, furnishing cabinet woods; on the southeast coast there are valuable salines. Almost the only inhabitants are Goajiros and Cosinas Indians, said to number about 30,000. They are practically independent, have extensive herds, the descendants of Spanish stock, and sell cattle, horses, hides, cheese, and hammocks to the traders. Venezuela long claimed the whole of the Goajira peninsula, though never holding any actual jurisdiction in it; the Spanish arbitration of 1891 left only a small part on the southeast coast to that country; the rest was awarded to Colombia, and has been incorporated in the state of Magdalena.

Herbert H. Smith.

**Goalpara**, gō-ăăl-paa′răă: the northwestern district of Assam, British India; N. of the Garo hills, S. of Bhutan, E. of Kuch Behar, and between parallels 25° 21′ and 26° 54′ N. and meridians 89° 44′ and 91° E. It is traversed by the Brahmaputra, and the plains are inundated yearly. There are extensive forests, and wild animals abound. Area, 4,430 sq. miles. Pop. about 450,000, mostly Hindus. Goalpara town is the chief center and largest town, but has only 5,000 inhabitants. Rice is the staple crop. The rivers form the chief means of communication. The climate is wet, with an average rainfall of 99 inches. Cholera is frequently epidemic, and fevers, dysentery, rheumatism, and smallpox prevail.

M. W. Harrington.

**Goat** [O. Eng. *gāt* : Germ. *Geiss* : Goth. *gaits* < Indo-Eur. **ghaidos* > Lat. *hædus*]: the popular name for the ruminant mammals of the genus *Capra*, of which the domestic goat is a familiar example. Goats are distinguished by compressed horns, keeled in front, curving backward, and usually present in both sexes. The hoofs are four-sided, and there is a sub-orbital fissure. The male has a bearded chin and vile smell. Although the domesticated goat (*Capra hiscus*) has been introduced into all countries, goats are found wild only in the Old World, and no fossil remains even have been found in America. The so-called Rocky Mountain goat is an antelope. The origin of the domestic goat is uncertain, but while some consider the original species as extinct, and others find it in the ibex (*C. ibex*), there is considerable reason to suppose that it may be the wild goat (*Capra ægagrus*) of the mountains of Central Asia. The male of this species is characterized by immense horns, which sometimes attain a length of 3 feet. These are small, or even wanting, in the female. The wild goat stands higher than the domestic animal, has stouter legs and a lighter body. As a result of long domestication, varied surroundings, and judicious crossing, the domestic goat has developed into numerous well-marked breeds, among which are the noted Angora and Kashmir goats. The former, which derives its name from Angora in Asia Minor, has slightly twisted horns and very long, curly, silky hair; there is a shorter and inferior under coat. This breed is raised in large numbers at the Cape of Good Hope, where it was introduced about 1864. The Kash-

mir goat is very similar to the Angora, but is of more delicate build, while it is the under coat of hair that is most prized. Of this are made the valuable Kashmir, or "camel's hair," shawls. The flesh of goats is rather dry, and is inferior to mutton, but the hides make good leather and furnish a part of the kid gloves of commerce. The milk of the goat is sweet and nutritious. F. A. Lucas.

**Goat Island**: an island which divides the current of the Niagara river at the Falls. It belongs to Niagara township, Niagara co., N. Y. Area, 70 acres. It is 900 feet distant from the mainland of the U. S. and 2,000 from the Canadian shore. It is connected with the New York shore by a substantial bridge.

**Goatsucker**: a bird (*Caprimulgus europæus*) of the Old World, belonging to the order *Picariæ* or *Macrochires*, the type of the family *Caprimulgidæ*, to which belong the whip-poor-will, the chuck-wills-widow, the night-hawk, and several other birds of the U. S., all of which are collectively called goatsuckers. The true goatsucker gets his name from the ancient and popular belief that he sucks the milk of goats and cows, infecting the animals with a deadly disease. The bird is also called fern-owl, dor-hawk, night-jar, etc., the latter name coming from a jarring or purring sound which it utters. It is the subject of many popular superstitions in the folk-lore of many nations.

**Gob'elins Tapestry**: a kind of tapestry (see Tapestry) manufactured only in the Gobelins factory, in the Faubourg St. Marcel, Paris, in the Rue Mouffetard. Some Gobelins tapestries cost from $30,000 to $40,000, and require from five to ten years for completion. Since 1791 none have been sold. They are mostly presented by the French Government to foreign courts. The Gobelins factory was first called *Gobelin's folly*. It was an unsightly structure, built by a Belgian wool-dyer of the fifteenth century, one Jehar Gobeelen. In 1662 Louis XIV. made it a royal manufactory. In 1826 another royal carpet-factory, La Savonnerie, established in 1615, was joined to it.

**Go'bi, Co'bi**, or **Sha'mo**: a wide tract in Central Asia; between lat. 40° and 50° N. and lon. 90° and 120° E. It forms a table-land 3,000 feet above the level of the sea, between the mountain-ranges of Altai and Kuen-Lun, with only small depressions and elevations. Its western part is mostly covered with fine sand, drifting before the wind, and forming an undulating surface which reminds the traveler of the waves of the ocean. The eastern part consists chiefly of naked rocks. It is a desolate region, where the winter is nine months long; frost and snow may occur in July, and the short summer, with its intense heat, creates but an oppressive atmosphere. Extensive steppes, rising toward the mountainous borders, afford pasture for the flocks of the nomadic tribes of Mongolians who wander in these wilds.

**Goblet**, René: politician; b. at Aire-sur-la-Lys, France, Nov. 26, 1828; was admitted to the bar at Amiens; aided in the founding of a liberal newspaper under the empire; and was appointed procureur-général in the court of appeal in that city Sept. 7, 1870, but resigned in the following year, and was elected to the National Assembly, where he voted with the republican left and distinguished himself as an orator. In Feb., 1879, he was appointed Under-Secretary of State for Justice, and in the cabinet of M. de Freycinet formed Jan. 31, 1882, he was Minister of the Interior. In Brisson's ministry he was made Minister of Public Instruction, and held the same office under de Freycinet, on whose downfall he formed a ministry himself Dec. 11, 1886. He was overthrown on the question of the budget May 17, 1887. In 1891 he was elected to the senate.

**Goby** [from Lat. *go'bius*, another form of *go'bio*, *gobio'nis* (whence Fr. *goujon*, Eng. *gudgeon*) = Gr. κωβιός, gudgeon,

The black goby.

tench]: a marine fish of the genus *Gobius* and family *Gobiidæ*, which live mostly upon muddy bottoms, where they burrow in holes. Some of them build nests for their young. These fishes are prized for the aquarium, in which their nesting can be readily observed. More than 100 species are known, some of them being found on all temperate and tropical coasts.

**God** [O. Eng. *god* (entirely distinct from O. Eng. *gōd* > Eng. *good*): O. H. Germ. *got* (> Mod. Germ. *Gott*): O. N. *guð*: Goth. *guþ* (masc. used of Christian God), plur. *guda* (neut. used of heathen gods) < Indo-Eur. *ghŭtó-m*, called upon, invoked, past partic. neut. of *ghū-*, call; cf. Sanskr. *hū-*, call, *hótar-*, priest (perhaps also connected with *hu-*, pour), *devá-hūti-*, supplication to the gods. If the Indo-Eur. language possessed a generic word for "god," it was probably *deiu̯os*, from the root *div-*, shine; cf. Sanskr. *devá-s*: Lat. *deus*: O. Ir. *dia*: Lith. *diẽwas*: O. N. *tīvar*. The Greek word θεός can not be directly compared, as Indo-Eur. *deiu̯os* would have appeared in Gr. as *δειός. This word has been apparently displaced by θεός < Indo-Eur. *dhu̯esó-s*, breath, spirit, ghost; cf. θέσφατος, Lith. *dvėsti*, breathe, *dvãsė*, breath, ghost]: the Supreme and Absolute Being, the Creator of the universe, the infinite, eternal, and unchangeable Spirit. What is known of God may be stated briefly under the following heads: (1) Definition of the term; (2) origin of the idea; (3) proofs of his existence; (4) attributes; (5) existence as Three Persons; (6) relation to the world; (7) works; (8) prevalent antitheistic theories.

I. In consequence of the predominance of Christian ideas in the literature of civilized nations for the last eighteen centuries, the word *God* has attained the permanent and definite sense of a self-existent, eternal, and absolutely perfect free personal Spirit, distinct from and sovereign over the world he has created.

II. Origin of the Idea.—The word, nevertheless, continues to be used with a wide latitude of meaning. The full conception associated with it by Christians is of course largely the product of revelation. On the other hand, the general idea of God as a being upon whom man depends and to whom he is responsible, and for whose communion he longs, is innate in human nature—i. e. it is universally generated and sustained in human consciousness by the laws of our nature. This fact is by some attributed to a "God-consciousness" (Schleiermacher); by others to an immediate knowledge or direct intuition of God (Schelling, Cousin); and by others to a constitutional tendency or impulse, or an innate religious sentiment or instinct. It bears all the marks of an intuitive truth or first principle of reason—e. g. universality and necessity—since it reappears and persists in all normal conditions of consciousness. (See Cicero, *De Natura Deorum*, and Gillett, *God in Human Thought*, etc.) This general idea of God, native to the human soul, has been moulded into various forms by tradition and speculation, and perfected by revelation.

*Theories of the Origin of the Idea of God.*—There are generically three theories as to the origin of the idea of God. (1) The first assigns it to a *primeval revelation* (Watson, Leland, Gladstone), and accounts for its persistence by the force of tradition and education. (2) The second assigns it to *inference*, and takes two specific forms: (*a*) the former of these derives the first notion of God from *invalid inferences of primitive man*, from dreams (Lubbock, Darwin, Spencer), animistic ideas (Tylor), crude personifications (Hume, Fiske), fear (M. J. Savage, *Religion of Evolution*), and the like; and accounts for the more purified and higher conceptions as an age-long development of thought from these crude beginnings. (*b*) The latter form of this theory assigns the origin of the idea of God to a *valid and rapid inference*, which the human mind inevitably makes from the facts brought before it as to its own nature and that of the world about it (Flint, McCosh). (3) The third assigns it to *intuition*, but takes divergent forms according as what is meant by this is the immediate knowledge of the Absolute of Schelling and Cousin, the God-consciousness of Jacobi and Schleiermacher, or merely the innate, constitutional tendency of Calderwood and Hodge. Both the first of these generic views and the former form of the second neglect the very point to be explained. The primitive revelation, which was a fact, was necessarily addressed to a precedent religious nature, without which it could not have been received; it was of importance in developing the idea of God, but did not first produce it. So the inference from dreams and the like to supernatural beings presupposes a pre-existent tendency to such a notion, without which such an inference would be inexplicable. The immediate knowledge of God

of the transcendentalists has been permanently refuted by Sir William Hamilton. The remaining theories—that of immediate and even unconscious inference, as taught by Flint and McCosh, and that of innate constitutional tendency, as taught by Hodge and Calderwood—differ little from one another. When we speak of an inference which is made by all men, which is unavoidable, and which is even made unconsciously and instinctively, we are not far from affirming an innate idea which is developed on the presentation of its material. What is contended for by those who teach that man has an intuitive knowledge of God is not that he is born with a fully formed conception of God but that he has a native undeveloped perception of God. All intellectual intuitions concern the relations of things or persons, not directly the existence of them; but they do involve their existence through the cognition of relations. The causal intuition, for example, is the conviction of the existence of a cause arising from the perception of an effect as an effect; that is, as an event standing in relation to something else as its cause, the existence of which is implied in our perception of the effect as such. The perception of God is equally intuitive, i. e. it is part of the content of our perception of man (self) as man, that is, as a dependent and responsible being; in other words, as standing in relation to somewhat which we call God, the existence of which is implied in our perception of man as such. The idea of God is thus, apparently, given in the very same act with the idea of self, though the contents of this idea are left to be developed by reflection; just as the intuition of causality tells us that the effect as such has a cause, but leaves the discovery of the nature of that cause to investigation. Compare on the origin of the idea of God, Kellogg, *Genesis and Growth of Religion*; Mead, *Supernatural Revelation*.

III. Proofs of God's Existence.—All the "arguments" for the being of God are intended either to quicken and confirm this innate idea, or to expand and render it definite by showing *what* God is, as well as proving *that* he is. See McCosh's *Intuitions of the Mind*, pt. 3, b. 2, ch. v., § 2.

The most commonly used of these arguments are four, one *a priori* and three *a posteriori*, as follows:

A. *The ontological argument* has been presented in various forms. The Eleatics gave it its earliest expression, while Boethius (A. D. 474) laid its foundations for Christian thought. The chief forms which it has been given are the following: 1. Anselm, Archbishop of Canterbury (1093–1109), in his *Monologium* and *Proslogium*, states the argument thus: What is necessarily thought to exist in reality, does exist in reality. But a Being than which a greater can not be conceived is necessarily thought to exist in reality; because what exists in reality is greater than what exists in thought. Therefore when we speak of a Being than which a greater can not be conceived, we must think of him as existing in reality. Otherwise we could conceive a greater, viz., one which existed in reality. Therefore a Being a greater than which can not be conceived must exist in reality. 2. Descartes (1596–1650), in his *Meditationes de prima philosophia*, prop. 2, p. 89, bases his proof on the idea of a Perfect Being, arguing that existence is comprised in the very idea of a Perfect Being, as a necessary element of perfection, "just as that the sum of its angles is equal to the right angles is comprised in the idea of a triangle." He further argued that the idea of an infinitely Perfect Being could not have originated in a finite source, and therefore must have been communicated by an infinitely Perfect Being. He also, in other arguments, claims that this idea represents an objective reality, because (1) it is pre-eminently clear, and ideas carry conviction of correspondence to truth in proportion to their clearness; and (2) it is necessary. 3. Dr. Samuel Clarke in 1705 published his *Demonstration of the Being and Attributes of God*, in which he (like Descartes) combines the *a priori* and *a posteriori* arguments, making a composite presentation of exceptional strength. His argument turns on the necessity of thinking of an eternal somewhat, which is itself immutable and independent, self-existent and necessary, as the cause of all else that is. He argues that this self-existent somewhat must be infinite, eternal, one, etc. He also argues that time and space are infinite and necessarily existent, but they are not substances. Therefore there must exist an eternal and infinite substance of which they are properties. On the ontological arguments, see Runze, *Der ontologische Gottesbeweis*; Shedd, *Dogmatic Theology* and *History of Doctrine*.

B. *The cosmological argument* may be stated in the form of a syllogism: Every new thing and every change in a previously existing thing must have a cause sufficient and pre-existing. The universe consists of a system of changes. Therefore the universe must have a cause exterior and anterior to itself. It has been objected that the "causal judgment" rests solely on experience, which gives only invariable sequence and not efficiency. (See Mill's *Logic*, p. 203, and Hume's *Treat. on Hum. Nature*, pt. 1, § 1.) On the contrary, the "causal judgment" is a self-evident or intuitive truth or law of reason, presupposed in all experience, bearing the marks of universality and necessity. Moreover, an endless series of effects supported by no absolute cause is infinitely less rational than any single uncaused effect. The mind can rest only when it has reached ultimately an uncaused first cause. McCosh's *Intuitions of the Mind*, pt. 2, b. 3, ch. ii., § 8.

That the universe is a system of changes is proved and illustrated by all the sciences, especially by geology, zoölogy, and anthropology. John Stuart Mill, in his *Essay on Theism*, argues that the conclusion from the doctrine of the conservation of force is that the matter and force of which the universe consists are a constant quantity, assuming various forms, but themselves without beginning or cause. But the fact is that the theory of cosmical development from the days of Laplace to the present involves the constant dispersion of physical energy, the sun and planets passing from a state of heated gas to frozen and lifeless solidity; and since this dispersed and lost energy is finite, it must have commenced in a spontaneous cause—i. e. a personal volition.

C. *The teleological argument*, or argument from design or final causes, is as follows: Design, or the adaptation of means to effect an end, implies the exercise of intelligence and free choice. The universe is full of traces of design. Therefore the "First Cause" must have been a Personal Spirit. This argument is as old as Anaxagoras, who has been justly called the father of the doctrine of final causes, and is elaborated by Socrates (*Memorabilia*, b. 4). Bacon says: "I had rather believe all the fables in the Legend, and the Talmud, and the Alkoran than that this universal frame is without a mind." "Final causes" have been repudiated as a principle of interpreting nature by Hume, and under his influence by a class of modern naturalists. He maintained (see *Dialogues on Nat. Relig.*) that the judgment which infers a designing cause from adjustments adapted to effect an end rests wholly upon experience; and as we have no experience of world-making, we have no right to infer a world-maker. But this judgment, on the contrary, is intuitive, universal, and necessary, and its force is admitted for example by J. S. Mill (*Essay on Theism*). The new doctrine of evolution has been represented by some of its teachers (as by Darwin himself and Spencer) as excluding final cause. This is not inherent in the doctrine of evolution, but only in that form of it which proceeds upon atheistic or agnostic postulates, i. e. in the philosophical presuppositions of some evolutionists. Many forms of the evolutionary hypothesis can not dispense with the idea of teleology. On this matter see especially Janet, *Final Causes*; Gray, *Darwiniana*; Wallace, *Natural Selection* and *Darwinism*; Calderwood, *Evolution and Man's Place in Nature*; Schmid, *The Darwinian Theories*; Le Conte, *Evolution in its Relation to Religious Thought*; McCosh, *The Religious Aspects of Evolution*; Hodge, *What is Darwinism?* Warfield, *Charles Darwin's Religious Life*, in *The Presbyterian Review* (Oct., 1888). The design everywhere manifest in the inorganic, organic, instinctive, and rational provinces of the universe has been fully demonstrated in the *Bridgewater Treatises*, Paley's *Nat. Theol.*, Butler's *Analogy*, McCosh's *Typical Forms*, etc., Buchanan's *Faith in God*, etc., Tulloch's *Theism*, etc.

D. *The moral argument* derived from the constitution and history of man, and his relations to the universe: 1. All our knowledge rests upon consciousness. We begin with the knowledge of self as a conscious, intelligent, spontaneous cause; and this is involved in every act of sense-perception, reflection, recollection, etc. From knowledge of self as (1) spontaneous cause, (2) intelligent, we come to recognize the absolute cause discovered by the "cosmological" and "teleological" arguments as a personal spirit. We are under the necessity of referring all the phenomena of the cosmos ultimately to mind. 2. The phenomena of conscience necessarily imply a sovereign personal will which binds ours. The hypothesis of the Associationists (Spencer, Mill, etc.), that all our intellectual and moral judgments are transformed sensations, is absurd, because (1) they are universally the same, (2) incapable of analysis, (3) necessary, (4) sovereign over all impulses, etc. 3. Man is a religious being. The

instinct of prayer and worship, the longing for and faith in divine love and help, are inseparable from human nature under normal conditions as known in history. 4. The entire history of the race, as far as known, discloses the presence and influence of a wise, righteous, and benevolent moral ruler and educator of men and nations. 5. The compact and mutually supporting system of divine interventions and culminating revelations recorded in the Christian Scripture, reaching through 2,000 years, is the true vertebrate column of human history, upon which all human progress in civilization or science rests.

Literature of the Theistic Argument.—(1) Cicero, *De Natura Deorum*; Anselm, *Monologium* and *Proslogium* (E. T. in the *Bibliotheca Sacra*, 1851); Raymond of Sabunde, *Theologia Naturalis*; Descartes, *Discourse on Method* and *Meditationes*; Leibnitz, *Theodicée* and *De la Démonstration Cartésienne*; Samuel Clarke, *Demonstration of the Being and Attributes of God*; Kant, *Critique* and *Religion within the Boundary of Pure Reason*.—(2) Flint, *Theism* and *Anti-theistic Theories*; Janet, *Final Cause*; Tyszka, *Geschichte der Beweise für d. Dasein Gottes*; Krebs, *Geschichte d. Beweise für d. Dasein Gottes*; Runze, *Der ontologische Gottesbeweis*; Saisset, *Modern Pantheism*; Diman, *The Theistic Argument*; Harris, *The Philosophical Basis of Theism*, and *The Self-revelation of God*; Bowne, *Studies in Theism* and *The Philosophy of Theism*; Cocker, *The Theistic Conception of the World* and *Christianity and Greek Philosophy*.

IV. The attributes of God are to be distinguished (1) from "predicates" of God in the concrete, marking his relation to his creatures, as Creator, Preserver, etc.; (2) from "properties," which belong to each divine Person in distinction from the others. The attributes are the modes of existence and of action of his substance. They are the very substance itself, existing and acting in the various modes determined by its nature. They differ among themselves, not as distinct things, but as distinct tendencies and modes of existence and action of the same thing.

The sources of our idea of God are found in his revelation of himself in the human soul, in physical nature, in history, and in the Scriptures. From these materials we construct our idea (1) by the way of negation, denying all imperfections; (2) by the way of eminence, affirming of him the possession of every excellence in absolute perfection; (3) by way of causation, attributing to him all the perfections discovered in his works. The attributes of God have been variously *classified*: (1) According to the order in which we arrive at the knowledge of them—e. g. by way of negation, or by way of eminence, or by way of causality, etc.; (2) according as they pertain to the substance, the intellect, or the will of God; (3) according to their nature as moral or natural (non-moral); (4) as communicable or incommunicable; (5) as absolute or relative. The most useful classification (6) discriminates between two primary classes, which may be called respectively (*a*) *physical* and (*b*) *personal* (so Thornwell, Steenstra, etc.). (*a*) The *physical* are attributes of God considered as necessary existence, and underlie and characterize all the personal attributes. They may be subdivided into classes, relatively to degree (intensive being), to space (extensive being), and to time (protensive being), and thus bring into view in turn God's infinite reality, unity, independence, God's immensity and omnipresence, and God's eternity and immutability (so Dr. W. L. Alexander). (*b*) The *personal* attributes would fall into classes according to mental faculty, relatively to intelligence (understanding, omniscience), to action (will, omnipotence), and to conduct (truth, righteousness, holiness, goodness). The following are, in any scheme of classification, the most important of the divine attributes:

1. The divine *unity*. Monotheism, the primitive religion, soon gave place through nature-worship to pantheism and polytheism. It has been recovered only imperfectly by philosophers of the first rank like Plato, and has been established as a popular faith only through the Mosaic and Christian revelations. It is proved: (1) There can be but one necessarily existent Being, and but one infinite and absolute of the same order. (2) The unity of the cosmos proves the unity of presiding intelligence. (3) Our moral consciousness testifies that the source of all moral authority must be single and unique. 2. God is an *infinite* and *absolute* Being. The transcendentalists, on the one hand, and Sir W. Hamilton, Mansell, and H. Spencer, on the other, understand by these predicates a Being including all Being, and excluding all relation to other being. Hence the infinite and the absolute can neither be a person, nor conscious, nor a cause nor an object of knowledge; all of which imply limitation and relation. But the true idea of the "absolute" is the finished, and that which exists in no relation to anything not determined by its own will. And the true idea of the "infinite" is that which admits of no increase after its kind. (Sir W. Hamilton, *Discussions and Lectures*; Mansell, *Lim. of Rel. Thought*; McCosh, *Intuitions*; Mill, *Review of Hamilton*; Porter, *Human Intel.*, pt. 4, ch. viii.; Hickok, *Creator and Creation*, ch. iii.) *Anthropomorphism* is right and necessary when limited to the application to God in an infinite degree of the spiritual excellences of man. But it is used in a bad sense when we attribute to God any likeness of our bodily parts or passions, or conceive of him as subject to our imperfections or limitations. 3. God is an absolute, perfect, *personal* Spirit. This, as shown above, is the result of the whole convergent testimony which establishes the fact of his existence. If not this, we have no evidence that he is anything. 4. He is *eternal*. His existence transcends all the limits of time. Eternity conceived of by us, as either *a parte ante* or *a parte post*, is really *una*, *individua*, *et tota simul*. 5. Absolutely, God is infinite in his *immensity*, transcending all the limits of space; relatively, he is *omnipresent* in his essence, as well as his knowledge and power to all his creatures. 6. He is *immutable*, as to his essence, his perfections, and his will. 7. His *knowledge* has no limits. He knows himself and all things possible by the light of his pure reason. He knows all things actually existent, whether past, present, or future, in the light of his purpose. He knows all things in their essential being, and in all their relations, by one all-comprehensive, timeless intuition. Wisdom is the perfect use which he makes of his knowledge and his power to effect his ends. 8. He is *omnipotent*—that is, the causal efficiency of his will has no limit other than his own perfections. Second causes are necessary to him only relatively to his own purpose. 9. The *goodness* of God, existing in the forms (1) of benevolence to all sentient creatures, (2) love to persons, (3) mercy to the miserable, and (4) grace to the ill-deserving, has no limit outside of his own perfections. This is as good a world as was consistent with the end God had in view. (Pascal, *Thoughts*; Leibnitz, *Theodicée*.) J. S. Mill in his *Essay on Theism* objects that if God is infinitely good, he can not in consistency with facts be infinitely powerful. But he forgets (1) the glory of the Creator, and not the good of the creature, must be the last end; (2) the *ultimate* reasons of facts known to us lie out of our reach, except they are revealed; (3) the great fact of sin, when once admitted, overthrows all his objections. 10. God is absolutely *true*—i. e. self-consistent and reliable. 11. He is absolutely *righteous*. This involves (1) holiness, or absolute subjective moral perfection; (2) justice, when he is regarded as standing to his intelligent creatures in the relation of moral governor. It is distinguished as rectoral and distributive, and is the immutable ground of rewards and punishment. 12. God's *will* is the organ of his infinite perfections. It is free, in the sense of being a rational spontaneity. It is sovereign, inasmuch as it is conditioned upon nothing save his own all-perfect nature. Hence God is an absolute sovereign, having an unconditioned right to dispose of and command his creatures as his own perfections require. His expressed will is to them an ultimate rule of right, in his "positive" commandments creating obligation, and with respect to essential morality expressing and giving effect to the law of absolute right resident in his own nature. See Cumberland, *De Legibus Naturæ*; Cudworth's *Intellectual System*.

On the attributes of God, see especially Charnock, *Discourses upon the Being and Attributes of God*; S. Clarke, *A Discourse concerning the Being and Attributes of God*; Bruch, *Lehre von den Göttl. Eigenschaften*; Moll, *De Justo Attributorum Dei Discrimine*.

V. The One God Exists as Three Hypostases or Persons.—The doctrine of the Trinity is purely a revealed doctrine. There are no natural analogies to it, and no proofs of it derived from natural phenomena or from pure thought. The triads of heathen conception rest on a pantheistic basis, and have no analogy with the Christian doctrine of the Trinity. Thus when Schelling says, "The philosophy of mythology proves that a trinity of divine potentialities is the root from which have grown the religious ideas of all nations of any importance," e. g. the Hindu Trimurti, Brahma, Vishnu, and Shiva, he does not show, as has been sometimes misconceived, that the Christian doctrine of the Trinity has a basis in man's religious nature, but exhibits

the deep pantheistic triad which has characterized the best heathen thinking on religious subjects. Nor are the so-called demonstrations of the Trinity constructed by modern philosophical theology from the very idea of God as a self-conscious or as a loving being, really proofs of the Christian doctrine; they rest rather upon concepts peculiar to a certain school of philosophy, and endanger the full personality of the hypostases. The best that can be said for rational construction in this matter is that the Christian doctrine of the Trinity, when once revealed, is accepted by reason as supplying a nobler and more adequate conception of God than was attainable by unassisted reason. Abstract Unitarian monotheism conceives of an isolated, unsocial God, existing from eternity, alone, whose urgent affections and infinite energies remain inactive until the advent of creation affords them an object. On the other hand, the Tripersonal God of the Christian revelation has within the infinite depths of the Godhead been eternally exercising upon adequate objects those unbounded perfections which can have only an inadequate field of demonstration in a created universe. If God is love, he must have an eternal and infinite object to love.

A. *The Biblical Doctrine of the Trinity.*—1. There is but One God. The monotheism of the Old and New Testaments is unquestionable (Deut. vi. 4; 1 Cor. viii. 4). This is expressed by saying that the Three Persons are the same in substance, numerically. 2. Father, Son, and Holy Ghost are each that one God. To each divine names, attributes, works, and worship are applied (Jer. xxiii. 6; John ii. 24, etc.). 3. Nevertheless, they are always set forth in speech and action as distinct persons. They use reciprocally the personal pronouns (John xi. 41, etc.). They regard each other objectively, loving, speaking to, and acting through and upon each other as personal agents (John xiv. 31, and xvii.). 4. The Father is the fountain of Godhead, self-existent as person as well as substance. The Son is eternally springing from the person of the Father, and the Spirit from the persons of the Father and of the Son, in virtue of the spontaneous yet necessary constitution of their nature, whereby they receive the indivisible common nature in its fullness. (1) The terms Father and Son are reciprocal. The Son is eternally "begotten" by the Father, his "word," "image," "form," the "radiance of his glory." (2) The term "Spirit" expresses the personal, not the substantial, nature and relations of the Third Person. He is the personal Breath of the Father and of the Son, proceeding from and returning to both. (3) They eternally love one another, take mutual counsel, and act together, as the coexecutors of their common purpose, in a system of distributed yet correlated functions. 5. In the economies of creation, providence, and redemption the order of procedure is always *to* or *from* the Father, *through* the Son, *by* the Spirit. All actions *ad extra* may be affirmed of either person or of the Godhead absolutely. But by way of eminence creation is ascribed to the Father, redemption to the Son, and sanctification to the Spirit. The Father is the absolute from and to whom all movement originates and ends. The Son is the Revealer and Mediator. The Spirit is the Executive of God.

B. *The Historical Definition of the Trinity.*—The Ante-Nicene Church was united in believing that Father, Son, and Holy Ghost are each eternal, supernatural divine Beings, and yet that the Son is inferior to the Father, and the Spirit to the Son. Origen admitted the eternal generation of the Son, but held that he was different from and dependent upon the Father. Irenæus, the disciple of Polycarp, and the Western Church generally, followed more faithfully the doctrine of the Apostle John. The two antagonistic principles, (*a*) the unity of God and (*b*) the distinct personality and the perfect equality of the Three divine Hypostases, were never accurately adjusted and defined in formal statement before the great œcumenical councils of Nice (325) and Constantinople (381 A. D.). Each principle determined a tendency and developed heresies.

1. *The principle of the divine unity* was maintained at the expense of the complementary elements of the revealed doctrine: (1) By the Humanitarians, who held that Christ was a mere man—e. g. the Ebionites, an heretical Jewish-Christian sect; the Alogians; the Theodotians and the disciples of Paul of Samosata (260), who denied the personality of the Logos, or divine principle dwelling in the man Jesus. (2) By the Patripassians (Praxias, Noetus, etc.), whose doctrine was matured by Sabellius (268), who held that the Godhead, existing with no intrinsic distinctions, manifests itself externally and successively in different forms; as the Father under the old dispensation, the Son in the incarnation, and the Spirit in inspiration, etc.

2. *The principle of the distinct personality* of the divine Persons, at the expense of their unity and equality: (1) By the Arians (from Arius of Alexandria, 336), who held that the Son is the first and greatest Being created by the will of the Father, and his instrument in creating the Spirit, and subsequently all other beings. They expressed this by saying the Son was *hetero-ousios*, of a different nature from the Father. (2) The Semi-Arians, or Eusebians, represented by Eusebius of Cæsarea (270–340), held that the Son was eternally begotten by the Father, but that he is of a different though similar essence—*homoi-ousios*.

3. *The principle of distinct personality and equality*, at the expense of the divine unity, was maintained by the Tritheists, John Philoponus and John Ascunages (about 550), and Dean Sherlock (1690) in his *Vind. Doc. Trin.*

The Council of Nice was convened by the Emperor Constantine in 325 to settle these questions by a thorough analysis and definition of the doctrine. There were present three parties: The Arians, led by Arius, who maintained the difference of essence, *hetero-ousios*; the Semi-Arians, led by Eusebius, who maintained the likeness of essence, *homoi-ousios*; the orthodox, led by Athanasius the Great (d. 373), who successfully maintained that Father and Son were of the same numerical substance, *homo-ousios*. This decision was expressed in the Creed of Nice, afterward completed at Constantinople (381) and Toledo (589). The points defined were: (1) There is but one numerical substance, *οὐσία, φύσις, substantia*, in the Godhead. (2) This substance eternally exists as three equal *hypostases, subsistentiæ, persons*. (3) Each person is distinguished from the others by a *character hypostaticus*, or personal property peculiar to himself. (4) The Father eternally begets the Son, and the Spirit eternally proceeds from the Father and the Son. The clauses relating to the Holy Ghost (the Lord, the giver of life, who, etc.) were added by the Council of Constantinople. The "Filioque" clause was added by the Western Church at the Council of Toledo, and was never accepted by the Eastern Church. The doctrine was restated with consummate skill in the Creed, "*Quicumque vult*," mistakenly ascribed to Athanasius, and has been adopted by all historical churches. Through political intrigues, Arianism prevailed widely in the East, partially in the West, from 325 to the accession of Julian (361), but was finally expelled upon the accession of Theodosius I. (379). See Bishop Bull's (1710) *Defensio Fid. Nicænæ*; Dorner's *Hist. Per. Christ.*; Neander's and Schaff's *Church Histories*; Dr. Shedd's *Hist. of Ch. Doc.*; Bishop Hefele's *Hist. of Christian Councils.*

On the Trinity, see further: Athanasius, *Contra Arianos*; Augustine, *De Trinitate*; Waterland, *On the Trinity*; Meier, *Geschichte der Lehre von der Trinität*; Baur, *Geschichte der Lehre von der Trinität*; and the relevant sections in the dogmatic treatises, e. g. of Dorner, Twesten, Kahnis, Shedd, Hodge, Miley. For the Unitarian opposition, see Norton, *Statement of Reasons*; J. Freeman Clarke, *Truths and Errors of Orthodoxy.*

VI. God's Relation to the World.—In opposition to the pantheistic and deistic false views (below defined), the Christian view of God's relation to the universe includes the following points: 1. That God is a free moral person, transcending the universe, and acting upon it *ab extra* in the exercise of his *potestas libera*. 2. God is nevertheless personally present to every atom of creation through each moment of duration, in his essence and in the free exercise of all his perfections, sustaining and co-working with every creature in every event in the exercise of his *potestas ordinata*. 3. The capital distinction is made between the physical and the moral order. The former God administers in the mode of fixed laws and forces inherent in the things themselves. The latter he administers through ideas, motives, and other moral and spiritual influences, brought to bear on the moral natures and free wills of his subjects. 4. As an infinitely perfect intelligence, God has formed a plan from eternity, immutably determining in general and in particular the being, the attributes, and the relations of all creatures, and hence the fixed laws of the physical order, and the course of events in the moral order, and his own actions concurrent therewith. In this universal plan he has established a fixed subordination of parts to the whole, and of order to order. The end of the whole he has placed in the manifestation of his own glory. The end of the natural order is the perfect development of the

moral order. "In him we live and move and have our being" (Acts xvii. 28); "Of him and through him and to him are all things" (Rom. xi. 36); "Thou madest man to have dominion over the works of thy hands; thou hast put all things under his feet" (Ps. viii. 6).

VII. The Works of God.—As an eternal, immutable Spirit, God is essentially active. His actions are distinguished as—

A. *Those which are Immanent.*—These are (1) his purposes, technically called decrees, which relate to all events, and are infinitely wise, righteous, and certainly efficacious; and they subordinate all his works, and all their forces, laws, and historical development in time, to a purpose or final end. (2) The actions peculiar to each person of which the other persons are the objects—e. g. eternal generation, procession, etc.

B. *His Emanant Actions*, or those which terminate *ad extra.*—These are—1. *Creation*, which is a free act of God in time, executing an eternal purpose. Some, as Origen among theologians, and Cousin among philosophers, have held that creation is a necessary and eternal (timeless) act of God. The latter says (*Psychol.*, p. 44): "God is no more without a world than a world without God." The Church has always held otherwise. Creation is of two kinds: (1) *Creatio prima seu immediata*, the "immediate creation" by God of the elements of things from nothing. This was denied by the ancients and by pantheists, and first taught by revelation. (2) *Creatio secunda seu mediata*, "mediate creation," or the origination by God, out of and by means of pre-existing material, of new genera and species—e. g. the body of man (Gen. ii. 7). This distinction was admitted by St. Augustine (*De Genesi ad Lit.*, v., 45), and by all theologians since. In the method of this "mediate creation" God has been evidently executing law, creating according to types in an ascending series. Argyle's *Reign of Law*, ch. v.; McCosh, *Typical Forms*; Mivart, *Gen. of Species*, ch. xii.

2. *Providence*, which includes (1) *Preservation.* This some make identical with a continual creation. By some, as Strauss and other pantheists, preservation is regarded as a necessary, unconscious, eternal act. By others, as by Heidegger (*Corp. Theol.*, 7, 32) and by President Edwards (*Orig. Sin*, pt. 4, ch. iii.), the design of such language is only to emphasize the dependence of the creature. The Scriptures teach that while second causes have real being and efficiency, "they have their being in God." (2) *Government.* (*a*) This extends to all creatures and all their actions. (*b*) Its method is consistent with the perfections of God, and congruous to the nature of each creature and action concerned. (*c*) Its end is God's glory through the execution of His purpose. (*d*) It comprehends every particular as a means to a general end; it is therefore for the same reason both general and special. (*e*) It extends to the sinful acts of men, to forbid, control, punish, and overrule them for good. (*f*) This universal government God accomplishes partly by means of the original properties of second causes and their primal adjustments, and partly by a present *concursus* of his own energy with them, guiding them in the direction predetermined by his purpose. Leibnitz (*New System of Nature*) taught the doctrine of pre-established harmony, whereby all events were predetermined from the creation by fixed sequences, alike in the separate spheres of the physical and spiritual. All theories of pantheistic tendency imply the sole agency of the Creator in all actions, the second cause being only the mode in which God appears, or the instrument by which his energy is immediately exerted. This is the tendency of Emmons, of certain ultra-Calvinists of a former age, and of the extreme wing of the school of Schleiermacher.

3. *Redemption* of course involves from beginning to end supernatural intervention with the physical order for the sake of the moral order perverted by sin. It includes (1) the incarnation; (2) expiatory sacrifice; (3) resurrection; (4) dispensation of the Holy Ghost, including inspiration of Scripture, the regeneration and sanctification of individuals, and the preservation and historical development of the Church.

4. *Miracles.* See separate article on Miracles.

VIII. Various prevalent Antitheistic Theories.—A. *Atheism*, according to its etymology, signifies the denial of the being of God. It was applied by the ancient Greeks to Socrates and other philosophers to indicate that they failed to conform to the popular religion. In the same sense it was applied to the early Christians. Since the usage of the term "theism" has been definitely fixed in all modern languages, "atheism" necessarily stands for the denial of the existence of a personal Creator and Moral Governor. Notwithstanding a belief in a personal God is intuitive, atheism is possible, as an abnormal state of consciousness induced by sophistical speculation or animal indulgence, as subjective idealism is possible. It exists in the following forms: 1, practical; 2, speculative. Again, speculative atheism may be—1. *Dogmatic*, as when the assertion is made either (1) that God does not exist, or (2) that the human faculties are positively incapable of ascertaining or of verifying his existence, in which case it is called *Agnosticism*—e. g. Herbert Spencer (*First Principles*, pt. 1). 2. *Skeptical*, as when it simply doubts the existence of God, and denies the conclusiveness of arguments generally relied upon. 3. *Virtual*, as when (1) principles are maintained essentially inconsistent with the existence of God, or with the possibility of our knowing him—e. g. by materialists, positivists, absolute idealists: (2) when some of the essential attributes of the divine nature are denied, as by pantheists, and by Stuart Mill in his *Essays on Religion*; (3) when explanations of the universe are given which exclude (*a*) the agency of an intelligent creator and governor, and (*b*) the moral government of God and the moral freedom of man. Such explanations are made by Darwin, H. Spencer, and by necessitarians generally. In ancient times Epicurus (341–270 B. C.) and his school were really, though not professedly, atheists, and Lucretius (95–52 B. C.) was openly so. In modern times the deism of Voltaire and the Encyclopédistes degenerated into the atheism of d'Holbach; while such thinkers as Moleschott, Feuerbach, the English secularist Holyoake, the disciples of Comte, and the naturalistic extreme of the evolution school generally, together with those who have assumed the name of agnostics, are atheistic in principle—either in a virtual, skeptical, or dogmatic sense. See Ulrici, *God and Nature*, *God and Man*, and *Review of Strauss*; Strauss, *Old and New Faith*; Buchanan, *Modern Atheism*; Tulloch, *Theism, etc.*

B. *Dualism* is used in two senses, which must be discriminated. As the opposite of *Monism* in philosophy, it is the doctrine that there are two generically distinct essences, matter and spirit, in the universe: in this sense the common doctrine of Christendom is dualistic. All the ancient pagan philosophers, on the other hand, held the eternal independent self-existence of matter, and consequently all among them who were also theists were strictly *cosmological dualists.* The religion of Zoroaster was a *mythological dualism* designed to account for the existence of evil: Ormuzd and Ahriman, the personal principles of good and evil, sprang from a supreme, abstract divinity, Akerenes. Some of the sects of this religion held dualism in its absolute form, and referred all evil to *hyle*, self-existent matter. This principle dominated in the various spurious Christian Gnostic sects in the second century, and in the system of Manes in the third century, and its prevalence in the Oriental world is manifested in the ascetic tendencies of the early Christian Church. John Stuart Mill considered that the assumption of a cosmological dualism would solve some difficulties. Dualistic tendencies in modern times assume a very subtle form, speaking of "the nothing" out of which things are created as exerting a dull and inert opposition to creative force. See J. F. Clarke, *Ten Religions*; Hardwick, *Christ and other Masters*; Neander, *Church History*; Pressensé, *Early Years of Christianity*; Tennemann, *Manual of the History of Philosophy.*

C. *Polytheism* (Gr. πολύς, many, and θεός, god) distributes the perfections and functions of the infinite God among many limited gods. It sprang out of that nature-worship seen in the earliest Hindu Vedas, so soon and so generally supplanting primitive monotheism. At first, as it long remained in Chaldæa and Arabia, it consisted in the worship of the elements, especially of the stars and of fire. Subsequently it took special forms from the traditions, the genius, and the relative civilization of each nationality. Among the rudest savages it sank to fetishism, as in Western and Central Africa. Among the Greeks it was made the vehicle for the expression of their refined humanitarianism in the apotheosis of heroic men rather than the revelation of incarnate gods. In India, springing from a pantheistic philosophy, it has been carried to the most extravagant extreme, both in respect to the number and the character of its deities. Whenever polytheism has been connected with speculation it appears as the exoteric counterpart of pantheism. See Carlyle, *Hero-worship*; Keightley, *Mythol. Greece and Italy*; Max Müller, *Compar. Mythol.*, in *Oxford Essays* (1856); Prof. Tyler, *Theology of Greek Poets.*

D. *Deism* (from Lat. *deus*, god), although etymologically synonymous with theism, has been distinguished from it since the middle of the sixteenth century, and used to designate a system admitting the existence of a personal Creator, but denying his controlling presence in the world (*concursus*), his immediate moral government, and all supernatural intervention and revelation. The movement began with the English deists, Lord Herbert of Cherbury (1581–1648), Hobbes (1588–1679), John Toland (1669–1722), Woolston (1669–1731), Tindal (1656–1733), Shaftesbury (1671–1713), Bolingbroke (1678–1751), and Thomas Paine (1737–1809). It passed over to France, and was represented by Voltaire (1694–1778) and the Encyclopédistes. It passed over into Germany, and was represented by Lessing (1729–81) and Reimarus (1694–1768) in his *Wolfenbüttel Fragmentist*, and, invading the Church and theology, it was essentially represented by the old school of the naturalistic rationalists, who admitted with it a low and inconsequent form of Socinianism—e. g. Eichhorn (1752–1827), Paulus (1761–1851), and Wegscheider (1771–1849). It has been represented in the U. S. by Theodore Parker (1810–60), and the extreme left of the party known as "Liberal Christians." In Germany mere deistical naturalism gave way to pantheism, as the latter has given way to materialistic atheism as, e. g., in the case of Strauss. See Leland, *View of Deistical Writers*; Van Mildert, *Boyle Lectures*; Farrar, *Crit. Hist. Free Thought*; Dorner, *Hist. Protest. Theol.*; Hurst, *Hist. Rationalism*; Butler, *Analogy*, admitted by J. S. Mill to be unanswerable as against deism.

E. *Pantheism* (from Gr. πᾶν, all, every + θεός, god) is absolute monism, maintaining that the entire phenomenal universe is the ever-changing existence-form of the one single universal substance, which is God. Thus God is all, and all is God. God is τὸ ὄν, absolute being, of which every finite thing is a differentiated and transient form. This doctrine is of course capable of assuming very various forms. (1) The one-substance pantheism of Spinoza. He held that God is the one absolute substance of all things, possessing two attributes, thought and extension, from either of which respectively the physical and the intellectual world proceeds by an eternal, necessary, and unconscious evolution. (2) The material pantheism of Strauss's *Old and New Faith*. (3) The idealistic pantheism of Schelling, which maintains the absolute identity of subject and object; and of Hegel, which maintains the absolute identity of thought and existence as determinations of the one absolute Spirit.

It is obvious that pantheism in all its forms must either deny the moral personality of God or that of man, or both. Logically, pantheism does render both impossible. God comes to self-consciousness only in man; the consciousness of free personal self-determination in man is a delusion; moral responsibility is a prejudice; the supernatural is impossible, and religion is superstition. Yet such is the flexibility of the system that in one form it puts on a mystical guise, representing God as the all-person absorbing the world into himself, and in an opposite form it puts on a purely naturalistic guise, representing the world as absorbing God, and the human race in its ever-culminating development as the only object of reverence or devotion. The same Spinoza who was declared by Pascal and Bossuet to be an atheist is represented by Jacobi and Schleiermacher to be the most devout of mystics. The intense individuality and the material science of the nineteenth century has reacted powerfully upon pantheism, substituting materialism for idealism, retiring God and elevating man, as is seen in the degeneration of pantheism into atheism in the case of Feuerbach and Strauss.

The most ancient, consistent, and prevalent pantheism of the world's history is that of India. As a religion it has molded the character, customs, and mythologies of that people for 4,000 years. As a philosophy, it has appeared in three principal forms—the Sankhya, the Nyaya, and the Vedanta. In Greece pantheistic modes of thought prevailed chiefly with the Stoic and New Platonic schools—Zeno (340–260 B. C.), Plotinus (205–270 A. D.), Porphyry (233–305), Iamblichus (333). It reappears in John Scotus Erigena (883) and with the Neo-Platonists of the Renaissance—e. g. Giordano Bruno, burnt at Rome in 1600. Modern pantheism began with Benedict Spinoza (1632–77), and closes with the disciples of Schelling and Hegel.

Besides the pure pantheism above referred to, there has existed an infinite variety of impure forms of virtual pantheism. This is true of all systems that affirm the impersonality of the infinite and absolute, and which resolve all the divine attributes into modes of casuality. The same is true, in principle, of all systems which represent providential preservation as a continued creation, deny the real efficiency of second causes, and make God the only agent in the universe—as is done, e. g., by Edwards (in *Original Sin*, pt. 4, ch. iii.) and Emmons. Under the same general category falls the fanciful doctrine of emanations which was the chief feature of Oriental theosophies, and the hylozoism of Averroes (1217), which supposes the coeternity of matter and of an unconscious plastic *anima mundi*. See Hunt, *Essay on Pantheism* (London, 1866); Saisset, *Modern Pantheism* (Edinburgh, 1863); Cousin, *History of Modern Philosophy*; Morell, *History of Modern Philosophy*; Ritter, *History of Modern Philosophy*; Buchanan, *Faith in God, etc.*; Döllinger, *Gentile and Jew* (London, 1863); Max Müller, *History of Ancient Sanskrit Literature*.

For the systems of Agnosticism, Materialism, and Positivism, see these articles.

Revised by Benj. B. Warfield.

**Godard**, Benjamin Louis Paul: opera-composer; b. in Paris, Aug. 18, 1849; studied at the Conservatory, and has composed much in various styles. His operas include *Pedro de Zalamea* (1884); *Jocelyn* (1888); *Les Guelfes*, and *Ruy Blas* (unproduced). He also composed symphonies, overtures, songs, etc. D. at Cannes, Jan. 11, 1895. D. E. H.

**Godavari**, gō-daa′vă̆a-rē̆e: the largest river of the Deccan: rises from the Western Ghats, within 50 miles from the Arabian Sea, and crosses the Deccan in a southeastern course of about 900 miles. After passing through the Eastern Ghats it separates into several arms, in lat. 16° 57′ N. and lon. 73° 30′, forms a delta, and falls into the Bay of Bengal. It is navigable for some distance above its passage through the Eastern Ghats. The area of the basin which the river drains is estimated at 112,200 sq. miles. The scenery along its banks is very fine, especially as it approaches its delta, where the hills approach one another and form a magnificent gorge.

**Go′derich**: port of entry and capital of Huron County, Ontario, Canada; on Lake Huron; the western terminus of the Buffalo and Goderich Division of the Grand Trunk Railway (see map of Ontario, ref. 4–B). It has a good harbor, and has extensive communication by steam with the various lake-ports. It has a large elevator for wheat, extensive lake fisheries, and valuable salt-wells. Pop. (1891) 3,839.

**Goderich**, Viscount: See Ripon, George Frederick Samuel Robinson, Marquis of.

**Godet**, gō′dā′, Frédéric Louis, D. D.: minister of the Reformed Church of Switzerland: b. in Neuchâtel, Oct. 25, 1812; educated at Neuchâtel, Bonn, and Berlin; ordained in 1836; assistant pastor at Valangin; preceptor of the Crown Prince of Prussia 1838–44; minister in the Val de Ruy 1845–51, and in Neuchâtel 1851–66; Professor of Exegetical and Critical Theology in the theological school of the National Church of the canton 1850–73; from 1873 he has occupied the same chair in the independent faculty of the church of Neuchâtel. Distinguished honors were paid him on the completion of his eightieth year, Oct., 1892. Among his published works are *Histoire de la Réformation et du Refuge dans le Canton de Neuchâtel* (Neuchâtel, 1859); *Commentaire sur l'évangile de Saint-Jean* (2 vols., 1863, 1865; 3d ed. 3 vols., 1881–85; English translations were published in Edinburgh, 1877, and in New York, 1886; it has also been translated into German, Danish, and Dutch); *Commentaire sur l'évangile de Luc* (1871; 2d ed. 1872; English translations in Edinburgh, 1875, and New York, 1881); *Commentaire sur l'épître aux Romains* (1879–80; first vol. of 2d ed. 1883; English translations, Edinburgh, 1881, New York, 1883); *Commentaire sur la premi*e*re épître aux Corinthiens* (1886); *Conférenees Apologétiques* (1869; English translation, *Leetures in Defense of the Christian Faith*, Edinburgh, 1881; 2d ed. 1883); two series of *Études bibliques* (1873–74; 3d ed. 1876; in English, the *Old Testament Studies*, Oxford, 1875; 3d ed. 1885; the *New Testament Studies*, London, 1876; 6th ed. 1885); a translation of his *Studies on the Epistles* (London and New York, 1889); six articles on Christian Dogmatics in the *Chrétien évangélique* (1891–92); *Introduetion to Paul's Epistles* (1893).

Willis J. Beecher.

**Godfather, Godmother**: See Sponsors.

**Godfrey of Bouillon**, boo′yōn′: King of Jerusalem and the sixth Duke Godfrey of Brabant, or the Lower Lorraine; b. at Nivelle, Lorraine, in 1061; governor of Bouillon (now included in the Belgian province of Luxembourg) 1076; fought with conspicuous valor in Germany and Italy on

behalf of Henry IV. against the pope; slew Rudolph, the rival emperor, with his own hand, and was the first to mount the walls of Rome on Henry's successful attack 1084; succeeded as duke 1089; took the cross for the Holy Land 1095, in order to expiate his sin of fighting against the pope (first crusade), and in order to pay his expenses pledged his duchy to the Bishop of Liège, and thus raised 1,300 marks, with which he furnished 80,000 infantry and 10,000 cavalry; led his men to the East by way of Constantinople; captured Nicæa 1096; defeated Soliman at Dorylæum 1097; took Antioch 1098, and stormed and took Jerusalem July 15, 1099; was declared King of Jerusalem, but declined to wear a crown of gold where his Lord had worn a crown of thorns, and refused the title of king, preferring that of Defender and Baron of the Holy Sepulcher; defeated the Egyptians at Ascalon; conquered Galilee; promulgated the *Assizes of Jerusalem*, a system of feudal law. Cf. treatise by F. Monnier (Paris, 1874). D. at Jerusalem, July 15, 1100, and was succeeded by Baldwin I. In 1244 the Carismians exhumed and burned his remains. Godfrey's strength, valor, piety, and virtue were favorite themes of mediæval poetry. He is the central figure of Tasso's *Jerusalem Delivered*. See his *Life* by A. Vetault (Paris, 1874) and that by J. Froboese (Berlin, 1879). Revised by S. M. Jackson.

**Godfrey of Strassburg**: See Gottfried of Strassburg.

**Godi'va, The Lady**: wife of Leofric, Earl of Mercia and Master of Coventry in England, who about 1040 imposed upon that town heavy exactions, by reason of which the people all complained. The Lady Godiva entreated her lord to spare the town, and he consented on condition that she should ride naked by daylight through Coventry, to which proposal she agreed, notwithstanding her well-known and extreme modesty. The people were ordered to keep within their houses and not look out. This (so the story goes) they all did excepting one tailor or baker, the Peeping Tom of Coventry, who looked out at a window as the lady rode by veiled with her flowing hair; but he was at once struck blind, and, according to one version, was soon afterward hanged by the earl. The earliest version of this legend occurs in a chronicle of the end of the twelfth century. A pageant, in which a young woman enacted the part of Godiva, continued at intervals at Coventry until 1826, and was revived in 1848. See the *Folklore Journal* for 1890.

**Godkin**, Edwin Lawrence: journalist; b. at Moyne, County Wicklow, Ireland, Oct. 2, 1831; educated at Queen's College, Belfast; war correspondent in Turkey and the Crimea for the London *Daily News* 1854–56; traveled in the U. S. as a correspondent of the same journal; admitted to the New York bar 1858; corresponded with *The Daily News* and the New York *Times* during the civil war in the U. S.; became editor of *The Nation* 1865, and its proprietor 1866. In 1881 *The Nation* was made the weekly issue of *The Evening Post*, and Mr. Godkin became one of the editors and proprietors of the joint publication. Author of *History of Hungary*, A. D. 300–1850 (London, 1856); *Government* (New York, 1871). Revised by C. H. Thurber.

**Godman**, John D., M. D.: medical writer and teacher; the son of a soldier in the Revolutionary war; b. at Annapolis, Md., Dec. 30, 1794. At the bombardment of Fort McHenry in 1814 he fought as a common sailor. In 1815 he began the study of medicine, removing to Baltimore to finish his studies. After taking his first course of lectures in the University of Maryland he was unanimously appointed by the faculty to take the place of the Professor of Anatomy, who was incapacitated by illness. On the organization of the Ohio Medical College in Cincinnati he became its first Professor of Anatomy, 1824. Subsequently he was called to the same chair in Rutgers Medical College, New York, where he became the associate of Mott and Hosack. Dr. Godman contributed largely to *The Western Quarterly Reporter*, Philadelphia *Journal of the Medical Sciences*, *Physical and Pathological Anatomy*, *Encyclopædia Americana*, etc. Author of *American Natural History* (3 vols., 1823–28); *Rambles of a Naturalist*, and other works. D. at Germantown, Pa., Apr. 17, 1830.

**Godol'phin**, Sidney Godolphin, Earl of: b. near Helstone, in Cornwall, in 1645; took the master's degree at Oxford 1663; became a Secretary of State 1664, and first commissioner of the treasury; was envoy to the Netherlands 1678; a lord of the treasury and one of the chief ministers 1679; a Secretary of State 1684; chamberlain to the queen 1685; commissioner of the treasury 1686–90; first lord of the treasury 1689–96, 1700–01; lord high treasurer 1702–10; was made a baron 1684; K. G. 1704; Viscount Rialton and Earl Godolphin 1706. Godolphin was a man of few words and decided talents for public business, but had no political or moral principles. When chamberlain to James II.'s queen he conformed to the Roman Catholic rites; was in turn Tory or Whig as best served his interest when these names carried meaning with them. His only conspicuous vices were gambling and fondness for the turf. He was very modest and retiring. D. at St. Albans, Sept. 15, 1712. See Elliot, *Life of Sidney, Earl Godolphin* (1888).

**Godowsky**, Leopold: See the Appendix.

**Godoy** (Span. pron. gō-dō'ĕē), Manuel, de: Duke of Alcudia, Albufera, and Soto-Roma, and Prince of the Peace; b. at Badajoz, Spain, May 12, 1767, of a noble but reduced family; entered the body-guard at Madrid 1787; became an officer 1790; major and adjutant-general and Knight Grand Cross of Charles III. 1792. His beauty had by this time won him the favor of the queen and her ladies, and with the former he lived in most intimate relations under the very eyes of the king, who nevertheless loaded him with honors. In 1795 he was made a grandee of the first rank, having in 1792 been made first Secretary of State, and in 1793 captain-general. His treaty of Basel (1796) won him the title Prince of the Peace. In 1797 he married Maria Theresa, the king's niece, although he was already secretly married to another wife. In 1798 he was declared grand major-domo, and in 1799 grand admiral. In 1801 he reassumed the power which in 1798 the popular will had forced him to abdicate, and soon after, by the treaty of Badajoz, he agreed to divide Portugal between France and Spain, for which service he received a large sum from France. In 1804 he was declared generalissimo. He assisted Napoleon in gaining possession of Spain, and Napoleon in turn released him (1808) from the prison into which the nobles and people had thrown him. Godoy never again returned to power. Hated by nobles, priests, and people, all of whom he despised and had braved so long, he followed the fortunes of the king and queen, who still clung to him. In 1835 he went to Paris, where he lived a pensioner of the French Government. In 1842 the Spanish Government confirmed to him his former honors. D. at Paris, Oct. 4, 1851.

**God Save the King!** (*Domine salvum fac Regem!*): a formula repeated upon occasions of solemnity and appended to state proclamations in Great Britain. The same words give name to a well-known British national air, the authorship of which was long ascribed to Dr. John Bull (1563–1622), but it is generally considered that his *God save great James, our king!* was not the national anthem of the present day. The authorship of both words and music of this piece, nearly as it now stands, is generally assigned to Henry Cary, who died in 1743; but some antiquaries claim that it was adapted from Jacobitic words and melody of that day. The expression "God save the king!" occurs several times in the historical books of the Old Testament. The "God save the king!" of the public proclamations has been changed to "God save the Commonwealth of Massachusetts!" in that State, and to "God save the Commonwealth!" in Pennsylvania.

**God's Truce**: See Truce of God.

**Godt'haab**: the first Danish colony in Greenland; established in 1721 by Hans Egede on Davis's Strait; in lat. 65° N. Pop. 946.

**Godwin**: Earl of the West Saxons and the most powerful noble in England during the reign of Edward the Confessor; b. toward the end of the tenth century; stood high in the favor of King Canute, whose policy he supported with energy, but in the reign of Hardicanute abandoned the Danish cause and was foremost in bringing about the elevation of Edward the Confessor to the throne in 1042. Edward's incapacity left the government in the hands of the earl, whose administration, though marred by his unscrupulous ambition in promoting the interests of his family, maintained a high degree of order and security. He had given his daughter Editha to the king in marriage, but his dislike of the Norman favorites of the king led to a quarrel, in which Godwin, failing of popular support, was worsted and obliged to leave the country, 1051. The Witenagemot, however, outlawed the Norman favorites in the following year and restored Godwin to his home. D. Apr. 15, 1052.

F. M. Colby.

**Godwin**, Mary Wollstonecraft: author; b. at Hoxton, near London, England, Apr. 27, 1759; daughter of Edward John Wollstonecraft, an Irishman of improvident habits. She began to earn her own living at the age of nineteen; started in 1783 a day-school at Islington from philanthropical motives, and on a more rational system of education than that then accepted; was subsequently governess to Lord Kingsborough's daughters, and published *Thoughts on the Education of Daughters* (1787), *Mary*, a tale, *Original Stories*, some translations from Salzmann and Lavater, and the famous *Vindication of the Rights of Woman* (1792), a presentation of the woman-suffrage ideas. From 1792 to 1795 she resided in Paris, where she wrote her *Moral and Historical View of the French Revolution*. In Paris, Gilbert Imlay, an author and merchant, a native of New Jersey, espoused her according to the requirements of the laws of France and of the U. S., but after the birth of a child he left her in great distress. The marriage being invalid according to English law, she married in 1797, in London, William Godwin, the novelist and political writer, but died in the same year (Sept. 10, 1797), giving birth to a daughter, the future Mrs. Shelley. Mrs. Godwin was a woman of attractive manners and of singular courage and independence. Kegan Paul, in his *Life of William Godwin*, and later writers have cleared her from unjust stigmas. Full justice to her character is done by her husband in the memoirs published in 1798.

**Godwin**, Parke: journalist; b. at Paterson, N. J., Feb. 25, 1816; graduated at Princeton, N. J., 1834; was called to the bar in Kentucky. Since 1837 he has been for a great part of the time connected with the New York *Evening Post*, of which his father-in-law, William C. Bryant, was so long the editor-in-chief. Of the *Post*, Mr. Godwin was at first a contributor and then managing editor. In 1843 he for a time conducted *The Pathfinder*, a weekly; was a prominent contributor to *The Democratic Review*, and was for a time one of the editors of *Putnam's Magazine*. Under Mr. Polk he was deputy collector in the New York custom-house; was an early member of the Republican party, but always an advocate of free trade. Author of a *Popular View of the Doctrines of Fourier* (1844); *Democracy, Pacific and Constructive* (1844); *Vata*, a romance (1851); *Handbook of Universal Biography* (1851); *Political Essays* (1856); the first volume of a *History of France* (1861); *Cyclopædia of Biography* (1865); *Out of the Past* (1870). He has also translated tales from Zschokke, and a portion of Goethe's *Autobiography*. In 1884 he edited *The Life and Works of William Cullen Bryant*, a complete and final edition of Mr. Bryant's writings in prose and poetry, with an elaborate biography. Revised by H. A. Beers.

**Godwin**, William: political writer and novelist; b. at Wisbeach, Cambridgeshire, England, Mar. 3, 1756; son of a Presbyterian minister; studied at the Hoxton Presbyterian College; was a Dissenting minister at Ware, Stowmarket and Beaconsfield 1778–83, when his new religious and political views led him to leave his profession. His *Sketches of History* (1784) was a pecuniary failure; but his *Political Justice* (1793), with its eloquent language and its generous though impracticable theory of universal benevolence, attracted wide attention, and in spite of its leveling doctrines was widely approved. The same doctrines are set forth in *Caleb Williams*, a novel (1794), his most powerful work. In 1797 he married Mary Wollstonecraft, whose memoirs he published in 1798. His other novels (*St. Leon*, *Fleetwood*, *Mandeville*, *Cloudesley*, *Deloraine*) and his tragedies (*Antonio*, *Faulkner*) are forgotten. He wrote useful *Lives* of Chaucer, John and Edward Phillips, Chatham, and others; an *Essay on Sepulchers* (1809); a valuable *History of the Commonwealth* (4 vols., 1827–28); *On Population* (against Malthus, 1820); *Thoughts on Man* (1831); *Lives of the Necromancers* (1834), and many political pamphlets, besides several works for the young, published under the assumed name of "Edward Baldwin." His posthumous *Genius of Christianity Unveiled* (1873) and *Autobiography*, etc. (1874), have somewhat revived the public interest in him and his works. Godwin was for some time a bookseller of London, and in 1833 became yeoman-usher of the Exchequer. Late in life his anti-marriage views were abandoned. D. in Palace Yard, London, Apr. 7, 1836. See Hazlitt, *The Spirit of the Age* (1825); Kegan Paul, *William Godwin; his Friends and Contemporaries* (2 vols., London, 1876); Leslie Stephen, *History of English Thought in the Eighteenth Century* (London, 1876).

**Godwit**: a name applied to birds of the snipe family of the genus *Limosa*, having the bill considerably longer than the head and slightly curved upward.

Excepting the curlews, the godwits are the largest of the bay birds, attaining a length of from 15 to 20 inches. The general color of the breeding plumage is rufous with dark markings; the winter dress is grayish brown. The flesh is of excellent flavor. The American species are the great marbled godwit, or marlin (*Limosa fedoa*), and the Hudsonian godwit (*L. hudsonica*). *Limosa ægocephala* inhabits Europe, *L. uropygialis* Siberia, although breeding to some extent in Alaska. These birds are remarkable for the extent of their migrations, the Siberian species reaching New Zealand, and the marlin the Falkland islands. F. A. Lucas.

**Goebel**, Julius, Ph. D.: philologist; b. in Frankfort-on-the-Main, Germany, May 23, 1857; educated at the University of Leipzig (1879–81) and the University of Tübingen (1881–82); instructor in German Literature and Philology at Johns Hopkins University (1885–88); editor of *Bettetristisches Journal*, New York (1888–92); became Professor of Germanic Literature and Philology at Leland Stanford Junior University in 1892. He has published *Ueber die Zukunft unseres Volkes in Amerika* (1883); *Ueber tragische Schuld und Süehne* (Berlin, 1884); *Zur deutschen Frage in Amerika* (1886); *Poetry in the Limburger Chronik* (Baltimore, 1888); and numerous essays and reviews in periodicals.

**Goeben**, gö'ben, August, von: Prussian general; b. at Stade, Hanover, Dec. 10, 1816; entered the Prussian service in 1833 as a lieutenant. After serving four years in Spain with the Carlists he re-entered the Prussian army, where he served chiefly on the staff. He took part in 1849 in suppressing the popular revolution in Baden; became in 1855 chief of the staff of the Sixth Army-corps; in 1860 was ordered, together with several officers, to follow the army of the Spanish general O'Donnell in order to observe the campaign in Morocco; in 1864 took part in the war against Denmark, and became commander of the Tenth Division; and in 1865 he became lieutenant-general and commander of the Thirteenth Division. At the head of this division he entered Hanover in 1866 and fought on several occasions with distinction. In the Franco-German war of 1870–71 he was appointed commander of the Eighth Army-corps, and played an important and conspicuous part in the battles of Saarbrücken and Metz. When Gen. von Manteuffel received the command of the army of the South, in Jan., 1871, Goeben was appointed commander of the army of the North, and defeated Gen. Faidherbe in the decisive battle of St.-Quentin, Jan. 19. He wrote *Four Years in Spain* (1841); *Letters of Travel and Camp* (1863). D. at Coblenz, Nov. 13, 1880. Revised by C. H. Thurber.

**Goes**, Jan Antonisz, or Joannes Antonides, van der: Dutch poet; b. in Goes in 1647; d. in Rotterdam, Sept. 18, 1684. He was the last considerable representative of the golden age of Dutch letters. At an early age he tried his hand at Latin verses, but soon, influenced by the fame of Hooft and Vondel, turned to his mother-tongue. His first effort in this was an ambitious one, being no less than a tragedy upon a theme then very interesting to the Dutch—i. e. the conquest of China by the Tartars (1644). Curiously enough the great Vondel was at the same moment at work upon the same theme, and having heard of his youthful competitor sought him out and became his lifelong friend. Antonides's tragedy appeared in 1664 under the title *Trazil of overrompeld Sina*, Vondel's *Zunchin* coming out in 1666. It is a remarkable testimony to the powers of the boyish poet that Dutch critics find his tragedy on the whole more powerful than that of the veteran. In 1667 he attracted universal attention by his poem *Bellone aen Bant*, on the peace between France and Holland; and this was followed in 1671 by another success, *De Ystroom*. These achievements led a rich Maecenas, Dirk Buisero, secretary of Flushing, to attach the youth to himself. He sent him to Utrecht to study medicine, and subsequently obtained for him a place in the admiralty on the Maas at Rotterdam, of which he himself had become an official. Few young poets have had greater fame in their own time, and it must be admitted that not all was deserved. Yet he was indubitably a poet, and his faults were those of youth rather than of inaptitude. His poems were collected and published after his death by his father in 1685. A. R. Marsh.

**Goess'mann**, Charles Anthony, Ph. D.: chemist; b. at Naumburg, Hesse-Cassel, Germany, June 13, 1827; was educated at Fritzlar and Göttingen, where he graduated in

1852; removed to the U. S. in 1857; resided for a time at Syracuse, N. Y., and since 1869 has been Professor of Chemistry in the Massachusetts Agricultural College at Amherst. In 1873 was appointed chemist to the State board of agriculture; in 1882 elected director of the Massachusetts State agricultural experiment station at Amherst, Mass. Author of many valuable papers upon chemical subjects, among which his nine articles on salt and the chemistry of natural brines, those on sugar and sugar-manufacture, and his annual reports on commercial fertilizers and on the work of the Massachusetts State agricultural experiment station have special interest.

**Goe'the**, Johann Wolfgang. von: the foremost poet in Germany; b. at Frankfort-on-the-Main, Aug. 28, 1749, of a wealthy and highly respected family; enjoyed a careful and very varied education, rich in the acquisition of knowledge and rich in impressions. The father was a peremptory and somewhat pedantic character, proud of his family connections and personal acquirements; he held no office, but had an imperial title. The mother was a bright and quick-witted woman, with very decided opinions and very vivid sympathies; she stood greatly in awe of her husband, and Wolfgang and she formed a little group of their own within the family. Under the father's superintendence the boy was taught drawing, music, grammar, rhetoric, foreign languages —Latin, Italian, French, Hebrew—and natural history; from the mother he learned to judge character as it presented itself in social intercourse, to understand life as it appeared in the streets, and to make small excursions into fairyland. But his religious impressions were defective; he knew the Bible very well, but it was, and always remained to him, an object of intellectual and æsthetic interest only. It had no authority over his heart, and when, in his great novel, *Wilhelm Meister*, he tried to bring the development of a human soul to a final and, so to speak, typical close, the hero was made to find refuge in a cheerful pagan resignation, content to expend his energies in practical usefulness to his fellow men, and leave the riddles of life unsolved. Far more genuine and truly productive of great ideas was the influence he received from the political events of the Seven Years' war—on the one side, the old idea of the emperor, so deeply rooted in the feeling and imagination of the German people, so magnificent, and at this moment represented by a beautiful young woman; on the other side, the new idea of the unity of the German nation, awakened by a young hero who stood unconquered among the heaviest calamities, and who had wrung from fate what Germany had not seen for centuries, a victory over a foreign nation, the battle of Rosbach. During one period of the war Frankfort was occupied by French troops, and young Goethe learned to speak French, to look at pictures, and to feel the strange charm of theatrical representations. In 1765, in the sixteenth year of his age, he went to the University of Leipzig, where he made the acquaintance of Gottsched and Gellert; in 1770 he went as a student to the University of Strassburg, where he formed intimate friendships with Herder, Jung Stilling, and Lenz. After taking the degree of licentiate in law at the latter university, he returned in 1771 to Frankfort and began to write lyrical poems and minor critical essays for periodicals, incited to do so by his intercourse with Merck. While in Leipzig he had written two dramas, *Die Laune des Verliebten* and *Die Mitschuldigen*, which were published then, but anonymously and without any effect. In the spring of 1772 he obtained leave to practice at the imperial chancellery at Wetzlar, but returned home in the fall, utterly disgusted with diplomatic affairs, and determined to concentrate himself on some poetical subject.

Personally, the young Goethe made a most extraordinary impression. His bearing in his student days was reserved, and at times a little haughty. But the beauty of his countenance was so irresistible, and the impression of courage, independence, nobleness, and kindness so powerful, that when he entered an inn conversation would stop and the guests look surprised at each other. And on nearer acquaintance, in spite of some occasional rashness and arrogance, he quite intoxicated people with the richness, originality, and grasp of his ideas, and with the wonderful freshness and enchanting enthusiasm of his feelings. Everybody expected that something great would come from him, and yet everybody was surprised when in 1773 he published his drama, *Götz von Berlichingen*, and in the following year his famous novel, *Werthers Leiden*. They not only opened a new period in the German literature, but they inaugurated a new epoch in the German civilization. The most striking quality of these two great works is their artistic truth, the magical vividness of their pictures, their objectivity. In order to represent any character or event with such perfect truth it is necessary that the poet shall paint nothing but that which falls within his own consciousness, and which at least as a possibility, as a danger, forms part of his own soul. Goethe fulfilled this condition, and the secret of the immense success of his works was that in writing out of his own heart he wrote out of the heart of his time. Shakspeare has painted greater characters than Goethe, but the exuberance of his style, which was the style of his time, throws a veil over his characters which aggrandizes the figure, but weakens the outline. No poet has ever reached Goethe in the magic of his representations. Every sentence in his dramas is charged with color. But although his method of reproducing his personal life in his poetical creations is a question of the highest interest, it requires too minute biographical and psychological researches to be treated here. The absolute objectivity of his descriptions raises other questions, however, which, through *Werthers Leiden*, became of historical consequence. Werther is a man who can do nothing ignoble, but the noble, that which is his duty, he can only half do. Halfness, however, in the fulfillment of duties deprives a man as absolutely of his moral freedom and spiritual happiness as a total denial of duty through crime and vice. It only conceals the fact to the person himself by entangling his soul in a morbid feeling of being misunderstood and wronged by the world. Such halfness was the disease of the time, produced partly by an imperfect enlightenment which furnished no motives to the volition, partly by a sentimental pietism which represented resignation as the highest form of the will. Every one who reads *Werthers Leiden* reads something about himself, but only those in the first stages of the disease understand the poet. To them the book becomes a help, a cure. Napoleon read it over and over again. Those, on the contrary, who are very far advanced in the disease understand only the hero, and, like him, they blow out their brains. The book was prohibited by law in several countries, and although we now may laugh at such measures, the question still remains, Is objectivity the highest goal of art? or shall there be something behind the picture which shines through it and explains it?

In 1775 the Duke of Saxe-Weimar, Charles Augustus, invited Goethe to take up his abode at his court. After some hesitation the invitation was accepted, and from 1776 Weimar became Goethe's residence. A warm and noble friendship sprang up between the duke and the poet; and as Goethe possessed much practical administrative talent and great business tact, he occupied at different times many different positions in the ducal government; at last that of a minister of state, which he held from 1815 to the death of the duke in 1828, when he resigned all his offices and retired to private life. A house was built for him, small enough according to the ideas of our times, but magnificent for those days, and containing an excellent library, a fine collection of scientific instruments, and many precious objects of art. During the first two years of his residence in Weimar the court life seems to have occupied his whole time, but by degrees he began to take part in practical business and to engage in severe scientific studies of botany, comparative anatomy, mineralogy, and optics. Great men, such as Wieland, Herder, Fichte, Schelling, and Schlegel, gathered around the court of Weimar, and made it a German Athens. And in spite of all its easy grace and its somewhat Epicurean aspect, Goethe's life during this period contains both efforts and results. With respect to poetry, the results were small enough. For the twelve years after the publication of *Werthers Leiden* nothing but *Stella* (1776), *Clavigo* (1778), and some other still less important works were produced. But much was prepared, and after his journey to Italy (from 1786 to 1788) masterpiece followed after masterpiece in rapid succession: *Egmont* (1785), *Iphigenia* (1786), *Römische Elegien* (1788), *Tasso* (1789), *Faust I.* (1790). *Wilhelm Meister* and *Hermann und Dorothea* (1796). The variety of these works is not more astonishing than their perfection. In *Tasso* Goethe reached a simplicity and limpidity of form which makes the words disappear behind the ideas they convey, and transforms the metrical movement of the language into a melody of the thoughts; and thus he succeeded in representing the most refined and delicate movements of

the human soul with perfect clearness and great dramatical impressiveness. In strong contrast to the antique harmony and classic repose which distinguishes *Iphigenia* and *Tasso* stand the romantic exuberance and picturesque disorder of *Faust*. The wildest and coarsest outbursts of passion and the most sublime and touching innocence of the heart, the flattest and most trivial phases of the intellect and the highest aspirations and innermost longings of the soul, combine in this drama to form a picture of human nature which is probably unequaled in any literature. In 1794 an intimate and noble friendship began between Goethe and Schiller which lasted to the death of the latter in 1805. The influence of this friendship on Goethe was wholesomely stimulating. It was chiefly due to Schiller's lively interest that he resumed his work upon *Faust*. To Schiller his friendship with Goethe was the baptism of his genius, and Goethe was during the whole period very active. His studies were comprehensive and assiduous; his critical sallies on the extravagances of his own pupils were most effective; and through his direction of the ducal theater in Weimar from 1790 to 1817 he exercised a lasting and ennobling influence on the theatrical art of Germany. On the day of the battle of Jena (Oct. 19, 1806), he married Christiane Vulpius, by whom he previously had a son.

Goethe had now ceased to be merely an influence; he had become an authority. Civilized life in Germany—and in foreign countries too—was deeply indebted to him. He had loosened the narrow ties of the old order, and in the wild fermentation of all the elements of civilization he had established a law which prevented chaos from breaking in. He had brought a nobler conception of freedom into the German civilization. There was in German life and character a hardness and narrowness which, although intimately allied to energy and honesty, hindered the free movement of human nature, and constrained it within the boundaries of the most singular prejudices. These were melted down by Goethe's influence, and human nature breathed more freely. Lessing had proclaimed in his criticism the right of nature against conventionalities, but it was Goethe who demonstrated the truth of the doctrine by his poetical creations. And with him it received a most important expansion. Lessing had said that truth to nature was the first condition of beauty, thus confining himself within the merely theoretical sphere. Goethe said that everything natural was true as far as it was beautiful, thus breaking into actual life with a new and almost revolutionary issue. This view of human life as composed merely of two agents —nature, giving the force, and beauty, giving the law—is the key to that grand phenomenon in the history of mankind which is called Goethe. It explains the vagaries of his pupils, the Romanticists; it explains the defects of certain of his works, *Wilhelm Meister's Wanderjahre* and *Faust II.*; it explains certain not commendable singularities in his life—why he did not marry Frederike Brion; why his first words on hearing that Charles Augustus had died were a scolding to the footman because he had not kept back the news till dinner was over. To us, in our days, it is apparent that such a view of human life is far from being exhaustive. We know that human nature contains elements which beauty is too weak to master—elements which even morality can not bring to full development—elements which only religion can grapple with. But to the time of Goethe, curbed and almost mutilated under the tyrannical constraints of pedantic prejudices, this view was a gospel of freedom, progress, power, and happiness. It will hold a certain authority in every age, because it contains a certain proportion of truth. It was followed by Goethe himself with a sincerity and honesty which admit of no question, and which in many cases certainly cost him unspeakable sufferings. Its effect on civilized life was most wonderful; it gave much more than it promised. Thus it was quite natural that the whole age bowed to its bringer with the deepest gratitude and reverence.

The most remarkable of Goethe's poetical productions during the last period of his life are—*Die Wahlverwandtschaften*, a romance (1808); *West-östlicher Divan*, a collection of lyrical poems (1813); *Faust II.* (1831); and the exceedingly interesting autobiography *Aus meinem Leben* (1830), which he calls a blending of facts and fiction. Most of his time, however, was given to practical business and scientific researches. In this last respect he has been very severely criticised by several scientific men of second rank, while all scientists of first rank have acknowledged that his discoveries in botany and comparative anatomy are valuable, and his studies and observations interesting and suggestive, even when the theories which he formed and endeavored to maintain proved untenable. He died in Weimar, Mar. 22, 1832, and lies interred in the ducal burial-vault beside the duke, Charles Augustus, his friend through many years. The best biographies of him are by Hermann Grimm and G. H. Lewes (London, 1855); the fullest impression of his personal character is given by the numerous collections of his correspondence with Schiller, Mad. von Stein, Lavater, Herder, Merck, Humboldt, Bettina, and numerous others. See also the sketch by W. Hayward (1878). See GERMAN LITERATURE.

Revised by H. H. BOYESEN.

**Goettling**, göt'ling, KARL WILHELM: philologist; b. at Jena, Germany, Jan. 19, 1793; began his studies in that place; served as a volunteer in the war with France 1814; finished his university course in Berlin; appointed in 1815 professor in the gymnasium at Rudolstadt; in 1819 director of the gymnasium at Neuwied; in 1822 professor extraordinary; in 1829 honorary professor; and in 1832 professor in the University of Jena; in 1826 was appointed also university librarian, and later associate director of the Philological Seminary. In 1828 he visited Italy and Sicily; in 1840, and again in 1852, Greece, in connection with historical and archæological studies. He wrote *Das Geschichtliche im Nibelungenliede* (The Historical in the Nibelungenlied), Rudolstadt, 1814; *Nibelungen u. Ghibellinen* (1817); *Lehre von Griech. Accent.* (5th ed. Jena, 1835), translated as *Elements of Greek Accentuation* (London, 1831); *Geschichte der römischen Staatsverfassung* (History of the Roman Constitution from the Founding of the City to Cæsar's Death), Halle, 1840; edited *Theodosii grammatica* (Leipzig, 1822); *Aristotelis Politica* (Jena, 1824); *Œconomica* (1830); *Hesiodi Carmina* (Gotha, 1831; 2d ed. 1843); published *Gesammelte Abhandlungen aus dem Classischen Alterthum* (vol. i., Halle, 1851; vol. ii., Munich, 1863). His *Opuscula Academica* were collected and edited by Kuno Fischer (Leipzig, 1869), after his death, which took place at Jena, Jan. 20, 1869. See K. Fischer, *Charakteristik*, prefixed to the *Opuscula*; C. Nipperdey, *Memoria C. Goettlingii* (Jena, 1869).

**Goetz**, götz, HERMANN: opera-composer; b. in Königsberg, Prussia, Dec. 17, 1840; studied music in Berlin; composed his first opera, *The Taming of the Shrew*, in his twenty-third year. It was produced with great success at Mannheim in 1874. He also composed a second opera, *Francesca da Rimini*, but he did not live to see it performed. He died in 1876, leaving this and other works, including a psalm, a cantata, *Nœnia*, and other works in MS., some of which have been published. D. E. HERVEY.

**Gog** and **Ma'gog** [of doubtful etymology; the latter originally the name probably of a tribe or nation]: names occurring several times in the Bible. In the Mosaic Table of Nations (Gen. x. 2), Magog is the second of the seven sons of Japhet, representing a people, probably the Scythians. In Ezekiel (xxxviii. 2 and xxxix. 1) Gog is the prince of the people Magog. In Revelation (xx. 8) both Gog and Magog are peoples, opposing, as in Ezekiel, the people of God, and doomed to destruction.—GOG and MAGOG are also the names of two images of giants standing in the Guildhall, London. These giants were made in 1708 by Richard Saunders, replacing two which were burned in the Great Fire. The original images are mentioned as early as 1415, and probably were much older. Many European towns have, or have had, their old corporation giants. The origin of the custom is obscure.

**Gogol-Janowsky**, NIKOLAI VASILIEVITCH, commonly called **Gogol**: author; b. in the government of Poltava, Russia, in Mar., 1809; went to St. Petersburg, where he held a Government clerkship for a short time. In 1830 there appeared in a periodical a sketch of Cossack life which was the first of a series of stories and sketches published in the following year under the title *Evenings on a Farm near Dikanka*. The graceful style of this work and its graphic delineation of Slavonic life and manners raised Gogol at once to the first rank of Russian writers, and his success prompted him to form a plan for a history of Little Russia on an extensive scale. This project was not carried out, but it led to his appointment as Adjunct Professor of History of the University of St. Petersburg. He was not successful in this position, which he resigned in 1835. In the meanwhile he had published his *Arabesques*, *Taras Bulba*, and a number of novelettes of a realistic character, but made the greatest im-

pression by a comedy called *Revizor*, or government inspector, in which he held up to contempt the corruption of Russian officialism. This was followed by the adventures of *Chichagov, or Dead Souls* (1842), considered by many his masterpiece. Like the *Revizor*, it had a political and moral purpose, its aim being to throw ridicule upon the institution of serfdom, in the hope of causing its abolition. From 1842 to 1848 he lived chiefly in Italy, and during this period underwent a change of conviction, becoming a partisan of absolutism and a gloomy and mystical ascetic. After a journey to Jerusalem in 1848, he returned to Russia, and died in Moscow in 1852. F. M. COLBY.

**Gogorza**, EMILIO, de: See the Appendix.

**Gogra**, or **Ghogra**: a river of Hindustan; one of the largest affluents of the Ganges; rises in lat. 30° 28′ N., lon. 80° 40′ E., at an elevation of between 17,000 and 18,000 feet, in the glaciers of the Himalayas; enters the plains of Hindustan in lat. 29° 6′ N., lon. 80° 13′ E., at an elevation of 798 feet, and joins the Ganges, in lat. 25° 46′ N., lon. 84° 40′ E., 150 miles below Benares, after a course of about 600 miles. After its descent into the plains it is navigable for large boats in all seasons, though its navigation is somewhat difficult on account of shoals.

**Goiana**: See GOYANNA.

**Goitre**, goi'ter, **Bronchocele**, brong'kō-sēēl, or **Derbyshire Neck** [*goitre* is from Fr. *goitre* < Lat. *guttur*, throat, whence Eng. *guttural*; *bronchocele* is from Gr. βρογχοκήλη, liter., windpipe-tumor: βρόγχος, windpipe + κήλη, tumor]: an enlargement of the thyroid gland, which lies across the front of the windpipe. There may be simply hypertrophy of the gland structure, or there may be enlargement of blood-vessels and formation of cysts filled with gelatinous material in the connective tissue of the gland. The disease has been supposed to be due to the drinking of snow-water, but it occurs where there is no snow. Although manifesting itself to a greater or less extent in all parts of the world, it is more prevalent in the chalky parts of England, especially Derbyshire and Nottingham, and in mountainous districts, among which may be named the Himalayas, Andes, Alps, the Tyrol, and the valley of the Rhône. It is seen upon almost all *crétins*. Goitre is also a symptom of the affection known as GRAVES'S DISEASE (*q. v.*) or Basedow's disease, which consists, besides the enlargement of the thyroid gland, of an unusual prominence of the eyeballs and a very rapid action of the heart. Unless it be very large, goitre causes but little inconvenience, but it often attains to such a size as to produce serious trouble by pressure on the neighboring important parts—the large veins, trachea, œsophagus, etc. Occasionally goitre may cause sudden death, but no satisfactory explanation can be given for this occurrence. The treatment usually adopted is iodine, both applied externally and administered internally, to cause absorption. Extirpation is sometimes performed. In India, powerful mercurial inunctions are successfully employed.

Revised by WILLIAM PEPPER.

**Golcon'da**: fortress and decayed town; 7 miles W. of Hyderabad, Nizam's Dominion, British India (see map of South India, ref. 4–E). It was long famous for its diamonds, which, however, were only cut and polished here; and it was the treasury of the Nizam, and as such fortified and jealously guarded; these two circumstances have given it an almost fabulous fame. In its neighborhood are the mausolea of its former sovereigns, stupendous buildings of granite, with roofs of porcelain tiles of the most brilliant blue color.

**Golconda**: village; capital of Pope co., Ill. (for location of county, see map of Illinois, ref. 11–F); on the Ohio river; 80 miles N. E. of Cairo. It is in an agricultural and mineral region; contains lead and kaolin mines; has a court-house, several churches and public schools, flour, saw, and woolen mills, hotels, 2 banks and 2 weekly newspapers, and is the shipping-point for a large region. Pop. (1880) 1,000; (1890) 1,174; (1900) 1,140.

**Gold** [O. Eng. *gold*: Germ. *Gold*: Icel. *goll*: Goth. *gulþ* < Teuton. *guldó-*: O. Bulg. *zlato*, gold, from root Indo-Eur. *ghel-*, meaning yellow, from which also the Indo-Iran. developed a word for gold independently; cf. Sanskr. *hiraṇya-*, Avest. *zaranya*. Distinct names are (1) Lat. *aurum*, which passed into Celtic, Ir. *ór*, and Baltic, Lith. *auksas*; (2) Gr. χρυσός, loan-word from Semitic; cf. Heb. *chārūz*. An Indo-Eur. word for gold does not exist]: one of the heaviest, softest, and the most malleable of metals. It is widely distributed, being found in the metallic state in nearly all the great mountain-chains of the globe, and in solution in minute quantity in sea-water. It was probably the earliest known metal, and it has been prized through all ages for its beauty and indestructible qualities. It is rarely found pure, being alloyed with silver in varying quantities in different regions. The silver ranges from 0·16 to 16 per cent. of the native metal. California gold averages 88 per cent. of pure gold and 12 per cent. of silver. Australian gold contains on an average 92·5 of gold and 7·5 of silver. New Zealand gold has about the same average of fineness. The percentage of silver varies at different localities in the same gold-region. In Nova Scotia gold is found nearly pure. The gold found on the Chaudière in Canada contains from 10 to 15 per cent. of silver. Alloys are found, however, with a much larger quantity of silver. The *electrum* of the ancients contained from 26 to 36 per cent. of silver. A mass of this nature weighing 25 lb. was found at Vöröspatak, Transylvania, and contained 25 per cent. of silver. A pale-yellow alloy occurs in the rich ores of the Comstock lode in Nevada, and, according to an analysis by Attwood, contains 55·37 per cent. of gold and 42·87 of silver. In U. S. gold coin there are 90 parts of pure gold and 10 parts of alloy, which consists chiefly of copper, with a little silver. Silver gives a lighter yellow color or whiter shade to the gold, and copper imparts a reddish color. The red gold used for watch-chains and jewelry is alloyed with copper. The mixture, whether formed by the addition of silver or of copper, or of both, is harder than pure gold, which is too soft and easily worn away to be used for coin or ornaments. In jewelry the quantity of alloy added to the gold varies from 12 to 50 per cent., or even more. The ratio of the quantity of gold to the other metals, called the *fineness*, is usually expressed in "thousandths" or "carats." Pure gold is 1,000 fine; half gold and half silver would be 500 fine. California gold as mined averages 880 thousandths, being 880 parts of gold in 1,000. It ranges from 870 to 890 thousandths. U. S. gold coin is 900 fine. The expression of fineness by carats is an older form, and is still in general use by jewelers and at the British mint. Pure gold is said to be 24 carats fine. When there are equal parts of gold and of other metals, the mixture is said to be 12 carats fine. Six parts of alloy give 18-carat gold, and so on. Common gold jewelry is often 14 carats fine, but the superior qualities are 18 carats. In Great Britain bullion accounts are rendered in carats, carat-grains, and eighths or thirty-seconds of a carat, the carat being divided into thirty-two equal parts. One carat is equivalent to $41\frac{2}{3}$ thousandths. The U. S. standard gold, 900 fine, is equivalent to 21·6 carats. The British standard is 22 carats, equivalent to $916\frac{2}{3}$ thousandths. The range of gold above the standard is designated in Great Britain as "*betterness*," and below the standard as "*worseness*."

The specific gravity of native gold and of artificial alloys of the metal varies with the fineness. Native gold ranges from 15 to 19. When quite pure and after pressure in a die, the gravity is 19·34. One cubic inch of pure gold weighs 10·12883 oz. troy, and is worth $209.38. In the calculation of tables of value 387 oz. troy are considered to be worth $8,000; hence an ounce is worth $20·6718+. The metal is not so hard as silver, being from 2·5 to 3 upon the mineralogical scale, but its hardness is slightly increased by hammering. Its extreme malleability is best shown by the thinness of gold-leaf as used in gilding. One ounce of gold may be beaten out so as to cover 189 sq. feet of surface, but the leaves are seldom made so thin, 100 sq. feet to the ounce troy being the usual extent. The average thickness of common leaf is $\frac{1}{282000}$th of an inch; thus 282,000 sheets would be required to make a pile an inch in height. When so thin, green light is transmitted. One grain will yield leaf sufficient to cover 56·75 sq. inches, or may be drawn into a wire 500 feet long.

The value of gold in the arts for ornamentation and for money rests in great part upon its unalterability by any ordinary agencies. It can not be easily rusted or dissolved, nor does it tarnish by exposure to the weather or to foul gases for ages. Gold ornaments found in Egyptian and other ancient tombs are unchanged. The proper solvent of gold is chlorine, and fluids containing free chlorine or evolving chlorine will dissolve it. The mixture of the two acids, nitric and hydrochloric, known as aqua regia, is commonly employed. Selenic acid acts upon it. Its solution in sea-water is referred to the presence of iodate of calcium. It is attacked by alkalies and the nitrates. A sulphate may be formed by heating gold with solid permanganate of potash

and concentrated sulphuric acid for a few minutes. Gold may be obtained in a powdered state by precipitating an aqueous solution of the chloride by green vitriol. Spongy gold, according to Dr. C. T. Jackson, is obtained by adding oxalic acid to a concentrated solution. It is also obtained by electrolysis. (See *Am. Jour. Sci.*, vol. xvi., 1878, and a patent issued in 1860.) Gold fuses at a temperature of 2,016°. It may be volatilized by solar heat concentrated by a glass, or by the oxyhydrogen jet, and rises in purple vapors. In solidifying from fusion it contracts greatly. The presence of $\frac{1}{2000}$th part of lead, bismuth, or antimony destroys the ductility of gold. It is also made brittle by sudden cooling. Its tenacity is next to that of silver. Atomic weight, 196·71. There are many interesting alloys of gold besides those already mentioned, as, for example, with palladium, and artificially with platinum, the latter giving a hard and highly elastic mixture. A native alloy of gold and palladium contains nearly 10 per cent. of the latter and 4 per cent. of silver.

As regards the nature of the rock-formations in which gold is found, it may be said, in general, that it occurs in formations of nearly all geological periods, from the earliest rocks to the latest Tertiary. It is chiefly, however, in the uplifted and partially altered slates and shales of the Middle Secondary and the Paleozoic periods that the great deposits occur. The principal veins and placers in California follow a belt of Jurassic and Triassic slates on the western slope of the Sierra Nevada. In all this region there are large areas of serpentine and magnesian slates. The metal also occurs in granite, syenite, limestone, and sandstone. Quartz is the almost universal veinstone, but the metal is sometimes found penetrating seams of calespar or dolomite in hornblendic slates without much quartz. Beautiful crystallizations of gold are occasionally found in cavities of the veinstone. They belong to the cubic system, and in California are generally distorted octahedra. In Australia dodecahedral crystals are more common. Very large irregular masses are sometimes taken from veins, but they are more common in placer-deposits, and are generally known as *nuggets*. The famous Blanch Barkly nugget in Australia weighed 146 lb., and one from Ballarat weighed 184 lb. 8 oz., and was worth over $41,000. A mass weighing about 160 lb., consisting partly of quartz, was reported in the early days of California mining as having been taken from the quartz-vein on Carson Hill. A mass weighing 28 lb. (= 37 lb. troy), and about the size of a smoothing-iron, was found in Cabarrus co., N. C. A highly crystalline mass, weighing about 17 lb., was dug up near Georgetown, Cal., in 1865, and was valued at $4,000. A great number of masses of considerable weight have been found in California of which no special record has been kept, but the Australian placers appear to have afforded the largest number of heavy nuggets.

The almost universal distribution of gold is not so surprising when its presence in sea-water is considered. Sonstadt has shown that there is nearly one grain to each ton of water, and that it can be separated so as to be recognized from a quantity of water so small as 150 to 200 cubic cm.; and as regards distribution in the soil, it is known, for example, that the ordinary brick-clay which underlies the city of Philadelphia contains gold.

The suitability of gold for money rests not only on the general estimation in which it is held, its unalterability, and its beauty, but on the fact that, while so generally distributed over the globe, it can not be obtained without labor. To extract an ounce of the metal from the earth requires a certain amount of work which differs somewhat in different places, but is approximately the same in all great gold-fields. The average quantity which a man can wash out in a day appears to determine the price of a day's labor for that locality. Thus when a man can conveniently wash out half an ounce of gold per day for himself, he will not work for less than its value. But placer-deposits are soon exhausted, and such exceptional yields do not last long. Vein-mines are not subject to such sudden fluctuations. The tenor of auriferous quartz and the force required to extract the gold are about the same in all countries. Hence gold is an excellent measure of labor performed, and represents labor. It is at once the measure and the reward of labor.

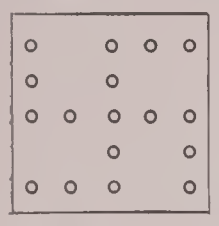
The value of gold relatively to silver has varied in time and in locality according to their relative abundance and the estimation in which they have been held. In the year 1546 in Great Britain, and all countries where values had been more or less equalized by commerce, the ratio was as 10 to 1; in 1849, as 15·63 to 1; in 1874, as 15 to 1. This ratio is constantly changing, having increased in 1892 to nearly 24 to 1, from various causes. (See SILVER.) In the far East, however, there has been a long-established preference for silver. When Japan was opened by Commodore Perry the relative value there of gold to silver was much below the European standard, and advantage was soon taken of it by traders, who exchanged silver for gold and depleted the empire of millions. Enormous quantities of gold are consumed annually in the arts and are lost by wear of coin and jewelry. The consumption for gilding alone is very large; for although the films are exceedingly thin, they are spread upon a variety of manufactures, such as frames, furniture, signs, pottery, jewelry, books, etc., to a far greater extent than is generally supposed. Electro-gilding has increased the waste. It is estimated that the consumption of gold bullion, new and old, for industrial purposes in the U. S. was $15,112,200 in value in the calendar year 1899. Since the discovery of gold in California in 1848 the annual production of the metal has greatly increased. The average product of the California mines up to 1870 was about $45,000,000 annually. The discovery was followed by the opening of new fields in Australia, in New Zealand, and other regions. At the date of the discovery in California the aggregate annual production of the metal, exclusive of Asia, was not over $30,000,000 in value. In 1853 the aggregate annual production reached its maximum, and was valued at $160,000,000. The production in California alone for that year was about $60,000,000. The world's production for the year 1899 was valued at $306,584,900, and of the U. S. $71,053,400. Over $73,000,000 in value was produced in South Africa. The total production of gold in the U. S. from 1792 to 1900 inclusive was approximately $2,305,914,000. The yield in California for 1899 was estimated at $15,197,800; that of Colorado at $25,982,800. The rapid increase of the production of Colorado from 1894–98 (from $9,000,000 to $23,000,000 in value) and the discoveries in Alaska should be noted. The greater part of the gold of the world is obtained by washing from detrital deposits in and along the beds of rivers. A smaller quantity is obtained from veins by crushing and washing the quartz. In the process of obtaining the gold by washing amalgamation is often resorted to, the mass of particles being subjected to the action of quicksilver by which the gold is held together in an amalgam. See GOLD MINES AND MINING.

WILLIAM P. BLAKE.

**Gold-beaters' Skin**: a thin material prepared from the peritoneal coat of the large intestines of the ox. The mucous coat is scraped away, and the remaining part undergoes a long and complicated process of preparation before it is fit for use. It is tanned with alum and softened with isinglass and white of egg, and after thorough beating and drying under pressure between sheets of paper it is ready for use. It is very costly, and is used by gold-beaters and sometimes in surgery.

**Gold-beating**: the process of preparing the thin leaves of gold used in gilding and by dentists in filling teeth. The first step in the process is to prepare the gold. For dentists' use this must be perfectly pure—1,000 fine. Common mint gold is dissolved in aqua regia, separated from the copper and silver it contains, precipitated by iron salt, and melted. For gilders' use alloys are prepared of silver and gold for the pale shades, and of copper and gold for the darker tints. "Light gold" contains from 2 to 12 pennyweights of silver to the ounce. "Extra deep gold" has 10 grains of copper and 12 grains of silver to the ounce, and "double extra deep gold" has 16 grains of copper to the ounce. In addition to these, leaf is made which has gold on one side and silver on the other. It is made by casting one metal upon the other in a mold, and subjecting the ingot to the processes described below. The gold is cast in an ingot usually of about 1,000 grains weight, and rolled to a ribbon a little more than $1\frac{1}{8}$ inches wide, and so thin that about 700 would go to the inch. In this form it is delivered to the beater, who receives 50 pennyweights, which he cuts up, after annealing, into squares a little more than an inch wide. These are placed in a book called the "kutch." Kutch is a kind of parchment-paper made in Germany, possessing great toughness combined with evenness of surface. The kutch is about $3\frac{3}{4}$ inches square. One ribbon of 50 pennyweights weight makes about 170 squares, the number depending upon the "number" or thickness of the leaf which is to be made from it—a detail which is determined

by the master in rolling the ribbon. The squares are laid precisely in the center of the kutch, and with their edges in an exact vertical line. Two envelopes, also of kutch, are drawn over the book in opposite directions, so as to inclose it on all four sides. It is then placed on a solid stone anvil, and the workman beats it with a sixteen-pound, round hammer with a broad and slightly rounded face. At first the blows are all directed toward the center, but as the gold flattens out the hammer is first struck upon the center and then a little toward the edge which is farthest from the workman. The book is then turned one-fourth round; the center is struck again, and the second blow toward the farther edge follows. This is repeated, the kutch being turned one-fourth round, until eight blows have been struck—four on the center and four toward the edge. The book is then turned over, and the same process is repeated on the other face. When the gold has spread so as nearly to fill the whole book, the workman strikes one blow on the center, one between the center and the edge, one on the edge in its middle line, one on the edge toward the right, and finally one on the upper right-hand corner. These five blows are repeated at each one-fourth turn, and the other face of the book is treated in the same way. The circles in the accompanying diagram indicate the position of the hammer at each blow. Sometimes a different succession is chosen, but whatever system is pursued must be continued until the book is finished, or the expansion of the gold between the leaves of kutch will not be uniform. The workman is careful not to strike on the extreme margin, and also to moderate the force of the blow as he nears the margin, the object being to keep the center of the leaf thinner than the edge. In the final operation of "booking" the edge is cut off and returned by the beater as scrap. If he has carelessly made the edge thin and the center thick, the result may be the loss of his week's wages in "short gold." Every three minutes the book is taken out of its covers and "riffled." Riffling consists in shaking up the leaves, so as to loosen the whole and prevent the gold from clinging to the parchment, which would cause an uneven spread of the metal. The kutch is beaten about half an hour, and is then "skewed." This consists in taking out the gold, and lasts another half hour. The leaves are then cut into quarters and laid in a "shodar." The shodar is a book made up of leaves, prepared from the cæcum (one of the intestines) of the ox. This is stretched and cleaned, and the mucous surfaces are pressed together, adhering strongly. It is then treated with some preparation which, so far as the best makers are concerned, is a secret, though isinglass, white of egg, and similar substances have been mentioned as dressings of more or less excellence. It is then cut into leaves 5 inches square, and made up into molds of 900 leaves. The cæca of nearly 600 oxen are required to form one mold, which is of course very expensive. These membranes have a perfectly smooth, even surface, free from veins and knots, and their fineness is indicated by the fact that a "mold" of 900 membranes, containing also 900 sheets of gold-leaf, is only an inch in thickness. The membranes become dry and stiff by use, and are also sensitive to the hygrometric condition of the atmosphere. When too dry, they are moistened; when too moist, they are heated to dry them, both operations requiring great care. The shodar, which is 4 inches square, is not made of fresh membranes, but of old molds cut down. The filling of the shodar requires one hour, and it is then beaten two hours with a lighter hammer, say 7 lb. in weight, and with the same precision as before. The leaves of gold are then cut into quarters and transferred to the "mold," which is made of new membranes in good condition. The leaves have now only $\frac{1}{16}$th the thickness of the ribbon, are partially transparent, and very fragile. The succeeding operations consequently must be performed with great care. The filling of the mold occupies two hours, and it is then beaten one hour with a five-pound hammer, after which it is annealed. Annealing is performed in a small screw-press of iron which is heated on a fire. After its removal from the fire the mold is placed between two plates, shoved into the hot press, and screwed down. It is evident that the least excess of temperature will ruin the delicate membranes of the mold, and this is the most hazardous part of the beater's work, for the mold is far more costly than the gold it contains. Beating, annealing, and cooling are performed four times in all. The whole operation of reducing 50 pennyweights of gold to leaf occupies twenty-four to thirty hours, average twenty-seven, or nearly three working days. After the last beating the gold is taken from the mold by girls and "booked," while the membranes are rubbed with "brime" or burnt talc, laid on with a hare's foot, to preserve their smoothness. Booking is the operation of placing the gold-leaf in books of tissue-paper, the leaves of which are rubbed with red ocher to keep the gold from sticking. The girl lifts the leaf by means of light wood pincers, lays it on a leather cushion, and blows it flat with her breath. She then cuts a piece $3\frac{1}{4}$ inches square from the center, by pressing down a wooden frame with sharp edges, and transfers the leaf to the book. Each of these holds 25 leaves or $5\frac{1}{2}$ grains of gold. In this extremely attenuated condition gold exhibits the phenomenon of malleability in the cold. Torn leaves are mended by laying a second torn leaf on top of the first and cutting them in two near the center by means of a thin and sharpened strip of reed. The leaves unite perfectly along the line of the cut, the scrap is removed, the double leaf blown out flat, and the center is cut out as usual. Sometimes no trace of the welding is visible. Holes are patched by merely pressing a bit of scrap on them. The malleability of the ordinary leaf is not, however, sufficiently perfect for the purposes of dentistry. Dentists' foil is accordingly annealed by floating the leaf for an instant over the flame of an alcohol lamp. A gas-flame will not answer, as it lessens rather than heightens the malleability of the leaf, probably by depositing a film of sulphur over it. After this process the leaves unite with the slightest touch, and adhere to any rough substance, as the finger.



It costs about $500 to stock a workman, of which not more than $150 is represented by gold, and the rest by his tools, books, etc. He must account by weight for all the gold he receives, the books of 25 leaves being taken at $5\frac{1}{2}$ grains, and all the scrap cut from his leaves being returned to him for melting down. Allowing that he cuts his ribbon into 170 pieces, this number is increased by 4, or to 680 leaves, in the shodar, and this again to 2,720 in the mold. Were he able to return this number of whole leaves, his pay would be very good, but the waste is such that the rate of wages is based upon the return of 2,000 whole leaves, or 80 books of the standard weight of 17 pennyweights. This is really under the average return of a good hand. If he beats his leaves beyond the standard thinness he will of course have an excess of gold, for which he receives pay as scrap. Slight variations are found in different establishments and different countries, but the art appears to have been practiced in a very similar way to that given above for thousands of years. Even the more peculiar details, such as the use of the cæca of oxen, have been in use so long that the date of their introduction is not known. Gold-leaf is found on ancient monuments of Egypt and other countries. An increasing skill appears to have been used in its manufacture, for the thinnest leaf mentioned by the ancients was fully three times the thickness of what is now ordinary leaf. The reduction of the gold from a foil $\frac{1}{700}$th of an inch thick to a leaf $\frac{1}{2524248}$th of an inch thick is the common work of the gold-beater. But this is by no means the limit of his skill, for sheets have been made of which 367,500 would go to the inch. Though the gold-beater receives credit for $5\frac{1}{2}$ grains on every 25 leaves he turns in, the real weight is not more than $5\frac{1}{10}$ grains; and as the book contains 264 sq. inches of leaf, 1 grain of gold has been beaten out to a surface of 52 sq. inches. Though gold-beating as an art remains almost as simple as it was centuries ago, the modern use of gold by dentists has given rise to a number of patented articles which are prepared by gold-beaters. "Carbonized foil" is one of these. It is made by interleaving gold-foil of more than usual thickness with coarse-grained paper, and setting fire to the latter while the book is placed in a press. In burning it contracts, and gives the gold a peculiar and very beautiful corrugated appearance. "Pack's crystal pellets" are made of ordinary leaf made into a mash by stirring the leaves in alcohol, and pouring them lightly into a mold. The alcohol remaining on the gold is then fired, and the heat causes the whole to weld to a very porous mass, which is cut into small square blocks. "Kiersing's blocks" are made of carbonized gold, the sheets being piled one above the other and the mass then cut into blocks. Dentists' gold is known by the name of "foil," which is heavier than the leaf. Machines have been invented to take the gold-beater's place, but they have not come into use. Simple as the work appears, it requires the exercise of discretion. Other metals than gold are beaten, as silver, alumi-

nium, and certain alloys of the baser metals made in imitation of gold. Silver-leaf is about four times as thick as gold-leaf. In the U. S. the price of labor hardly permits the beating of silver, while aluminium and the alloys can not be beaten at all with profit. Aluminium-foil is used by hat-makers for the stamp on the inside of the hat, where the vapors from the head would tarnish silver. J. A. Church.

**Goldbeck**, Edward: See the Appendix.

**Gold Coast, The**: a British colony in West Africa, stretching along the Gulf of Guinea from lon. 2° E. to lon. 5° W., and inland to the Ashantee kingdom, over which a nominal protectorate is extended. Area of colony about 15,000 sq. miles; including protectorate, 46,000 sq. miles. The estimated population is 1,473,882, of whom 500 are whites. The native population contains numerous tribes, belonging to two distinct sub-races—the black and the reddish. The Fantis and Ashantees represent the former, and the Aera and Crobo the latter. Mohammedanism and Christianity are both actively working in missionary efforts in this part of Africa. The climate is very wet and notoriously unhealthy, especially along the coast, where there are many swamps and lagoons. Whites suffer greatly from fevers, especially the coast fever, and even native blacks are liable in the rainy season to rheumatism and complaints of the throat and lungs. The Gold Coast owes its name to the former abundance of gold on this coast. It is now produced in small quantities only, though the whole region is more or less auriferous. The country is covered with vast forests of large trees. The chief productions are palm oil and kernels, and the export of caoutchouc and woods is increasing. The jurisdiction of Great Britain began in 1844. The principal towns are Cape Coast Castle, pop. (1891) 11,614; Acra, 16,267; Ada, 7,000; and Elmina, 10,530. The colony has a telegraph line 688 miles long. Exports (1899) £1,111,738; imports, £1,323,218; revenue, £192,792. There is no public debt. M. W. Harrington.

**Goldcrest**, or **Golden-crested Wren**: a name given in Great Britain to *Regulus cristatus*, and in the U. S. to *Regulus satrapa*, on account of the bright-yellow stripe on the head. See Kinglet. F. A. L.

**Golden**: city; capital of Jefferson co., Col. (for location of county, see map of Colorado, ref. 3–E); on Clear creek and on the Union Pacific Railway; 15 miles W. of Denver. It is in a rich coal-region, and, besides several coal mines, has smelting and reduction works for gold and silver, flour-mills, glass-works, and manufactures of pottery, drain-pipe, fire-brick, pressed brick, paper, and foundry products. Golden is the seat of the State School of Mines and of the State Industrial School, and has one quarterly and two weekly periodicals. Pop. (1880) 2,730; (1890) 2,383; (1900) 2,152.

**Golden Age**: in the traditions of many nations, the supposed period of primeval happiness and innocence, from which mankind have departed. The ancients referred this time to the reign of Saturn. A favorite dream of some modern reformers is that the golden age is in the future instead of in the past. The term is now used to denote the culminating or most brilliant epoch of any period of history or the like. The "golden age" of Roman literature is reckoned from the time of Livius Andronicus, about 250 B. C., to the time of Augustus Cæsar's death, A. D. 14. Plautus, Terence, Lucretius, Catullus, Cæsar, Cicero, Sallust, Propertius, Vergil, Tibullus, Livy, Ovid, and Horace are the principal writers of the golden age.

**Golden Calf** (or, better, young bull): a golden image formed for idolatrous worship by the Israelites at Mt. Sinai (Ex. xxxii.). Probably it was a wooden figure covered with gold, and was either a representation of the Egyptian god Mnevis or Apis, or else was an adaptation of these gods to the worship of Jehovah. It was destroyed by Moses. In later times golden calves, doubtless adaptations, as suggested above, were set up by King Jeroboam at Bethel and Dan, where they became favorite objects of popular worship (1 Kings xii. 28, 32, 33). Revised by S. M. Jackson.

**Golden Eagle**: a large and handsome bird of prey (*Aquila chrysaëtos*) common to Europe, Asia, and North America; named from the golden-brown color of the head and upper neck of the adult bird. The rest of the plumage is dark brown. The American bird is slightly larger than the European-Asiatic form, and is accorded the rank of a geographical race or sub-species under the title *Aquila chrysaëtos canadensis*. The bird is 3 to 3½ feet in length, and 6 or 7 feet in spread of wing. See Eagle. F. A. L.



**Golden-eye**: a name applied to a North American duck (*Glaucionetta clangula americana*) on account of its bright yellow eye. The male is 18 inches long, of a striking black-and-white plumage, recognizable by its greenish-black head and white cheek spot. The female is brown and gray. The golden-eye is a sub-species or geographical race of the European garrot (*Glaucionetta clangula*). F. A. L.

**Golden-eyed Fly**: a name applied to the troublesome horse-flies of the genus *Chrysops*; also to the neuropterous insects of the genus *Chrysopa*, important as an active destroyer of plant-lice.

**Golden Fleece**: in Greek mythology, the golden wool produced by the ram Chrysomallus. The fleece was suspended in an oak-tree in the grove of Ares in Colchis, and was guarded by a dragon. When the Argonautæ (*q. v.*) came to Colchis for the fleece, being sent thither by Pelias, Medea put the dragon to sleep and Jason carried the fleece away. Various attempts have been made at explaining the origin of this legend, which probably arose from accounts of the commercial enterprises of the early Greeks on the coasts of the Black Sea, but the interpretation usually given is that the Golden Fleece is the golden garment of solar light. See Cox, *Mythology and Folklore*, pp. 260–264 (New York, 1881). Revised by J. R. S. Sterrett.

**Golden Fleece** (transl. of Fr. *Toison d'Or*), **Order of the**: a famous order of knighthood, the oldest, the most exclusive, and the most illustrious in Europe. It was founded at Bruges in 1429 by Philip III. of Burgundy, on the occasion of his marriage with the Portuguese princess Isabella, and was consecrated to the Virgin Mary and the apostle St. Andrew, with a reference to Philip's father, who had been a prisoner at Cachis. Charles VI., Emperor of Germany, as possessor of the Netherlands, transferred the seat of the order to Vienna, as the Spanish monarchs had already done to Madrid. Thus there arose two branches, a Spanish and an Austrian, the latter having the original archives, but the former being the more exclusive.

**Golden Horde**: a band of Tartars who appeared at Khipsali in 1235; in 1240 invaded Russia and burned Moscow and Kiev; destroyed Lublin and Cracow 1240, burned Breslau in 1241, and defeated Henry, Duke of Silesia, at Liegnitz; ravaged Moravia and Hungary, and massacred the Magyar army 1241. A crusade was preached against them in that year; their siege of Neustadt was unsuccessful; they crossed to the S. of the Danube 1242, then marched eastward, and established in Russia an empire which lasted until the reign of Ivan III. (1462–1505); captured Bagdad, the seat of the Abassid caliphate, holding the city till the beginning of the fifteenth century, when they were conquered by Tamerlane. Their first leader, Batou, was a grandson of Genghis Khan, and their invasion was ordered by Octai, the great khan.

**Golden Maid**: See Connor.

**Golden Number**: the number of the year in the Metonic cycle, otherwise called the lunar cycle. (See Cycle.) As the times of holding the Grecian games were dependent on the state of the moon, this number was of prominent importance in the Grecian calendar; and hence is said by some to have been inscribed in characters of gold on the columns of the temple of Minerva at Athens, whence its name. Others say that it was thus called because it was written in gold in the calendar tables publicly suspended in the Grecian cities; and later in the portable calendars in use among the early Christians. The golden number is useful only in finding the day upon which Easter (and consequently the other movable feasts of the Church) will fall. For the explanation of this, and also of the mode of finding the golden number, see Easter.

**Golden Rod**: a popular name originally belonging to the *Solidago virga aurea*, an extremely variable plant of North America and Europe, once in repute as a vulnerary. In the U. S. the name is extended to the very numerous herbs of the same genus (family *Compositæ*) which are mostly tall, stiff annuals with yellow flowers. They are chiefly American. One species, the *S. odora*, is often fragrant, abounding in a volatile oil. It has a limited use in medicine, being carminative, aromatic, and diaphoretic.

**Golden Rose**: a rose made of gold and set with precious stones, which is blessed by the Pope annually on the fourth Sunday in Lent, and then presented to some prince or other dignitary, or, if no one is deemed worthy to receive it, laid up in the Vatican. The ceremonies of the consecration are

very elaborate, and by liturgists are explained as designed to give the symbol a distinct reference to Christ and Christian graces. The custom seems to be very old, but to have developed gradually. Gregory the Great used to send filings of the chains of St. Peter set in gold keys or gold crosses to persons with whom he wanted to be on good terms. The first one presented was sent by Urban V. in 1366 to Queen Joanna of Naples. The only English monarch who received a golden rose was Henry VIII., who had three bestowed upon him.

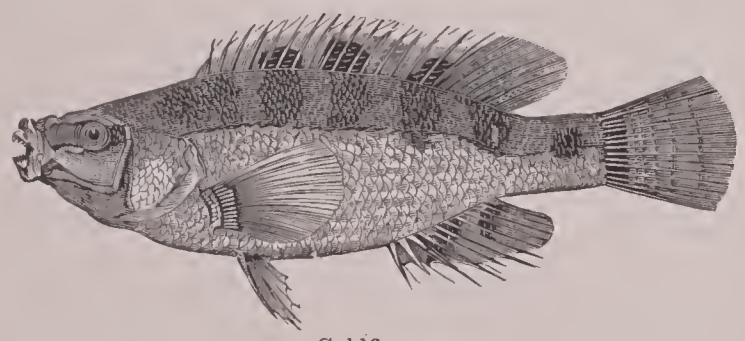
**Gold-eye**: the name of certain North American freshwater fishes of the genus *Hyodon*, family *Hyodontidæ*, having teeth on the jaws, palate, and tongue. The fishes are small, and will rise to a fly like the trout or grayling.

**Goldfinch**: a favorite European song bird (*Carduelis elegans*), prettily colored with yellow, white, black, and a little red. It is readily domesticated, sings fairly well, and breeds freely with the linnet and canary, the hybrids being prized for their song. It ranges over Europe and North Africa,

The common goldfinch of Europe.

extending eastwardly to Persia. The American goldfinch is a distinct bird (*Spinus tristis*), and much more "golden" than its namesake, the breeding plumage of the male being bright yellow, wings, tail, and top of head black, with some white markings. The fall and winter plumage of both sexes is much alike, being mainly a delicate pale brown. See NESTS OF BIRDS. F. A. LUCAS.

**Goldfinny**, or **Goldsinny**: the *Symphodus melops*, a



Goldfinny.

small European fish of the family *Labridæ*. It is brilliantly colored, and is found in kelp and about rocks.

**Goldfish**: the *Carassius auratus*, or golden carp, a Chinese fish naturalized in many streams and lakes of Europe

The gold carp, or goldfish.

and the U. S. From its beautiful orange color and its tenacity of life it is often kept in glass globes and aquaria. A great number of varieties and monstrosities are common in domestication.

**Gold Flux**: See AVENTURINE GLASS.

**Gold Hill**, Nev.: See VIRGINIA CITY.

**Goldmark**, gōlt'maărk, CARL: composer; b. at Keszthely, Hungary, May 18, 1830; studied at Vienna; began composition at an early age, and has produced many fine works, among which may be mentioned the overture *Sakuntala*, the operas *Queen of Sheba*, *Merlin*, the symphony *Die ländliche Hochzeit*. He has also composed some chamber music. D. E. H.

**Gold Mines and Mining**: places where gold is obtained, and the method of separating it from the rocky and earthy substances in which it is found. Gold mines may be grouped in two broadly marked divisions: (1) vein mines and (2) placer mines. Gold-bearing veins are generally of quartz, and they penetrate solid rocks to considerable depths. Placer mines are the comparatively superficial detrital deposits formed by the action of rivers and floods upon the veins. In veins the gold is firmly fixed in the gangue or veinstone, and is in irregular, ragged masses or crystalline particles; but in placers the gold is detached from the gangue, and is worn and rounded by attrition, having been rolled and tumbled in the beds of creeks and torrents together with pebbles and bowlders until all the asperities have been removed. Placer gold can thus be easily distinguished from vein gold. The gold so broken out from veins is distributed through the gravel and sand, but, owing to its high specific gravity, it gradually finds its way down to the lowest layers of gravel, and accumulates upon the surface of the underlying rock, generally known among miners as the "bed-rock." There is thus a kind of concentration of the gold in a layer under the gravel and soil, having more or less lateral extension, and comparatively near the surface; while in veins the gold is distributed through a layer of quartz traversing the rocks in a vertical or nearly vertical plane to great depths. This great difference in the mode of occurrence of the metal of course necessitates a great difference in the methods of mining. The operation of collecting the gold is in both cases essentially a mechanical one, based upon the superior gravity of the gold, which permits it to be readily separated from the rocks, gravel, or soil in which it occurs.

Gold-bearing veins are found in rocks of various ages and kinds: argillaceous, talcose, and chloritic slates appear, however, to be peculiarly favorable to the occurrence of the metal. In some regions hornblendic slates are more highly auriferous than the other rocks. Veins vary in width from a few inches or less to several feet. As a general rule, veins are larger, broader, and more extensive in slate-regions than in granite or the hard rocks. This seems to result from the fact that slates are more readily and deeply fissured in one direction than in any other. This direction is the plane of stratification or of highly developed cleavage, and veins generally conform to it in their direction and depth. There is a remarkable uniformity in the characteristics of gold-bearing veins all over the world. The veinstone is generally the opaque or translucent, milky-white variety of quartz, without distinct crystallization or cleavage. In some veins, however, it is very much harder than in other veins, and requires great labor and much powder to break it out. Sometimes it is readily excavated by the pickax; as, for example, in some parts of the great Comstock lode in Nevada, yielding silver and gold, the white quartz is in a fragmentary or powdered condition. It is usually, in all veins, much softer at considerable depths and when freshly mined than at the outcrops or after it has been exposed to the air for a long time. In some veins the bulk of the quartz exists in hard, rounded, nodular masses, surrounded more or less by softer cellular quartz, in which the gold is chiefly found associated with pyritous minerals, while the hard bowlder-like masses of quartz are comparatively barren. These veins are known in California as "bowlder-veins." A distinctly mark, banded structure, with a more or less crystalline medial plane, is not uncommon where veins traverse a hard, homogeneous rock, such as granite or syenite. This is a structural arrangement of the gangue which is regarded as one of the characteristics of true fissure veins. A banded structure, due chiefly to the parallel arrangement of the pyrites or to inclosed films of slate, is often seen in veins traversing slates. Such veinstone is often known as "ribbon-quartz," and is considered by miners as favorable to the richness of the ore. There is a class of veins known as "slate-veins," in which a belt of slates is traversed by thin

seams of quartz so much divided up into films and mixed with the layers of slate as scarcely to be recognized. Such seams, perhaps not thicker than a card or knife-blade, are sometimes highly charged with gold. It is very rare to find gold in rocks without quartz, but it sometimes occurs in seams of calcspar, dolomite, or steatite. The decomposition of such minerals would leave the gold in the rock apparently without gangue. Large amounts of gold have frequently been taken out of such seams in the rocks in a short time, and without finding any distinct evidence of the existence of a vein.

The gold in almost all veins is associated with pyritous minerals varying in quantity from 1 to 3 per cent. Sulphuret of iron is most common, though yellow copper ore, galena, and arsenical pyrites are common. Tellurium and telluret of bismuth are also abundant in some veins. Such minerals in the upper portions of veins, where exposed to air and moisture, become decomposed by oxidation, and impart a rusty, ochery condition to the veinstone. As a general rule, all of the upper portions of veins above the line of the permanent level of the subterranean water have lost their pyritous minerals by decomposition, and present a very different appearance from the portions protected by water from the access of air. By such decomposition any gold that was inclosed or covered by pyrites is left free and in a condition to be easily collected. The extraction of gold from such ores is therefore more simple and less costly than from the unchanged ore obtained at greater depths. The difference is so great that many mines are abandoned so soon as the naturally decomposed or "rotten ores" are worked out. The rusted vein-stuff is not only more easily worked, but it is likewise mined with more ease than the undecomposed ores below the water-level. In many veins the gold is not visible to the naked eye except where the pyrites is decomposed. The distribution of gold in the mass of the veinstone is a very important matter practically. Many quartz veins exist even in gold-regions without gold having been found in them; and in those known to be gold-bearing there are extensive portions without gold. The metal is thus not equally distributed along the vein; it is more abundant in some places than in others. Sometimes one side of a vein contains gold, while the other side is quite barren. Each vein has some distinctive peculiarity, which only becomes known to those who work it after long experience and observation. The metal, it is to be remembered, is not always visible, and to an unpracticed eye the quartz from all parts of a vein may appear of equal value. Gold conforms to the general law of distribution of ores in veins. It is found in "chutes" or "chimneys," so called, having a vertical rather than a horizontal extension upon the plane of the vein. The gold-bearing portion may thus be only a few feet in length horizontally, but may extend downward hundreds of feet. The length of the chute is the distance it extends horizontally along the vein. Its depth is the distance it extends downward, and its breadth or thickness is at right angles, horizontally, to its length. The vein may continue unchanged in size for some distance beyond the paying ground, but be too poor to be worked, or be absolutely free of gold. The length of a vein does not therefore determine its value; it is the length and thickness of the ore-chute which are of the greatest consequence. Several chutes often occur in succession, separated by barren vein-stuff. Such chutes generally maintain an approximate parallelism in depth. They are rarely exactly vertical, being generally inclined upon the plane of the vein, partaking in inclination not only of the dip of the vein in the rocks, but having an independent inclination or "pitch" upon that dip.

The origin of these chutes of "pay-quartz" is explained on the theory of the ascent, along certain channels, of the thermal waters or vapors by which the gold was deposited as soot is deposited in a chimney. Such a distribution of the precious metal of necessity affects the position and extent of the operations for mining it. The shafts and levels must be located with reference to the extent and pitch of the chutes as well as the dip of the vein. Mining upon gold-bearing veins does not differ materially from mining on veins of ores of the ordinary metals. The same kind of machinery for drilling, hoisting, pumping, and tramming is brought into use. The great value of the metal, compared with its bulk, often permits extremely narrow veins to be followed with profit, although necessitating the excavation of a large amount of wall-rock on one side or the other. On the other hand, in some large veins only one side of the veinstone contains gold enough to pay for extraction. In general it is difficult or impossible to determine the value of the quartz by mere inspection, and it is therefore not safe to select the paying portions too closely. The extraction of gold from the quartz veinstone is in the main a mechanical operation, but requires great special skill, and the details of the work vary with the condition in which the gold occurs, whether in coarse or fine grains, in thick or thin particles, or whether associated with much or little heavy pyrites or other minerals. The bulk or weight in all cases is extremely small compared with the veinstone. The pyritous minerals associated with it, generally known as "sulphurets," rarely exceed 3 per cent. of the mass; the gold is but a fraction of this amount. An ounce to a ton, equivalent to ·0034 per cent., is a large yield. If it were not for the high gravity of gold compared with quartz, about as 16·5 to 2·5, satisfactory mechanical separation would be impossible. The operation consists in crushing the quartz to a fine powder, so as to detach every particle of gold, and in washing away the quartz with water, leaving the gold behind. Quicksilver is used to aid in arresting the fine particles of gold by uniting them in an amalgam. The crushing to powder is effected in stamp-mills, the large masses being first broken up in a rock-breaker, so that no mass larger than the fist is thrown under the stamps. Quicksilver is used either in the battery mortars or only outside in riffles or on amalgamated metal plates which present a broad surface, over which all the gold coming from the batteries must pass. A great advantage in using quicksilver in the mortars is the immediate amalgamation of the coarse particles of gold when broken out from the quartz, thus removing them from the action of the stamps and preventing their being further reduced in size. Amalgamated copper plates placed inside the mortars serve to catch and retain the amalgam, which accumulates to a thickness of half an inch or more. In cleaning up, such amalgam has to be removed by chisels; it is dissolved or softened in quicksilver to separate all impurities. The excess of quicksilver is then removed by straining through a cloth or buckskin, leaving balls of pasty amalgam. The residue of the quicksilver is expelled by heating the amalgam in an iron retort, from which the gold is taken in a spongy, cavernous condition, known as "retorted gold." It is then fused and cast into ingots.

The sulphurets, which inclose more or less gold, are usually saved by concentrating machinery or by thick woolen blankets with a long hairy nap made expressly for the purpose. The battery sand in passing over such a surface deposits the greater part of the sulphurets, which are removed from the blankets by rinsing in water at short intervals. Such concentrated sand is usually worked by the chlorination process, which consists in dissolving out the gold by chlorine after a preliminary roasting to remove all of the sulphur, arsenic, etc. The value of sulphurets varies with the richness of the ore and at different mines. It ranges ordinarily between $50 and $250 per ton. The average value during the year 1873 at the Eureka mine, Grass Valley, Cal., was $80.57 per ton. This was one of the most noted and typical gold mines of California, and a few facts regarding it and other prominent mines will fairly illustrate vein gold-mining generally. The thickness of the Eureka quartz-vein was about 4 feet, and the length of the pay-chute about 1,000 feet. The main shaft had been sunk to a depth of 1,250 feet. There were eight levels, with an aggregate length of 9,000 feet. From Oct. 1, 1865, to Sept. 30, 1874, gold bullion valued at $4,273,148 was taken out, and an aggregate of $2,054,000 was paid in dividends. The cost of sinking in exploring was $65 per foot; of drifting, $25; and of stoping, about $10.50 per ton of quartz. Quantity extracted, 8,130 tons; average yield of gold, $25; percentage of sulphurets, 1·5. The cost of milling the ore was $2.61 per ton. This mine is regarded as exhausted. The Idaho mine is another good example of a first-class mine. It adjoins the Eureka, and is worked to a depth of 2,100 feet. In five years fifty-three dividends, aggregating $1,284,950, were paid. In 1873 27,624¾ tons of ore were worked, and averaged $37.91½ per ton. The average cost of mining and milling was $8.61½ per ton. In the years 1889 and 1890 39,225 tons of ore, valued at $20 per ton, were extracted. The mine had produced in 1892 over $13,000,000, two-thirds of which was profit, paid in 261 dividends. At the Empire mine, worked to a depth of 2,000 feet, 11,000 tons were extracted in 1874 from a vein averaging only 15 inches in thickness. The cost of extraction is stated at $8, and of milling $1.75 per ton; average yield, $16.75; per-

centage of sulphurets, 2½. In 1891 17,320 tons of ore were milled and 388 tons of sulphurets produced. At the Sierra Buttes, in Sierra co., Cal., the average value per ton of 40,035 tons worked in 1873 was $9; cost of mining, $3.60; and of milling, only 80 cents. During six months ending June 1, 1893, 3,420 tons of ore averaged $3.91; cost of working, $2.16; profit, $1.75 per ton. At the Alaska Treadwell mine in five months ending Oct. 1, 1893, 100,502 tons of ore yielded gold to the value of $356,227, averaging about $3.44; expenses, $122,227; profit, $234,000. Favorable conditions for mining, and the use of water-power instead of steam, make a great difference in the expense of working a mine and extracting the gold. At the Benton mills, run by water, on the Merced river, Mariposas estate, quartz could be crushed and stamped for less than 60 cents a ton, and the total cost of milling was about $1. At Hayward's Eureka mine, in Amador County, worked to a depth of nearly 1,700 feet (1874), 22,465 tons were worked in 1873, and yielded an average of $17.91 per ton. The vein in some places was found to be not less than 55 feet thick, and in others only 8 feet and 4 feet. Some portions were quite barren. The cost of extraction averaged $2.50 per ton for the higher levels. The famous Princeton mine on the Mariposas estate yielded from $13 to $25 per ton at different times, the average generally being about $16. The Mt. Morgan mine, in Australia, up to 1892 had produced 907,697 oz. of gold from 383,330 tons of ore, and paid forty-six dividends aggregating £2,750,000.

The form of occurrence of gold in South Africa is wonderful, and is unique in the history of gold-mining. It is found in stratified beds of conglomerates, locally known as "bankets," from their resemblance to a cake called banket by the Boers. From a production of 43,155 oz., valued at $755,212, at Witwatersrand in 1887, there has been a steady annual increase in the amount to 1,210,862 oz., valued at $21,190,085, in 1892. The gold of this district is valued at $17.50 to $18.25 per ounce. In 1890 702,828 tons of ore were crushed, yielding 494,817 oz. of gold, averaging 13·36 pennyweights per ton. In 1891 1,154,145 tons of ore gave 729,238 oz., an average of 11·23 pennyweights per ton. The total production for the year 1898 in the Transvaal was 4,555,022 oz., valued at $16,044,135. Deep borings with the diamond drill have penetrated the main "reef" at a depth of about 2,300 feet, and show it to be gold bearing.

Gold-bearing veins are often found by tracing the placer gold up the valleys to the side of the vein. When rough and ragged masses of gold are found in placers, it is good evidence that they have not been transported far from the original source. There are frequent examples of detrital deposits being barren of gold above certain veins, and rich in gold below them. Quartz-veins which appear to be perfectly barren sometimes seem to have been the source from which large stream-deposits of the metal have been supplied. In seeking an explanation, the unequal distribution of gold in the mass of the veinstone is to be considered, as well as the enormous amount of erosion which most veins have undergone. The wearing away and natural mining by rivers and floods through long ages of time far exceed in extent any human efforts. Valleys in California transverse to the direction of gold-bearing veins are from 1,000 to 3,000 feet deep, and all of the gold which existed in the veins eroded to that depth is collected in the detrital deposit of the valley below. Nature has performed on a gigantic scale the very operations required to obtain the gold from veins. The quartz is mined, crushed, and the gold is rudely separated and concentrated on the bed-rock of rivers and alluvial deposits. Placer mining may thus be considered a collecting operation, and it affords a more rapid and abundant harvest of gold for a short time than can be expected from veins. The rivers and brooks of a gold-region are in fact natural sluices, in which the gold broken from the vein is gradually concentrated; but the distribution of the metal in such valleys is extremely irregular, depending upon the supply, the nature of the current and of the bed-rock. As a general rule, where the bed of a stream is hard and the current is swift the bed-rock is swept clean, and no gold remains, except, perhaps, in deep holes and crevices, where it accumulates out of reach of the force of the water. In the process of ages streams cut their channels to greater depths, and the drainage of the country changes: valleys are drained and terrace-like deposits are left upon the hills. These deposits are generally rich in gold, and are more accessible to the miner than the beds of rivers. Placer mining is thus conducted not only in the beds of existing but of ancient streams. Such stream-deposits have been traced for long distances, apparently across the existing drainage of the mountain region of California, and have been mined with great profit. The gravel in many places, being deeply buried and excluded from the air, has a bluish color, due to the presence of protoxide of iron, contrasting strongly with the ordinary deposits. This blue gravel, wherever found in the higher parts of the gold-region, is generally regarded as the deposit of one great river which formerly flowed in a southeasterly direction. It is known as the "blue lead." But probably there were several ancient streams, each leaving deposits having a general similarity.

There are other classes of deposits besides those mentioned. Some appear to have been formed in lakes, inasmuch as the coarser materials at the bottom carrying the gold are overlaid by horizontal beds of clay and sand hundreds of feet in thickness. Other extensive deposits of enormous bowlders seem to have resulted from ice-action, and may be the medial or terminal moraines of ancient glaciers. This variety in the conditions of occurrence necessitates a variety of methods for securing the precious metal.

In placer gold-washing, as in collecting the gold from crushed quartz, the separation from earthy substances is effected by a current of water flowing over inclined surfaces. The materials presenting the greatest surface and having the least gravity are swept forward most rapidly; while the heavier and smaller objects are left behind at or near the upper part of the incline. All apparatus and methods are based upon this principle; the difference is in degree, not in kind. Formerly, nearly all auriferous earth and gravel was washed by throwing it into "rockers" or "long toms," so called, which were essentially inclined troughs made of boards and set at such an angle that the current of water flowing through would be strong enough to sweep away the earth and gravel and leave the gold. A coarsely perforated plate or grating at the lower end allowed the water and gold to fall through into a box provided with riffles and charged with quicksilver. The coarse gravel was removed by shoveling. Such apparatus, with the pick and shovel and a pan, is sufficient for operations on a small scale in ordinary alluvial deposits, where the upper and barren layers of sand and gravel are shoveled off, and only the comparatively small amount of pay gravel at the bottom is washed. For such operations only one or two men are necessary, and but little or no capital, but for the more extensive deposits hundreds of feet below the surface, and overlaid, perhaps, by thick outflows of basaltic lava, extensive mining operations requiring combined effort and large capital are necessary. The great bulk of the gold of California and Australia is now obtained from the deep placers worked by associated capital on a stupendous scale. A large portion of the richest gravel deposits are found in trough-like channels or basin-shaped depressions with a rocky rim, which must be pierced to reach the paying substratum and to afford the requisite drainage for successful working. This piercing is effected by running a tunnel from some adjoining valley, so as to reach the lowest depression of the deposit and give an outlet for the flood of water used in washing. The grade or "fall" must be such as to convey away the earth, gravel, and bowlders, and there must be room enough at the final outlet for the accumulation of tailings. In some cases the pay gravel on the bed-rock is removed by mining, in the same manner as a coal-bed is taken out, and is washed in sluices outside of the mine; but the most economical and expeditious method of excavation, when water can be had under pressure, is what is known as "hydraulic mining." This process originated in California in 1852, and has since been greatly improved. Water is conveyed in ditches for many miles to the hills above the deposits, and is carried down in iron pipes and delivered in large streams, under a pressure of from 100 to 300 or even 500 feet of height of column, against the base of the gravel deposit to be washed. The end of the pipe is furnished with a nozzle from 5 to 8 inches in diameter. A 6-inch nozzle, under a pressure of 275 to 300 feet of column, will deliver 1,579 cubic feet of water in one minute with a velocity of 140 feet per second. This mass of water striking in a solid column against the base of a bank of gravel excavates it with great rapidity. Bowlders weighing hundreds of pounds are tossed right and left. The upper portion of the bank is soon undermined, and caves in. This brings down huge masses of the overlying deposits, which, under the continuous force of the jet,

are in their turn broken up and carried off in the currents of water flowing in sluiceways converging to the tunnel leading through the rim-rock. When the gravel bank is so hard that it will not yield readily to the force of the jet, it is broken up or loosened by blasting. From 100 to 600 kegs of powder are used at a time, and as much as 2,000 kegs in one instance.

The iron used for the pipes varies in thickness from No. 16 to No. 11, and the diameter of the pipes ranges from 22 inches to 30 inches. Specially constructed nozzles, with goose-necks or universal joints, and moved by levers and strong tackle, are requisite to control the jets. They are usually placed at a distance of 200 feet from the bank. Danger from caving usually prevents a nearer approach. The grade or "fall" should be about 6 inches in 12 feet. Sluice-boxes are laid in the tunnel, and are from 4 to 6 feet in breadth and 36 to 40 inches high. These are paved with hard flat stones set on edge, so as to catch the gold and to prevent the wear of the bottom by the rapidly moving gravel and bowlders. Blocks of wood, set with narrow spaces between them, are also used. At the lower end of the sluice iron gratings are so arranged as to separate the large bowlders from the gravel and water. Large derricks are required at the upper end for moving the heavier rocks which can not be washed down the sluice. An invention known as the "undercurrent sluice" is largely used to withdraw the finer portions of the gravel with the gold from the main current, and spread them over a broader and less inclined surface, so that they move in a shallower current. These conditions are more favorable to the deposition of the gold than a deep and rapidly flowing stream, such as the coarse materials require.

The operation of hydraulic washing is a continuous one, and requires very little manual labor compared with the amount of material disintegrated and moved. The washing continues for months, and no gold is seen until the cleaning-up, which in one of the large sluices is an operation of considerable magnitude. Some of the bed-rock tunnels are thousands of feet in length, and require several years for their completion. The works of the North Bloomfield Company, in Nevada co., Cal., may be cited as an example. Ditches and reservoirs for the water-supply have been constructed at an expense of over $1,250,000, and with an aggregate length of more than 100 miles. The pay channel is about a mile in width, and to reach and work it a tunnel nearly 8,000 feet is required. This tunnel is for part of the distance 6 by 6½ feet, and for the remainder 8 feet by 8 feet. W. P. Blake.

**Gold of Pleasure**, or **False Flax**: the *Camelina sativa*, an annual herb of the family *Cruciferæ*. It grows in Europe and Asia, and has been sparingly naturalized in the U. S., where it is a worthless weed. But in some parts of Europe it is cultivated for the oil obtained from its seed. This oil is of rather poor quality. The oil-cake is acrid, and not much relished by cattle. The green plant is sometimes plowed in for manure. It has the advantage of growing well and rapidly on sandy land.

**Goldo'ni**, Carlo: father of the modern Italian comedy; b. at Venice in 1707. From his father and grandfather he inherited a strong passion for theatricals, but as he was unfit for the stage, he studied law, and he had even commenced practicing as a lawyer in his native city when the success of a play he wrote for a troop of strolling actors induced him to give up his business and become a play-writer. In 1761 he went to Paris to write for the Italian theater in that city. He was appointed teacher in the Italian language to the three daughters of Louis XV., and received a pension of 4,000 francs yearly, which was taken from him at the outbreak of the Revolution, but restored to him by the efforts of André Chenier. He wrote about 200 comedies, of which a few—for instance, *Le Bourru bienfaisant*, as well as his *Mémoires pour servir à l'Histoire de sa vie et à cette de son Théâtre*—are written in French; the rest are written in Italian, often in the Venetian dialect, which makes them difficult to enjoy, at least to foreigners; but the liveliness, gracefulness, and wit of his dialogue, especially in pieces picturing low life in his native city, are still highly appreciated by his countrymen, and his influence on the history of the Italian theater was very great. From his time the *commedia dell' arte* disappeared from the stage. In his earlier plays—for instance, in *The Servant of Two Masters*—he still employed the stock characters, the so-called masks of *commedia dell' arte*, Harlequin, Pierrot, Pantaleon, etc., and the interest of the play centered in the comicality of the situations. But the improvisation ceased, the dialogue was written out in full, and the clown became an artist. In his later plays—for instance, in *A Curious Accident*—he discarded even the masks; and as his observation of human character, such as reveals itself in everyday life, was as acute and lively as his power of representing it in dialogues was brilliant and charming, the transformation from the *commedia dell' arte* to the present form of modern comedy was happily achieved. Among his plays, besides those already mentioned, are *La Donna di Garbo*, *La Bottega di Café*, *Pamela nubile*, *Todero Brontolon*, *La Casa nova*, *Il Barbero benefico*, *La Locandiera*, and two tragedies, *Amalasunta* and *Belisario*. D. Feb. 6, 1793. See the *Life* by Molmenti (Venice, 1875); and by Galanti, *Carlo Goldoni* (2d ed. 1883); Goldoni's *Mémoires* were published in 1787, and a corrected edition of his works in 1788–89 (3d ed. 53 vols., Florence, 1827).

**Gold-purple**: a pigment known as the precipitate of Cassius, and described by Andreas Cassius and his son in 1685; used chiefly for giving a pink or violet color to glass and enamels. It is formed by adding a dilute mixture of protochloride and perchloride of tin, drop by drop, to a dilute neutral solution of terchloride of gold; a purple precipitate is formed. Its separation from the liquid is promoted by adding a little salt and boiling it. W. P. B.

**Goldsboro**: city; capital of Wayne co., N. C. (for location of county, see map of North Carolina, ref. 3–H); on the Neuse river and the Atlantic and N. C., the Richmond and Danville, and the Wilmington and Weldon Railroads; 84 miles N. of Wilmington, N. C., 142 miles S. of Petersburg, Va. It is in an agricultural and cotton-growing region, and has important manufactures. There are several churches, a high school, 3 grammar schools, 1 bank, and 1 daily, 1 semi-monthly, and 3 weekly periodicals. Pop. (1880) 3,286; (1890) 4,017; (1900) 5,877.

**Goldsborough**, Louis Malesherbes: rear-admiral U. S. navy; b. in Washington, D. C., Feb. 18, 1805; entered the navy as a midshipman June 18, 1821. In 1827, while serving in the Mediterranean on board the schooner Porpoise, Lieut. Goldsborough was given the command of the boats of that vessel with orders to rescue a British brig called the Comet, captured by Greek pirates at night in the Doro Passage, while one of a convoy in charge of the Porpoise. The pirates numbered 200, while Goldsborough's little band, all told, did not exceed forty; yet the Comet was boarded, many of the pirates slain, and the British restored to liberty. He was commissioned captain in 1855, and in Sept., 1861, was given command of the North Atlantic blockading squadron. He had hardly hoisted his flag as commander-in-chief when from a report sent to him by Lieut.-Com. (the late Commodore) W. N. Jeffers, commanding a gunboat off Hatteras Inlet, he inferred that possession of the sounds of North Carolina might be obtained by a joint army and navy expedition, the objective point to be the stronghold of Roanoke island. His views being approved by the Navy Department, he was summoned to Washington to hold a conference with Gen. McClellan, Assistant Secretary of the Navy Fox, and the superintendent of the Coast Survey, Prof. A. D. Bache, as to the best means of carrying them into execution. The "Burnside expedition" (as it was popularly styled) was soon in possession of not only Roanoke island and the sounds, but of many important positions in North Carolina. Goldsborough was made a full rear-admiral, received the thanks of Congress, and at the close of the war was put in command of the European squadron. D. in Washington, Feb. 20, 1877.

**Goldschmidt**, gōlt'shmit, Adalbert, von: composer; b. in Vienna in 1848. Composed his first work, an overture for orchestra, for the Vienna Opera-house. A mass written in 1870 received much praise. His greatest work was the cantata *The Seven Deadly Sins*, produced in Berlin in 1876, and in 1879 at Vienna, with great success. D. E. H.

**Goldschmidt**, Hermann: astronomer; b. of Jewish parents at Frankfort, Germany, June 17, 1802; studied painting under Cornelius, and practiced that art with some success at Paris 1836–47; then devoted himself to astronomy, and discovered (1852–61) fourteen asteroids. He also detected thousands of stars not given on the best atlases before his time, and announced the discovery of several new companion stars revolving around Sirius. D. at Fontainebleau, Sept. 11, 1866.

**Goldschmidt**, Meyer Aaron: novelist; b. at Vordingborg, a small town of the island of Seeland, Denmark, Oct. 26, 1819; received a careful education, and studied at the University of Copenhagen. In 1840 he founded a weekly journal, *The Corsair*, which made a great sensation in sedate Copenhagen by its brilliant wit and audacious satire. In 1848 he founded another weekly paper, *North and South*, which was well patronized on account of its criticisms, generally sound and always fine and elegant. But, although a very able and successful journalist, it was as a novelist that he became dear to his countrymen. His style has sparkling wit and considerable pathetic power, but its highest excellence is its wonderful simplicity, as fit for the description of nature and character as for the expression of sentiment and ideas. Some of his novels are well known to English readers—*A Jew* (1852); *The Homeless One* (1853); *The Heir* (1865); and *The Raven* (1867). D. Aug. 16, 1887.

**Goldschmidt**, Otto: composer and conductor; b. in Hamburg, Aug. 21, 1829. Educated at Leipzig and Paris. Went to England in 1848, and in 1852 married Jenny Lind (*q. v.*) at Boston, Mass. In 1855 they made their home in England. He composed an oratorio, *Ruth*, for the Hereford festival of 1867, founded the Bach choir in 1875, and conducted it till his death. He also conducted many festivals in Germany and composed much good music. D. in 1890.

D. E. H.

**Goldsmith**, Oliver: author; b. at Pallas, County Longford, Ireland, Nov. 10, 1728; the son of a poor Anglican minister; graduated A. B. at Trinity College, Dublin, after five years as a sizar, during which he was subject to most humiliating indignities and much distress, partly the result of his own characteristic improvidence. A rejected applicant for holy orders, he tried the study of law, but having wasted his scanty means in gaming, he spent eighteen months as a medical student in Edinburgh, out of which town he was hunted by creditors; lived abroad 1754–56, chiefly at Leyden, and afterward wandered over a large part of France, Germany, and Italy, taking his medical degree at Padua, and supporting himself by his musical talents, which entertained the kind peasants, and by the gratuities given by the universities to wandering students. In 1756 he went to London, where, after some years of hard experience as a chemist's assistant and practitioner of medicine, he became a proof-reader for the novelist Richardson. Still later, as usher in a school and as hack-writer for various journals, he earned a scanty living. His *Inquiry into the Present State of Polite Literature in Europe* (1759) was chiefly important as leading to opportunities for better work. The admirable *Citizen of the World* (1760) won him the friendship of Johnson and a membership in his Literary Club. The *Life of Beau Nash* was followed by the *History of England* (1761; revised ed. 1771), a work still read, for, though not of high critical value, its style is delightful. *The Traveller* (1764) established his place as a poet. *The Vicar of Wakefield* (1766), his only novel, is one of the choicest treasures of literature. *The Good-natured Man* (a comedy, 1767), *Roman History* (1768), *The Deserted Village* (1770), his best poem, *She Stoops to Conquer* (1773), his best comedy, were followed by the *Grecian History* (1774), one of the least meritorious of his works, though long highly popular. The unfinished *Animated Nature* (1774) was his last undertaking, a well-written and pleasing work, but one without any scientific value. His last days were rendered miserable by the pressure of debt, incurred partly at the gaming-table, partly by his thoughtless improvidence, and in no small degree by his liberal benefactions to the poor. D. in London, Apr. 4, 1774. Forster's *Life of Goldsmith* is the best, but that of Irving is good and appreciative.

Revised by Henry A. Beers.

**Goldsmith's Work**: See Metal-work.

**Gold Stick**: a title given to colonels of the British Life Guards, and to the captain of the gentlemen-at-arms, so called from the gilded bâtons which they carry on state occasions. See Silver Stick.

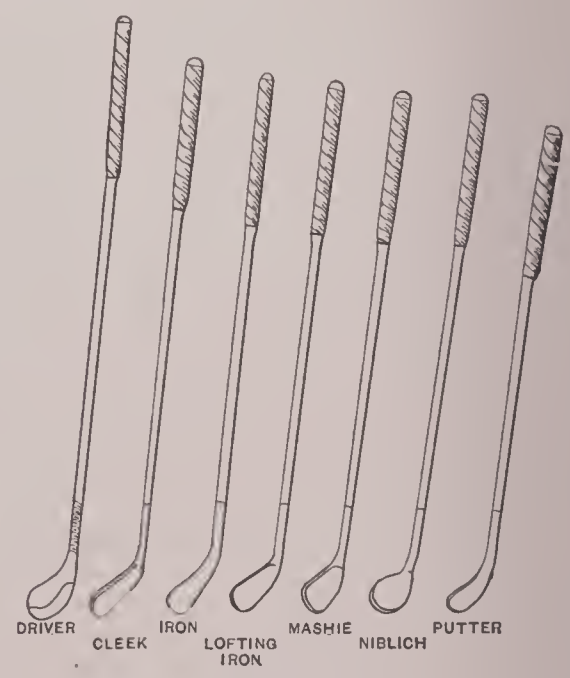
**Goldstone**: See Aventurine Glass.

**Goldstücker**, gōlt'stük-er, Theodor: Sanskrit scholar; b. in Königsberg, Germany, Jan. 18, 1821. He was educated at his native place, at Bonn, and at Paris; became a teacher in Berlin; removed to London in 1850, and was Professor of Sanskrit in University College from 1852 till his death. He founded the Sanskrit Text Society; was a member of the Philological and Royal Asiatic Societies; wrote sixty-seven articles on Indian mythology and philology in the first edition of *Chambers's Encyclopædia*; published *Pânini, his Place in Sanskrit Literature* (1861), the Sanskrit text of the *Jauninîya-Nyâya-Mâlâ-Vistara*, and part of a Sanskrit dictionary, and collected much material for other works. D. in London, Mar. 6, 1872.

**Golet**: a species of trout. See Dolly Varden.

**Golf** [prob. from Dutch *kolf*, club; cf. Germ. *Kolben*, club, and Eng. *club*]: one of the oldest of out-door sports, supposed to have originated with the Flemings some time prior to the fifteenth century, and then known as *kolf*. As played by them, however, kolf bore little resemblance to the game as it has been played in Scotland for at least four centuries. We learn from history that as early as 1457 golf was the national game. Indeed so popular was the game in Scotland about the middle of the fifteenth century that Parliament passed an act restricting the play to certain days in the week, in order that the people might practice archery, which, it was claimed, they had neglected for the sake of golf. For a time the game was restricted almost entirely to the wealthy and well-to-do. It is now very common everywhere throughout the United Kingdom, and there is hardly a city or town of any note in Great Britain that has not at least one golf club. It is also taking root in various parts of the continent of Europe, and is played in all the British colonies. In Canada there are quite a number of very strong clubs, with a good many excellent players. In the U. S. the game is also very popular. There are many fine courses in all parts of the country laid out and in charge of professional players, most of whom are from Scotland. The oldest club in the U. S. is the St. Andrew's of Yonkers, N. Y.

The game consists in driving, with an implement called a "club," a hard gutta-percha ball, about 5½ inches in circumference, from one hole in the ground (about 4 inches in diameter) to another, in a regular series of eighteen holes, being from 150 to 500 yards apart. To make the full eighteen holes means traveling from 3½ to 4 miles. When, as sometimes happens, there are only nine holes, the course must be gone over twice. The player who "holes" the ball with the least number of strokes wins the holes, and he who wins the greatest number of holes in the round wins the game.




Golf clubs.

The game is usually played by two persons, but can be played by four, two on a side. When played by two, each player has a ball and about half a dozen "clubs" of various sizes and shapes. These are carried by an attendant termed a *caddy*. The game is started by each player teeing his ball, i. e. placing it on a small bit of clay or sand, thus raising it slightly off the ground. This is done on what is called the *teeing-ground*, which is in the vicinity of, but not in any way situated so as to interfere with, the "green," that is the well-kept turf surrounding each hole for, say, 20 or 30 yards. When the ball is driven off the player can not again touch it, but must take his next shot at it from wherever it may lie, using that one of the various clubs with which he can best strike the ball. The player far-

thest from the hole always plays first, i. e. after the balls have been driven off from the *tee*. With four players, i. e. two on a side, the partners strike the same ball alternately, there being but two balls, one for each side. The points in the game demanding most skill are the *drive*, the *approach*, and the *putt*, some players excelling in one and some in another. The drive is the most showy feature of the game, although it is not always the strongest driver that wins. A good drive is from 150 to 200 yards, although the record is slightly over 300. The *approach* shot is probably the one that requires the greatest skill, and consists in lofting the ball with an iron club called a *lofting iron*, or *mashie*, when it lies from 30 to, say, 60 yards from the hole, and dropping it on the green near enough the hole to *lie dead*, i. e. near enough to insure its going in with another stroke. *Putting* requires a very steady hand and good eye.

The best golfing-grounds, called links, are to be found in Scotland and England by the sea, where the rolling downs are dry and sandy and mostly covered with short, thick grass. The most famous links are those of St. Andrews, Musselburgh, Prestwick, Berwick, Leven, Carnoustie, and Troon in Scotland, and Westward Ho, Holyoke, Sandwich, Wimbledon, and Blackheath in England, all but two of these being by the sea.

There is a large amount of literature on the subject of golf, and many periodicals are devoted to it. The most interesting, useful, and comprehensive work is to be found in the Badminton Series, written by the ex-amateur champion of Great Britain, Mr. Horace G. Hutchinson. JOHN REID.

**Golfo Dulce**, gōl'fō-dool'thā [Span., Fresh Bay; *golfo*, gulf, bay + *dulce*, sweet, fresh]: a deep bay with narrow mouth in the southwest angle of Costa Rica. The safety of its navigation and the healthfulness and fertility of its shores have frequently commended it for colonization, but they still remain sparsely populated. A French attempt at colonization about 1850 failed completely. Forests abounding in excellent timber cover the coasts. M. W. H.

**Golfo Dulce**, Guatemala: See IZABAL.

**Golgotha**: See CALVARY, MT.

**Goliards**: See VAGANTES.

**Goli'ath Beetles**: a group of large beetles from Western Africa, belonging to the *Scarabæidæ*. They live in the tops of trees, where they suck the juice of succulent stalks and devour the blossoms. The *Goliathus giganteus* is one of the largest of all Coleoptera. It is sometimes 4 inches long. Some of these insects are most gorgeously colored.

**Go'lius**, JACOBUS: mathematician and lexicographer; b. at The Hague in 1596; was educated at Leyden, and was for a time Greek professor of La Rochelle; was attached to the Dutch embassy in Morocco 1622, and in 1624 became Professor of Arabic at Leyden; was in the East 1625–29; became Professor of Mathematics at Leyden 1629. Published many translations from the Arabic, and a folio *Lexicon Arabico-Latinum* (1653), and left a MS. Persian dictionary. D. at Leyden, Sept. 28, 1667.

**Golomyn'ka**: the *Comephorus baikalensis*; a fish of the family *Comephoridæ*, caught in Lake Baikal for its abundant oil, which is extracted by pressure. It is a foot long, without scales, and is not edible.

**Golov'nin**, or **Golownin**, VASILI or BASIL: sailor; b. in the Riazan government, Russia, Apr. 8, 1776; became distinguished as a naval officer; was sent in 1807 to survey the shores of Asiatic and American Russia in command of the sloop of war Diana; was engaged in this work until 1811, when, having been driven by lack of food and water to land upon the Japanese island of Kunashiri, he was seized and imprisoned (1811–13), but finally set at liberty. He afterward led an exploring expedition around the world (1817–19), and was promoted to be vice-admiral and general overseer of the navy. His *Observations upon Japan* and *Memoirs of a Captivity in Japan* have been translated into most modern languages, and were long the most valuable sources of knowledge regarding that country. He also wrote in Russian *A Voyage Round the World* (1822), and a book giving accounts of remarkable shipwrecks, etc. D. at St. Petersburg, July 12, 1831.

**Goltz**, BOGUMIL: humorous and satirical writer; b. at Warsaw, Mar. 20, 1801, of German parents; studied at Königsberg and the University of Breslau; bought an estate near Thorn, but not succeeding as a farmer he retired in 1830 to the small town of Gollub, where he devoted himself to the study of literature. His first work was the *Buch der Kindheit* (1847), which treats of the impressions of childhood in the poetical style of Jean Paul. After extensive travels, in the course of which he visited Germany, Italy, France, England, and Egypt, he published *Das Menschendasein in seinen weltewigen Zügen und Zeichen* (1850), which was followed by *Ein Jugendleben: Biographisches Idyll aus Westpreussen* (1852), which dealt with the experiences of his own childhood, and by *Der Mensch und die Leute* (1858), a work of keenness and power. D. at Thorn, Nov. 11, 1870. Among his other writings are *Ein Kleinstädter in Aegypten* (1853); *Zur Charakteristik und Naturgeschichte der Frauen* (1859); *Typen der Gesellschaft* (1860); and *Die Weltklugheit und die Lebensweisheit mit ihren correspondirenden Studien* (1869).

**Gomara**, gō-mää'-rää, FRANCISCO LOPEZ, de (some old and modern authors write the name GÓMARA or GÓMORA): Spanish historian; b. at Seville, 1510. He was educated at the University of Alcalá, and at first embraced the career of arms, but owing to his literary tastes abandoned it for the priesthood. In 1540 he became the secretary and chaplain of Hernando Cortés, who was then on his last visit to Spain; he accompanied his master on the Argel expedition, and presumably remained with him until his death in 1547. Of Gomara's subsequent life nothing is known, and the date and place of his death are uncertain. It does not appear that he was ever in America. His *Historia general de las Indias* was first published at Saragossa in two folio parts (1552–53); the first part is general, and deals largely with Peru; the second is devoted to Mexico; and in the third edition (1554) this appeared with the separate title, *Crónica de la Nueva España, con la conquista de Mexico*, etc. Gomara's history was very popular, and was translated into French, Italian, and English; there are numerous editions. Modern historians criticise it somewhat severely. See *Biblioteca de Autores Españolas* (1852).

HERBERT H. SMITH.

**Go'marists**, or **Contra-remonstrants**: the followers of Francis Gomar (1563–1641), a former ultra-Calvinistic party in the Dutch national Church, distinguished by their opposition to the Remonstrants or Arminian party, whose expulsion their leader secured at the Synod of Dort (1618). See DORT, SYNOD OF.

**Gombroon'**: town on the Persian coast, at the Strait of Ormuz, belonging to the imamat of Muscat, in Arabia. On the island of Ormuz existed a flourishing town of the same name, established by the Portuguese. In 1622 the Persian Shah Abbas and the English disturbed this town, thereby transferring its commerce to Gombroon on the opposite shore. Gombroon rose immediately, and is said to have had 30,000 inhabitants. But under Persian rule it soon lost its commerce; the Europeans went away, the factories fell into decay, and the place is now an insignificant village of 3,000 inhabitants called Bénder-Abbas'.

**Gomera**, gō-mā'rää: one of the smallest of the Canary islands; lying 20 miles S. W. of Teneriffe; about 23 miles long by 9 broad; area, 144 sq. miles. Pop. (1887) 14,108. It has the most wood and water of the group. Dromedaries are reared in considerable numbers. Columbus resided here before sailing for the New World. St. Sebastian, the chief town and a port, has about 2,500 inhabitants. M. W. H.

**Gomez**, A. CARLOS: See the Appendix.

**Gomperz**, gōm'pārts, THEODOR: Greek scholar; b. in Brünn, Austria, Mar. 29, 1832; studied at Vienna, where he became privat-docent in 1867, professor extraordinary 1869, professor ordinary 1873. Member of the Vienna Academy since 1882. He is best known for his decipherment and elucidations of the papyri found in Herculaneum, *Philodemi Epicurei de ira* (1864); *Herculanische Studien* (1886); *Philodemus de musica* (1885). He also published valuable contributions to *Demosthenes*, the fragments of the *Greek Tragic Poets*, *Herodotus*, and translated with others the works of J. S. Mill (1869–80). ALFRED GUDEMAN.

**Gomuti** (gō-moo'tĕe) **Palm** [from *gumuti*, the Malayan name]: the *Arenga saccharifera*, a very valuable palm-tree of Annam and the Malay islands. It produces sago, palm wine, palm cabbage, sugar, *baru* (a substance used in calking ships), and especially a large amount of COIR (*q. v.*) more durable than that of the cocoanut, but less flexible and not so good for the manufacture of running rigging for ships. Cables of the gomuti coir are very strong indeed, but rough and stiff, so that sailors dislike to handle them.

**Gonaïves, Les**, lās-gō-naa'i-ves: a city and port of Haiti; capital of the department of Artibonite; on Gonaïves Bay, at the west end of the island: 70 miles N. N. W. of Port-au-Prince (see map of West Indies, ref. 5–G). The port affords excellent anchorage for the largest vessels, and is exposed only on the western side. The town is irregularly built on a great plain, which stretches from the bay eastward to the Monts Noirs or Black Mountains; this plain is very fertile, and with the neighboring valleys forms one of the richest agricultural districts of Haiti. Gonaïves was originally an Indian village, and attained commercial importance only in the nineteenth century. It exports considerable quantities of coffee and cotton. Haitian independence was first proclaimed at this place, and it has been the scene of many important events in the history of the country. Pop. (1887) estimated at 18,000. HERBERT H. SMITH.

**Gonçalves Dias**, ANTONIO: Brazilian poet: b. at Caehias, province of Maranhão, in 1823. He was sent by his parents to Coïmbra, in Portugal, to study philosophy and jurisprudence, in order to fit himself for a public career in Brazil. He had more interest in poetry, however, and soon began to publish verses in Portuguese periodicals. On his return home, he gave up his place as magistrate in order to become Professor of History; and in 1846 he published at Rio de Janeiro his first volume, *Primeiros Cantos*. This was followed in 1848 by *Segundos Cantos, e Sextilhas de Fr. Antão*, and in 1851 by *Ultimos Cantos*. About 1850, however, he had returned to Europe on a mission from the Brazilian Government to study German and French scientific schools. He remained abroad till 1858, mainly in Germany. He printed in Leipzig a collection of his poems (1857), and in the same year the first four cantos of an epic entitled *Os Tymbiras, Poema Americano*. In 1858 he returned to Brazil in order to take part as historian and ethnographer in the scientific expedition sent by the Brazilian Government into the province of Ceará. For this he had prepared himself by long studies, the results of which are to be found in several memoirs (cf. *Rev. do Inst.*, xviii., 5 and 289), and in his *Diccionario da lingua Tupy chamada lingua geral dos indigenas do Brazil* (Leipzig, 1858). Gonçalves Dias's first poetical impulse came from the *Brasilianas* of ARANJO PORTO-ALEGRE (*q. v.*), and he continued to be a writer ardently national and eager to give expression to the life of the Brazilians, whether indigenous or Portuguese. In this he was eminently successful, and, in the words of the Spanish critic, Juan Valera, he became "the most popular of all the Brazilian poets." See *Cantos, Collecão de poezias de A. Gonçalves Dias* (3d ed. Leipzig, 1860); also the review *Guanabara*, founded and edited by him in conjunction with Aranjo Porto-Alegre and MANOEL DE MACEDO (*q. v.*). A. R. MARSH.

**Goncourt**, gōn'koor': the name of two brothers—EDMOND LOUIS ANTOINE HUOT DE GONCOURT, b. at Nancy, May 26, 1822, and JULES ALFRED HUOT DE GONCOURT, b. in Paris, Dec. 17, 1830, sons of Jean Antoine Huot de Goncourt, deputy to the National Assembly of 1789; celebrated as joint authors of a number of brilliant writings—historical and critical essays, novels, dramas, all belonging to the realistic school. Conspicuous among those works are *Histoire de la société française pendant la Révolution, et sous le Directoire* (1854–55, 2 vols.; 3d ed. 1865); *Portraits intimes du XVIII. siècle* (1856–58, 2 vols.; new ed. 1878); *Histoire de Marie-Antoinette* (1858: numerous editions); *Les Maîtresses de Louis XV.* (1860, 2 vols.; reissued in three series with the titles *la Du Barry, la Pompadour, la Duchesse de Châteauroux et ses sœurs*, 1878–79); *L'Art du XVIII^e siècle* (1874, 2 vols.); the novels *Renée Mauperin* (1864); *Idées et Sensations* (1866); *Manette Salomon* (1867, 2 vols.); *Madame Gervaisais* (1869); the drama *Henriette Maréchal* (played in 1865); *Pages retrouvées* (1886); *Préfaces et manifestes littéraires* (1888); *Journal des Goncourt* (1st series, 3 vols., 1887–88; 2d series, by Edmond de Goncourt, 1890). After the death of Jules, which occurred at Auteuil, June 20, 1870, Edmond published among other works *l'Œuvre de Watteau* (1876); *l'Œuvre de Prud'hon* (1877); *La fille Eliza* (1878); *Les frères Zemganno* (1879); *La Maison d'un Artiste* (1881); *Chérie* (1884); *Madame Saint-Huberti, Mlle. Clairon* (1885, 1890); a drama, *La Patrie en danger* (1873), originally called *Mlle. de la Rochedragon* (played in 1888); and dramatized *Germinie Lacerteux*, a romance by the two brothers. This was put on the stage in 1887. See the *Lettres de Jules Goncourt* (1885). Edmond Louis died July 16, 1896.

**Gon'da** (*Gontha*, a cattlefold): a district of Fyzabad, Oudh, British India; between 26° 46′ and 27° 50′ N. lat. and 81° 35′ and 82° 48′ E. lon.; just S. of the Himalayas. Area, 2,881 sq. miles. It is traversed by the Gogra river, and is a vast alluvial plain dotted with lakes and groves of mango-trees. Rice, wheat, and barley are the chief products. Pop. 1,300,000, nearly all Hindus. The capital is Gonda, a town formerly celebrated for the manufacture of shields, now of little importance. Pop. 15,000. M. W. H.

**Gon'dar** (properly *Guendar*): city of Abyssinia; in lat. 12° 35′ N. and lon. 37° 31′ 57″ E.; on the ridge and slope of a southern spur of the Wogara Mountains, at an elevation of about 7,000 feet above the sea and 1,200 feet above Lake Tana (see map of Africa, ref. 4–G). In the beginning of the seventeenth century, under the government of the negus Fasilidas, whose name as king was Aslem-Seged, Gondar was made the capital, and is said to have had 50,000 inhabitants, while in the period between 1852 and 1862, as estimated by Th. von Heuglin, its population was 6,000 or 7,000 only. The city consists of several extensive quarters, separated from each other by barren commons and mounds of rubbish, but at a distance it presents from all sides an imposing and wonderful aspect, with its picturesque groups of trees, its churches with their high conical roofs, and its royal palace, built according to the Portuguese taste of the Middle Ages. The northernmost quarter of the city, called Abun-Bed, contains the residence of the patriarch (*abuna*), and is separated by a brook flowing westward from the politically free state, Etsege-Bed, where the higher clergy and the religious orders live. The quarter of Debra Birhan (the church of the light), with a church of the same name, extends to the S. and E.; and that of Gempsa-Bed (the palace-quarter) meets Etsege-Bed to the N. W. and Debra Birhan to the E. Here the royal palace, Gemp, arises among miserable huts thatched with straw, a high, towering castle, encircled with walls surmounted by towers and pinnacles. At some distance, and to the S. W. of Gempsa-Bed, the large market-place is situated; on the slope to the S. the Mohammedan quarter, Islam-Bed; and directly S. W. the Jewish suburb, Felasa-Bed. The streets are narrow and crooked, partly paved with basalt, but partly covered with dirt and rubbish. The finer dwellings are low circular houses of two stories, built of unhewn stones, cemented with lime. Gondar contains 44 churches, with 1,200 ecclesiasties.

**Gondoko'ro**, or **Ismailia**, ĕes-maă-eel'yaă: an African village; celebrated in the history of exploration; on the White Nile, near the parallel of 5° N. It was formerly a center of the ivory and slave trades. In 1846 a Roman Catholic mission station was placed there, but abandoned on account of a famine in 1859. The town itself is now all but abandoned. M. W. H.

**Gon'dola** [=Ital., dimin. of older *gonda*, gondola]: a boat about 30 feet long and 4 feet wide, used on the canals of Venice and in other parts of Italy. The Venetian gondolas have curved ends, which rise out of the water, the bow being ornamented with a serrated iron plate. The space in the center of the gondola is usually canopied and curtained to form a shelter for the occupants. The lavish ornamentation of gondolas in Venice led in the sixteenth century to the passing of laws forbidding distinctions of ornament and color, foreign ambassadors and the patriarch, if a cardinal, being excepted; hence black came to be the prevailing color for gondolas. The gondola is propelled by one or two rowers, who stand at their oars. In parts of the U. S. flat boats used for heavy merchandise are called gondolas (vulgarly pronounced *gundelo*).

**Gonds**: a non-Aryan or Dravidian race of Central India, whose name is seen in Gundwana, the principal district where they dwell. (See DRAVIDIAN LANGUAGES.) They are small, strong, hardy, and brave, totally distinct from the Hindus in language, religion, and habits; have no caste, except so far as they have adopted Hindu customs, for the Raj-Gonds are partly of Rajpoot descent, and have some elements of Hindu civilization, and some Gonds have attached themselves as pariahs to Hindu society. The Gonds number about 1,500,000.

**Gon'falon**, or **Gon'fanon** [for *gonfanon* < M. Eng. *gonfanon*, from O. Fr. *gonfanon* > *gonfalon*, from Mediæv. Lat. *gonfa'no*, banner, from O. H. Germ. *gundfano*, battle-flag; *gund*, battle + *fano* (> Mod. Germ. *Fahne*: Eng. *vane*), flag]: in mediæval Italy the banner or standard of a city, a

monastery, or a church. The bearer of this, and in some cases the chief magistrate of a town, was called a gonfalonier.

**Gong** [from Javanese *gōng*, gong]: an East Indian and Chinese instrument; a sort of cymbal, which emits a loud sound on percussion. A bronze with 78 parts of copper and 22 of tin (*Klaproth*) is a common material for gongs. It is stated that gongs are at first brittle, and have to be annealed and then hardened before use. A leather-covered wooden mallet is used for striking the gong.

**Góngora y Argote**, Luis, de: poet; b. in Cordova, Spain, July 11, 1561. He is the Spanish representative *par excellence* of that affected and labored style known in England as euphuism, in Italy and France as marinism, and in Spain as *culteranismo*, or, from this very poet, *gongorismo*. The details of his life are unimportant. At fifteen he was studying law at Salamanca, though he must also have been giving some time to the muses, for already in 1584 he was well known as a poet. In that year Cervantes devoted to him a *copla* of the versified catalogue of the poets of Spain, which he put into the mouth of Caliope, in his *Galatea* (*Galatea*, ed. 1784, ii., p. 284; *Bibl. de Aut. Españoles*, i., p. 88). Nevertheless, Góngora found fortune shy and hesitating, and was obliged to return to Cordova, where he lived some twenty years, poor and unappreciated. Finally, to insure his old age against want, he became a priest; and soon after, about 1605, he went to Valladolid, then the residence of the court, and entered upon the weary and disappointing life of a seeker for the favor of the great. He obtained the good-natured patronage of the Duke of Lerma and of the Marquis of Siete-Iglesias, and through them an honorary chaplaincy to Philip III. At last the great Count-Duke Olivares noticed him, and he seemed on the way to see his ambitions satisfied. But his health was already broken, and in 1627 he had to return to Cordova, to die on May 23. The poems of Góngora were not printed during his life, probably from motives of policy, though there exists in the library of Don Pascual de Gayangos in Madrid a magnificent manuscript of them in four volumes, corrected by the poet's own hand. In the year of his death (1627), however, they were published by his friend Juan Lopez de Vicuña, under the title *Obras en verso del Homero Español*, in Madrid, with a *Life* by his friend Hozes (1633, and again 1654); once more in Madrid, with commentary by García de Salcedo Coronel (3 vols., 1636–49). The most available modern edition is in the *Biblioteca de Antores Españoles* (t. xxxii., p. 425, *seq.*, Madrid, 1872). In this we find Góngora's poetical achievement to consist of 183 sonnets, numerous *canciones*, or odes (among them a fine one on the invincible Armada), 123 *romances*, or ballads, numerous epigrams and short pieces called *letrillas*, *décimas*, etc., and two or three short poetical pastorals. The earlier poems are remarkable for their simplicity and directness, but in the later Góngora, apparently of set purpose, in order to obtain public notice, adopted the intricate and difficult style of which mention has already been made. As a consequence few could understand him, and his admirers found it necessary to provide his works with commentaries far more extensive than the works themselves. Of these, the most elaborate was that of Coronel, named above; the most valuable that of José Pellicer, *Lecciones solemnes á las obras de Luis de Góngora* (Madrid, 1630). See Edward Churton, *Góngora, an Historical and Critical Essay, etc., with Translations* (2 vols., London, 1862).

A. R. Marsh.

**Goniati'tes** [Mod. Lat., deriv. of Gr. γωνία, angle]: a genus of fossil cephalopods of the family *Ammonitidæ*; characterized by the structure of the septa, which are lobed, but without lateral denticulations; they consequently exhibit a continuous undulating line. Some 150 species from Paleozoic strata are described. See Ammonoidea.

**Gonid'ia**: See Lichens.

**Goniom'eter** [from Gr. γωνία, angle + μέτρον, measure, measurer]: was originally the instrument for measuring all angles. Its use is now almost entirely restricted to those instruments used in measuring the angles of crystals. Goniometers are divided into two classes—goniometers of application and goniometers of reflection. The first consist of two strips of steel, which can be applied to the faces of the crystal. The second are constructed so as to make use of the reflection of an image seen successively in different faces of a crystal. The first application goniometer was invented by Caringeau in 1783. It was the one used by Haüy in his researches, and afterward received the name of "Haüy's goniometer." It is founded upon the principle that if any two straight lines cut each other, the opposite angles are equal. This instrument (Fig. 1), as Caringeau constructed it, is composed of a semicircle hinged at 90°, to

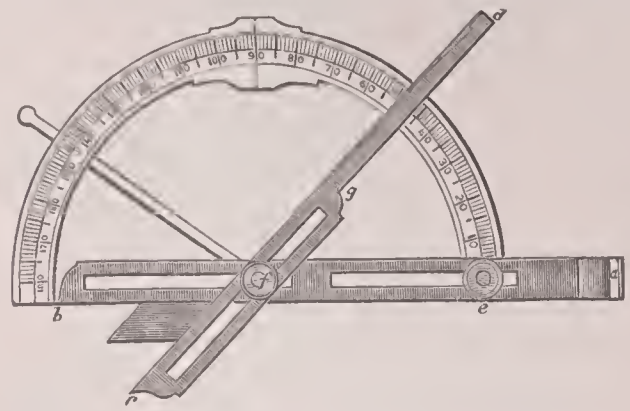



Fig. 1.—Caringeau's goniometer.

which two arms of steel are attached, which are applied directly to the angle to be measured. One of these has no movement of rotation, but moves horizontally on the pins *e* and *f*, its upper edge always remaining at zero. The other is movable on the pin *f*, and can be made to assume any angle with the horizontal arm. One of its edges is beveled to facilitate reading the angle. The arms can be lengthened or shortened at will. The operation of measurement consists in applying one end of the arms to the faces of the crystal, and reading the angle shown on the circle by the other. When the crystal is engaged in a gangue, and the extremity of the semicircle prevents the application of the arms, it can be turned back on its hinge. The instrument so arranged is heavy, and requires great skill in use. For this reason Brongniart detached the arms from the semicircle, so that they can be applied independently of it, and the instrument so construeted is called "Brongniart's goniometer," and is the modification in general use. This goniometer gives rapidly an approximation to the real angle when it is necessary to determine it within a degree. The defect of such an instrument is that it is impossible to verify whether it has been well adjusted. It requires great skill to place the plane of the arms perpendicular to the surface of the crystal and the edge parallel to it. Sometimes the nature of the crystal prevents it, as when the faces are rough or are unequally laminated. Generally the crystals to be measured are quite small, and the surfaces too small to obtain an exact measurement of the angle, so that any imperfection of manipulation is necessarily magnified. In most cases approximate measurements are sufficient both to recognize the nature of the mineral and to describe it. But when its physical properties are to be studied, these values are not sufficiently exact, and a reflecting goniometer must be used.

The idea of using the reflecting property of the faces of crystals for measuring angles was first suggested by Malus, but Dr. Wollaston first applied it. His goniometer was first called the reflecting goniometer, but afterward, when several based upon the same principle had been invented, "Wollaston's goniometer." It gives measurements within a few minutes; it can be used almost as easily as the application goniometer, and the errors which a skilled person is likely to commit are very much less. But it is necessary to its applicability that the faces of the crystal should be brilliant, and when that is the case their small size is no obstacle, as crystals can be measured which are only a millimeter square. An angle is measured with these instruments by causing the crystal to rotate around the edge of the angle, from a given position of one of the faces, until the other has taken the same position; a position determined by the coincidence of images observed in each of the two faces successively, the eye remaining fixed. The value of the rotation is measured upon a graduated circle placed perpendicularly to the edge of the crystal, which gives the complement of its angle.

Wollaston's goniometer (Fig. 2) will give within a minute the inclination of planes which are almost invisible. It is composed of a vertical graduated circle, divided upon its edge to half degrees. Through its center two arms are arranged, supported in a fixed upright. One of them carries the circle, and is made to turn both the circle and the crys-

tal-holder. This arm is hollow, and carries in its anterior another arm, which moves independently of the circle, and upon which the support for the crystal is placed, which consists of two arms with a joint which allows a rotation of

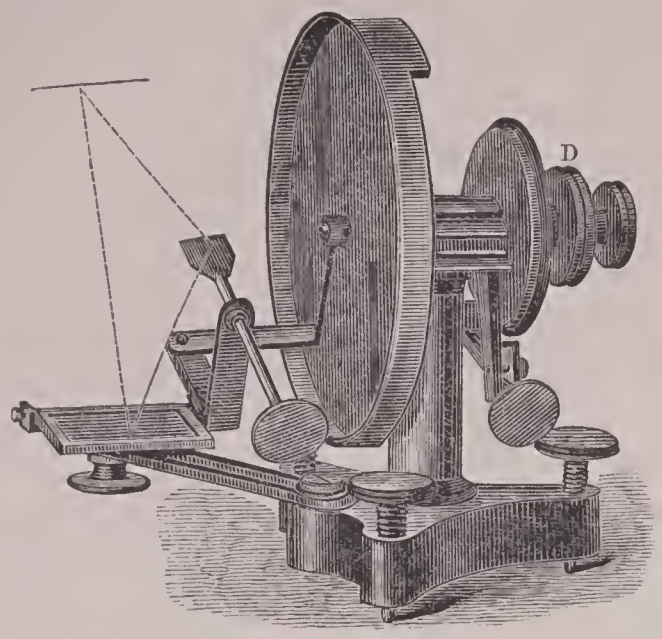



FIG. 2.—Wollaston's goniometer.

180°. The whole arm has a rotation of 360°. Through one end, at right angles to it, a piece of round steel is passed, which is slit to receive a plate of thin brass, on which the crystal is placed. Attached to the fixed support of the circle is a vernier.

The instrument is placed for use on a table 5 to 6 meters from an open window, so that two horizontal lines A B of some distant building may be seen, or two window-bars, or lines drawn for the purpose. The circle is made vertical. To facilitate this adjustment the foot of the instrument is provided with thumb-screws and small glass levels. The crystal is then fixed on its support with wax, so that one of the faces D C (Fig. 3) of the angle D C E, and their edge, is at right angles to the plane of the circle, and as near as possible in the prolongation of the axis of the instrument. The eye is now brought so near the crystal that the reflection of the lines A and B may be seen, and the image of the upper line is brought, by turning the crystal, to the lower line as seen directly, with which, by proper adjustment, it must be made to coincide. The crystal is then turned until the reflection of the image at A is seen in the second face C E, and a similar adjustment is made with this. The 0 of the circle and vernier are then brought

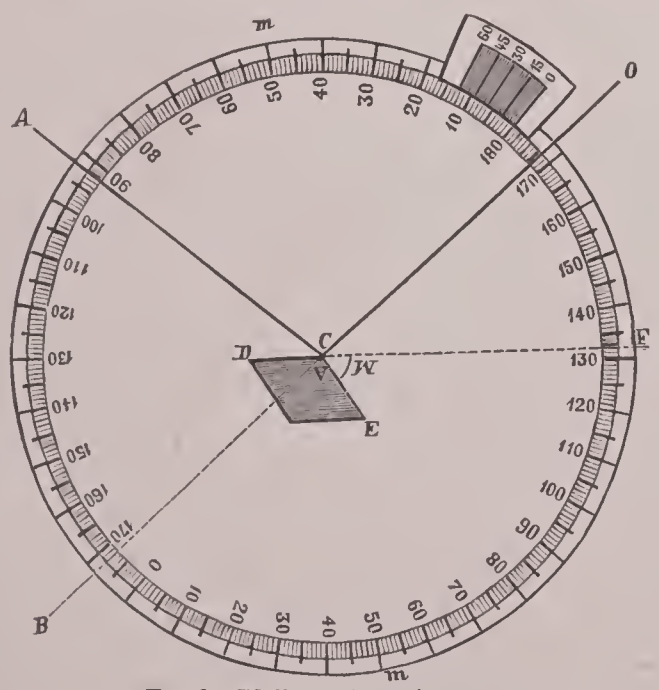



FIG. 3.—Wollaston's goniometer.

together by turning the large thumb-screw D (Fig. 2); when the circle is at zero the small thumb-screw is turned until the line is seen as before in the first face. The eye remaining fixed, the circle and crystal are turned together until a new coincidence is observed in the second face. The number of degrees and minutes which measure the rotation of the crystal is then read. It is essential that the eye should remain fixed—a condition which is easily fulfilled, since the faces of the crystal are usually very small, and it sometimes happens that they are not distinctly visible, although the reflected line is.

Dr. Kupfer published in Berlin in 1825 a treatise on the theory of Wollaston's goniometer, in which he details the possible causes of error attending its use. He shows that the conditions necessary for exact measurement are—(1) That the crystal must be small, and that its edge must be as near the axis as possible, and parallel to it, and if possible in its prolongation, or at least must have a very small eccentricity. (2) That the reflected lines shall both be as far as possible from the instrument, and at exactly the same distance from the crystal. As this can seldom be, the instrument must be so placed that the plane of the circle shall cut the reflected lines at right angles. (3) The axis of rotation of the circle must be in the plane which divides the angle to be measured into two equal parts. Thus the two normals of the faces start from a point of the axis, turn round their point of intersection, and are brought so that the two faces occupy successively the same position. If the axis is at a distance from the bisecting plane, the normals drawn from a point of this axis to the faces will be unequal, and one of the faces will not take the place of the other. It can only become parallel to it. The error which this may occasion will be less in proportion as the fixed lines are more distant, and by taking them far enough off may be practically eliminated.

By numerous repetitions made by turning back the crystal after each observation without turning back the circle, personal errors or the errors of graduation may be nearly or quite eliminated, and a result reached within a minute of the truth. When observations are repeated, though with great care and under the most favorable circumstances, variations in the readings are observed, which may attain the value of some minutes. It is only by taking the mean of many that it is possible to get the exact value of the angle.

As it is difficult to find two lines at exactly the same distance, most crystallographers choose only one, and have this reflected in a mirror attached to the foot of the instrument (see Fig. 2). This mirror reproduces the image of the upper line at the same distance below that the line itself is above, and with this the one reflected from the crystal is made to coincide. In this way the equality of the distances of the two lines with regard to the crystal is fulfilled. The cross-hairs of a telescope would answer equally well. The telescope has the advantage of giving very exact results, but it is difficult to use when the reflecting power of the crystal is small. Sometimes a single point, instead of a line, is taken, and its image, reflected, is made to coincide with the intersection of two cross-hairs of a telescope.

The principal mistakes which can arise in using Wollaston's goniometer are—(1) The errors of adjustment of the crystal, caused by the eccentricity of the edge. This may be eliminated by two readings, turning the instrument so that they are made alternately on the right and left hand. (2) Other errors arise from the imperfection of the instrument, both as to its divisions and its centering, and from the fact that the position of the observer is not absolutely fixed. These may be made exceedingly small by repeating the measurement.

*Mitscherlich's Goniometer.*—Mitscherlich has avoided the inconvenience of keeping the eye fixed by adding a telescope to the instrument. The graduation of the circle is so fine that readings can be made within 10 inches. The light falls on the vernier and on the graduations of the circle through a screen of oiled paper. The microscopes are fixed to a movable support, so that the whole line of the vernier can be overlooked. The hollow axis, as in Wollaston's goniometer, carries the circle. The inner solid axis carries the crystal and the apparatus for holding it. The instrument carries a telescope of very small magnifying power, with cross-hairs, which moves in a vertical plane on pivots. It has also a movement of rotation to the right and left on the rod which fits into the pillar. The pillar has a lateral motion by means of the slide upon which it rests. Mitscherlich recommended the use of an eye-piece and objective whose foci are about 33 mm., both of them alike or very nearly so. In order to eliminate parallactic errors the cross-hairs must be made to coincide with the reflected image seen through the objective. The adjustments must be such that the movement of the observing telescope shall be in a plane parallel

to that of the graduated circle. As, during observation, the movements of the hand are apt to be brusque, it is difficult to bring the image of the reflected line into perfect contact with the line seen directly. The support for the crystal

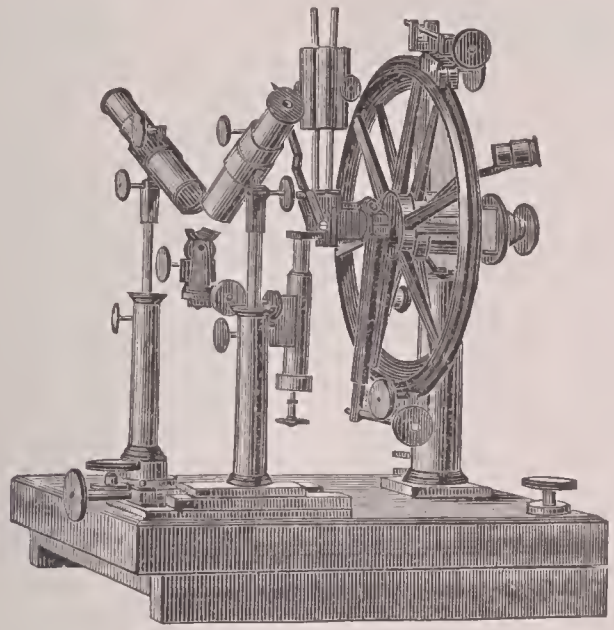


FIG. 4.—Mitscherlich's goniometer.

carries for this reason a number of adjusting screws, and a knife-edge which is in the exact prolongation of the axis, and so arranged that after the edge of the angle has been brought into contact with it, it can be turned back out of the way. The crystal is fixed with wax on the small plate. It can then be raised or lowered, or rotated to the right or left, or vertically and horizontally, by the adjusting screws.

In measuring with Mitscherlich's goniometer exactly the same conditions are to be fulfilled as in using Wollaston's. The telescope allows, however, of using a single point, which is made to coincide with the point of intersection of the cross-hairs of the telescope. The instrument as constructed by Mitscherlich had only a single telescope. Later, a second was added. The objective of the second teleseope is turned toward the crystal, and its cross-hairs serve as an object whose reflection is seen by the first. When it is used in a dark room the light of the sun is directed through a small aperture on to the eye-piece, or a light is placed before it, to illuminate the cross-hairs. When these are in the focus of the objective they answer the purpose of a line at an infinite distanee. The instrument is really only a perfected Wollaston goniometer.

*Mallard's Collimator.*—In making measurements with the ordinary Wollaston goniometer two errors are likely to oc-

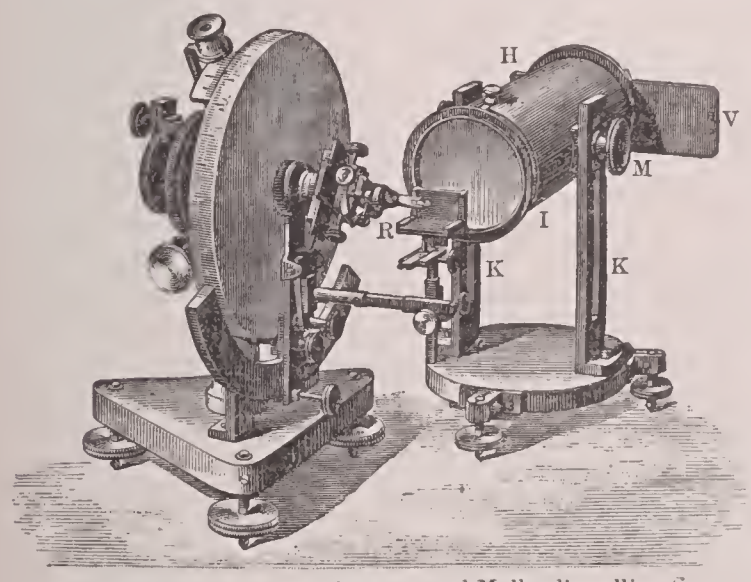



FIG. 5.—Wollaston's goniometer and Mallard's collimator.

cur. One of these arises from the changes which take place in the position of the eye during the measurements, and the other from the fact that the crystal is not placed exactly in the prolongation of the axis of the instrument, so that the angle to be measured is not exactly bisected by the plane of rotation. When telescopes are used, as in the Mitscherlich goniometer, the absorption of light by the lenses is such as at times to make the measurement impossible.

To obviate this inconvenience Mr. Mallard, of the School of Mines in Paris, has devised an instrument which he calls a collimator, whose object is to overcome these difficulties. The instrument is shown at Fig. 5, and consists of a tube, the interior of which is blackened, in one end of which there is a lens, I, fitted to slide in and out of the tube H, so as to allow of changing the foeal distance. At the other end a slide, J, moves in V grooves, and can be pushed in and out

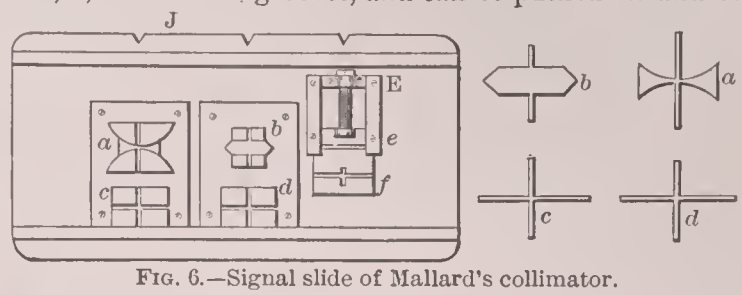



FIG. 6.—Signal slide of Mallard's collimator.

at will. This slide (Fig. 6) has five slots in it which serve as signals to be refleeted on the surfaee of the crystal. The sides of this slide are notched, so that whenever any of the openings are exactly opposite the center of the lens a catch worked by a spring falls into the notch and holds it in place. The tube with the lens and slide is supported on a base which has three leveling screws, and whieh carries two slotted uprights, K, in which the tube H ean be fixed to any desired height by means of thumb-screws, M. It therefore moves up and down in parallel planes. Generally the tube has no other motions, but a movement of rotation around the thumb-screws might be given to it. Behind the slide a gas-lamp is fixed, which serves to throw the reflection of the slots on to the lens. The lens ought to be at least 4 inches in diameter. It must be large enough to insure that a part of the central rays shall fall both on the crystal and on the mirror, R, carried on the axis of the instrument, which has a movement in three planes perpendieular to eaeh other, one of whieh is in the direction of the axis of the goniometer. Only the central part of the lens I, which throws the image on to the crystal, need be achromatic. The object reflected by the mirror is rendered achromatic by colored glasses which are placed before the mirror. The slots *a b c d* in the slide J are fixed, but the slide carries two other slots, *e* and *f*, which can be opened and closed at will by the thumb-screw E. Any one of these slots may be placed in such a position that the light from the gas-burner may be thrown to the center of the lens. When the image of the slot reflected on the crystal becomes superposed on the image seen by reflection in the mirror, the mirror and the face of the crystal are parallel. Great exactitude is not, however, arrived at when two images of the same slot are superposed. The slots *a* and *b* are ealled signals, and below them are other forms, *c* and *d*, which have a direction parallel to the others. The lower one does not give a good image on the crystal, but it does on the mirror, and as it is colored by the glass, by superposing these two, an exactitude up to 30 seconds is easily obtained. The faces of the crystal and of the mirror in this operation are no longer exactly parallel, but if the axis of the lens is nearly at right angles to the axis of the collimator, the error is very small. The mirror R may make an angle of 40 to 50 degrees, and is fixed, except for the small amount of movement necessary to place it, parallel to the axis of rotation. As the crystal to be measured may be of very variable dimensions, this mirror has three movements at right angles to each other, it remaining all the while parallel to itself. This is most easily accomplished by adapting it to the axis of the goniometer on the crystal support used by Dr. Groth in his goniometer. This method can also be used for the measurement of indices of refraction.

This collimator can be used with any reflecting goniometer, but it is of the greatest use when the goniometer is provided with a crystal carrier like that invented by Dr. Groth and shown in Figs. 5 and 8. It has two movements in planes at right angles to each other, and has two movements of rotation also at right angles, so that the crystal may be adjusted for the slightest errors of position.

*Babinet's Goniometer.*—Babinet's goniometer was invented to measure indices of refraction, but can be used quite as well for the measurement of angles. It is founded upon the same principles as that of Wollaston. The plane of the circle may be either horizontal, inclined, or vertical, the set screws on the top of the foot allowing of its being placed at any angle between the horizontal and the vertical.

The direction of the lines of reference is determined by the inclination of the circle. The circle carries two telescopes, and a movable arm with a vernier attached. Both telescopes are movable, but one of them is fixed at the commencement and the other during the observation. This last one carries a vernier. The lines to be reflected are cross-hairs at right angles to each other in the foci of the eye-pieces of the telescopes. One of these lines in the fixed telescope is parallel to the plane of the circle; the other, consequently, perpendicular. The telescope is focused for great distances. The light which is to illuminate the lines is placed beyond its eye-piece, at a distance greater than its focus. The light may be either that of the clouds or of a lamp. With this disposition all the light by which the lines are illuminated leaves the telescope through the objective in parallel rays, and a point or line is obtained which produces exactly the same effect as if it were really at an infinite distance. In the Wollaston goniometer we judge that the two faces of the angle are perpendicular to the plane of the circle when each of them shows reflected lines parallel to the real ones. The same is true in the Babinet goniometer, but here the image seen directly is the intersection of the lines of the movable telescope, and is only a point. The image observed by reflection on the crystal is the reflection of the horizontal line in the fixed telescope. If the face under observation is perpendicular to the circle, the image of the point will appear to move parallel to the horizontal line when the movable telescope is made to change its position. For further details as to the adjust-

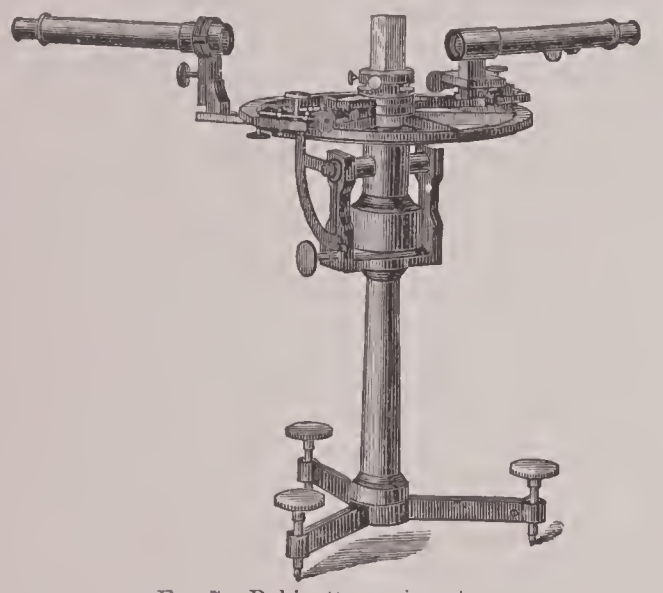


Fig. 7.—Babinet's goniometer.

ments and use of this instrument, the reader must consult systematic treatises on optical instruments or on mineralogy. It is convenient in use, but has the disadvantage of all instruments requiring the use of lenses, that the sharpness of the images is diminished, which renders its use impossible when the crystals are very small or their faces not very brilliant. It is therefore impossible for the mineralogist to do away with the Wollaston goniometer, which, having been arranged for almost microscopic crystals, is the one most applicable to general cases.

*Moh's Goniometer.*—Moh's goniometer has a horizontal circle, and is really a slight modification of Babinet's goniometer. It is used in the center of a room in which four perpendicular lines equally distant from the crystal, and at the same height, can be seen. Those usually selected are the bars of two windows upon different sides of a room. By turning the back to the two windows successively, the lines upon the opposite sides can be made to coincide. The methods of adjustment and verification are the same as those of Wollaston's goniometer. It sometimes carries a telescope with cross-hairs, when it requires only a single line.

*Groth's Goniometer.*—The latest and best form of Babinet's goniometer is shown in Fig. 8, and is due to Dr. Groth, of Munich. It is arranged with telescopes. One of these, D, has a lens, F, used for the finder, which can be thrown in and out of position when the crystal is adjusted. The other, C, which is fixed, is the infinite-distance telescope. The axis of the instrument carried four adjusting screws, similar to those described with Wollaston's goniometer. The instrument has several telescopes fitted with both C and D, four of which carry sights. It has also four eye-pieces or Nichols prisms, and a slit-collimator. The reading-glasses are provided with screens, so that the eye is but little fatigued by the readings. The telescope, the eye-pieces, and the graduated circle all move and may be combined or independent. The fine adjustment screws, A B, allow of great accuracy of

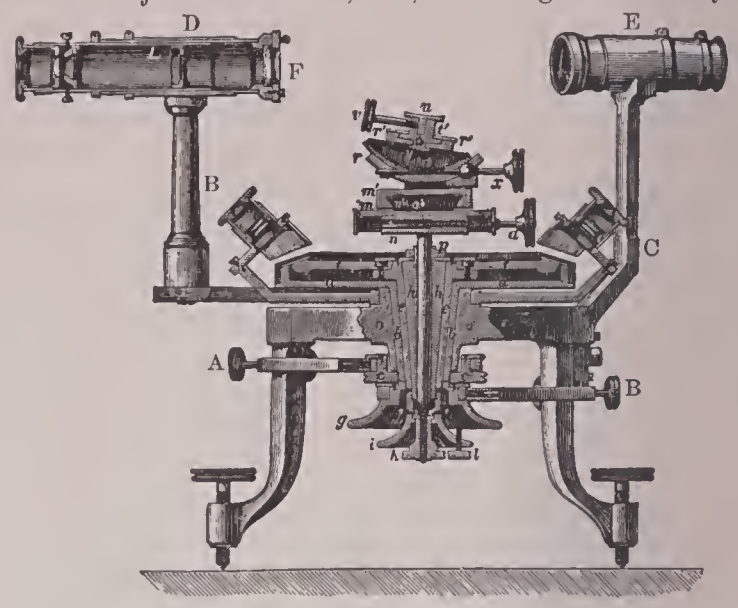



Fig. 8.—Groth's goniometer.

measurement. The angles of this goniometer can be read to seconds, but it is rare that the crystal faces are so perfect that this limit can be reached. Ordinarily they are read only to minutes. In all measurements it is best to use small crystals, as their faces generally are more perfect than larger ones. When there are variations of temperature or when the reading is continued for a considerable length of time, it has been noticed that there is a slight variation in the angles measured. These, however, are so very small that in ordinary measurements they are not taken into account. This instrument may also be used as a spectrometer.

Thomas Egleston.

**Gonorrhœ'a** [Gr. *γονόρροια*; *γονή*, or *γόνος*, semen + *ῥοιά*, flow, flowing, deriv. of *ῥέω*, flow]: acute catarrh of the urethra, a disease which is usually of venereal origin. It is a painful disease, and may result in the chronic catarrh called *gleet*, or may lead to stricture, epididymitis, enlarged prostate, and other serious evils. Its treatment should be intrusted only to practitioners of the highest character. See Stricture.

**Gonsal'vo de Cór'dova** (*Gonzalo Hernandez de Córdova y Aguilar*): Duke of St. Angelo and of Sessa; "the Great Captain"; b. at Montilla, Spain, 1453; became one of the brightest ornaments of the court of Ferdinand and Isabella; was distinguished in the Portuguese war of 1479 and the Moorish war in 1481–92; took command in Italy 1495; drove the French from Naples 1496; suppressed the Moorish rebellion 1500; commanded with success against the Turks 1500–01; was made lieutenant-general of Calabria and Apulia 1501; served against the French in Italy 1502–07; was besieged by Bayard and the Duc de Nemours at Barletta 1502–03, but destroyed the French army in the great battle of Cerignola, Apr., 1503; won the great victories on the Garigliano (Nov. 6, Dec. 28–29, 1503); soon after which Gaeta fell and the French gave up their claim upon Naples. He was viceroy in Italy until 1507; retired to his estates at Loxa, and there lived in great state, venerated by the people, but hated by the king, who was jealous of his fame. D. at Granada, Dec. 2, 1515.

**Gonzaga**, gon-zaa'găă: town of Italy; about 22 miles from Mantua (see map of Italy, ref. 3–D). It was formerly well fortified, and possessed a strong castle, the remains of which still exist, but is chiefly remarkable as the cradle of the Gonzaga family, who ruled Mantua from 1328 to 1707. Pop. 1,134.

**Gonzaga**: a famous Italian family, to which belonged the captaincy of Mantua 1328–1433; the marquisate of Mantua 1433–1530; the dukedom of the same city 1530–1708; the duchy of Guastalla 1539–1729; the duchy of Montferrat 1536–1707; and that of Nevers 1565–1659; other honors held at various periods by the heads or cadet lines of the house being the duchy of Solferino, the duchy of Rethel, the county of Torelli, the duchy of Sabbioncetta, the principality of Bozollo, the marquisate of Medola, etc. Many illustrious generals, statesmen, churchmen, and men of letters sprang from this stock. The most celebrated member of the whole fam-

ily was Giovanni Francesco II., 1466–1519, who in 1494 was appointed commander-in-chief of the united Italian army against Charles VIII. of France. On July 6, 1495, he gained a decisive victory in the battle of Fornovo, and took prisoner the bastard of Bourbon. Luigi, known as St. Aloysius (1568–91), entered the Society of Jesus in 1585, devoted his life to the care of the sick, and died at Rome during a plague. He was canonized in 1726. With Vincenzo II. the elder branch of the family became extinct in 1627. The younger branch continued to flourish until the death of Carlo IV. in 1708. He took part in the Spanish War of Succession, sided with France, and received a French garrison in Mantua. The consequence was that after the defeat of the French he was placed under the ban by the emperor, Joseph I. By the treaty of peace his lands were divided between Savoy, which obtained Montferrat, and Austria, which took Mantua.

**Gonzaga**, Thomaz Antonio: Brazilian poet; b. in Oporto, Portugal, Aug., 1744, of a Brazilian father, João Bernardo Gonzaga, at that time serving as councilor of the tribunal of Oporto. In 1759 the father went back to Brazil, as member of the supreme court of Bahia, and here Thomaz Antonio passed his youth. In 1763, however, he returned to Portugal to study at Coimbra, and in 1768 obtained his bachelor's degree there. Returning now to Brazil, he was made *ouvidor* (court councilor) at Villa Rica (now Ouro Preto), the capital of the province of Minas Geraes. Here he made the acquaintance of Manoel da Costa (*q. v.*) and other poets of the school of Minas, and also that of D. Maria Joaquina Dorothea de Seixas, with whom he was soon in love, and whom he celebrated under the name of Marilia, himself adopting the pastoral pseudonym Dirceu. As an official the poet gained rapidly in reputation for wisdom and justice; but when the plot of the Minas Geraes was unearthed in 1791, his connection with the chief conspirators caused him to be suspected of complicity, and he was arrested. In spite of his protestations of innocence and the slight evidence against him, he was condemned on Apr. 18, 1792, to perpetual banishment to the Pedras de Augoehe; but this penalty was reduced to ten years' exile to Mozambique. May 22, 1792, he parted from his home and his mistress, in such depression of mind that he practically lost his reason soon after his arrival in Mozambique. He finally married his nurse and lived a wretched life till 1809, when he died. As a poet he took Petrarch for his model, striving to make his Marilia rival Laura. His poems fall into three classes, the first containing those previous to his imprisonment, full of his love and of the charms of Marilia; the second, written in prison, devoted to his laments over his hard fate, but addressed also to his mistress; the third, consisting of poems not concerning her, and mainly written before he knew her. All have the charm of a gracious style, harmonious numbers, and delicate sentiment; and the *Marilia de Dirceu*, as the collection is called, has passed through many editions, both in Brazil and Portugal, being one of the most popular in the Portuguese tongue. Perhaps the best of these editions is that of Pereira da Silva (Rio de Janeiro, 1845), with a biography of the poet. A. R. Marsh.

**Gonzales**, gon-zaa'lez: city; capital of Gonzales co., Tex. (for location of county, see map of Texas, ref. 5–H); on the Guadalupe river at the mouth of the San Marcos, and on the San. Ant. and Aran. Pass and the S. Pacific Railways; 70 miles S. by E. of Austin. It is an agricultural and stock-raising region, and has important manufactures and large shipments of cotton. It contains several churches and graded public schools, water, gas, and electric-light plants, 2 banks, and 2 weekly newspapers. The city is popularly known as the Lexington of Texas. Pop. (1880) 1,581; (1890) 1,641; (1900) 4,297. Editor of "Inquirer."

**Gonzalez**, Manuel: general and statesman; b. near Matamoras, Mexico, about 1820. He joined the army in 1839, and as a guerrilla leader fought on the side of the reactionists in the civil wars; but when the allies invaded the country in 1861, he offered his sword to the liberal leader Juarez, and under him took part in all the campaigns until the fall of Mexico; his lifelong friendship with Porfirio Diaz dated from the siege of Puebla, where Gonzalez lost an arm. During the French occupation he held out with a small force in the mountains, finally joined Escobedo in 1865, was made brigadier-general, and was one of the leaders who entered the capital in June, 1867. Juarez appointed him governor of the palace; but his alliance with Diaz made him many enemies, and in 1871 he was accused by his opponents of being concerned in the disappearance of plate which had belonged to Maximilian. Imprisoned on this charge, he escaped and joined Diaz, whom he followed in the subsequent revolts against Juarez and Lerdo. When Diaz became president (1877) he made Gonzalez his Secretary of War, and subsequently supported his candidature to the presidency, to which he was elected. His term (Dec. 1, 1880, to Nov. 30, 1884) was peaceful, but Mexican credit was greatly disturbed by his unwise financial schemes. Subsequently he was governor of Guanajuato. D. at Mexico, May 8, 1893.

Herbert H. Smith.

**Gonzalez Vigil**, Francisco de Paula: scholar and statesman; b. at Tacna, Peru, Sept. 15, 1792. He studied at the Seminary of Arequipa; took orders in 1818, and was rector of a college at Arequipa. In 1825 he was elected deputy, retaining his seat through several successive Congresses; he led the opposition to Bolivar in 1826, and strongly condemned the irregularities of Gamarra in 1832. From 1836 until his death he was director of the national library at Lima, and most of his life was spent in literary work. He published numerous historical and controversial works, the most important being *Defénsa de la autoridád de los gobiernos y de los obíspos contra la cúria romána* (12 vols., 1848–56), for which he was excommunicated; and *Los Jesuítas* (4 vols., 1872). He is regarded as the greatest scholar yet produced by Peru. D. at Lima in 1876. Herbert H. Smith.

**Goober**: the peanut (*Arachis hypogæa*); known also as the earthnut, groundnut, pinda, pindar, pindal, pinder, and monkeynut. It is a much-branched leguminous plant, somewhat resembling clover in its foliage, but with quadrifoliate leaves, and small, yellow, single flowers. After blossoming, the little pods bend down and thrust themselves into the soil, where they grow into the well-known thick-shelled fruits. In cultivation the pods are covered with earth, thus insuring a larger crop. Goobers are natives of tropical America, but are now grown in many warm countries. In the Southern U. S. they constitute an important crop, especially in Virginia, and are planted and cared for much like Indian corn. When the pods are ripe, the plants are taken from the earth by pronged hoes, allowed to dry a couple of days, and afterward cured in sheds or stacks. The pods after removal are carefully cleaned, sorted, and sent to market. An oil is prepared by grinding, heating, and pressing the kernels, which yield over 20 per cent. of fixed, non-drying oil, useful as a lubricant, as soap-stock, and in woolen-factories. Its specific gravity is ·918. In lamps it is better than sperm oil, except in cold weather, when it thickens. When deodorized it is used for adulterating olive oil. Charles E. Bessey.

Goober, or peanut, reduced.

**Good**, James Isaac, D. D.: minister of the Reformed Church in the U. S.; b. in York, Pa., Dec. 31, 1850; graduated from Lafayette College (1872) and Union Theological Seminary (1875); pastor of Heidelberg Reformed church,

York, Pa., 1875–77; Philadelphia 1877–90; Calvary Reformed church, Reading, Pa., from 1890; acting Professor of Dogmatics, Ursinus Theological Seminary, 1890–93; Professor of Dogmatics and Pastoral Theology 1893. He has published *Origin of the Reformed Church of Germany* (Reading, 1887); *Rambles Round Reformed Lands* (Reading, 1889); originator and editor of *Reformed Church Magazine* (1893). WILLIS J. BEECHER.

**Good**, JOHN MASON, M. D.: b. at Epping, England, May 25, 1764; was apprenticed to a surgeon of Gosport; began surgical practice at Sudbury in 1784, in London 1793; received the medical degree from Aberdeen 1820. Dr. Good was an able and successful practitioner and an accomplished linguist and literary critic. He compiled and edited the "Junius" letters, and among his numerous works are the poem *Triumph of Britain* (1803); translations of Canticles (1803); Job (1812); Lucretius's *De Natura Rerum* (1805–07); besides a translation of the *Basia* of Johannes Secundus, made in his youth, and *The Book of Nature* (1826). He aided Dr. Olinthus Gregory and Newton Bosworth in preparing a *Pantalogia or Encyclopædia, comprising a General Dictionary of Arts, Sciences, and General Literature* (completed in 1813). His chief professional works were *Diseases of Prisons*, etc. (1785); a *History of Medicine*, etc. (1795); *System of Nosology* (1817); *The Study of Medicine* (4 vols., 1822). D. at Shepperton, Middlesex, Jan. 2, 1827. See his *Life* by Olinthus Gregory (1828).

**Goodale**, ELAINE and DORA READ: sister poets, remarkable for their precocity; b. respectively Oct. 9, 1863, and Oct. 29, 1866, at Sky Farm, Mt. Washington, Mass. Their verses were published together as *Apple Blossoms: Verses of Two Children* (1878). This volume was succeeded by others, including *In Berkshire with the Wild Flowers* (1879) and *Verses from Sky Farm* (1880). Elaine published separately *The Journal of a Farmer's Daughter* (1881). Elaine has devoted herself to Indian education at Hampton, Va., and in South Dakota. In 1891 she married C. A. Eastman, M. D. Dora has devoted herself to the study of art at Northampton, Mass. HENRY A. BEERS.

**Goodale**, GEORGE LINCOLN, M. D.: botanist; b. at Saco, Me., Aug. 3, 1839; graduated at Amherst College in 1860 and at the Harvard Medical School in 1863; practiced medicine in Portland, Me., and was a lecturer on Anatomy in the medical school of that city until 1869; lecturer on Materia Medica in the medical school of Maine, and Professor of Natural Sciences in Bowdoin College until 1871. In 1872 he became instructor in Botany in Harvard University; in 1878 was made Professor of Botany, and in 1879 director of the botanic garden. Author of *Physiological Botany* (1885); *Useful Plants of the Future* (1891).

**Goode**, GEORGE BROWN, LL. D.: ichthyologist; b. in New Albany, Ind., Feb. 13, 1851; graduated in 1870 at Wesleyan University, and was curator of the museum there from 1871 to 1877, when he became one of the curators of the U. S. National Museum in Washington, D. C. In 1881 became assistant director of that institution, and in 1888 was appointed assistant secretary of the Smithsonian Institution. He attained great eminence as an ichthyologist, and published many monographs on fishes, and many descriptions of new species, chiefly in connection with Dr. Tarleton H. Bean. In 1876 he was director of the Natural History division of the Centennial Exposition at Philadelphia; was U. S. commissioner to the International Fishery Exhibition held in Berlin, Germany, in 1880, and to the Fisheries Exhibition at South Kensington, London, in 1883; and was statistical expert in connection with Halifax fisheries commission in 1877. He was the author of *The Game Fishes of the United States* (New York, 1879); *History of the American Menhaden* (1880); *Natural History of the Useful Aquatic Animals of the United States*; *Material for a History of the Sword-fishes* (1882); *The Fishery Industries of the United States* (London, 1883); *Beginnings of Natural History in America* (1886); *Britains, Saxons, and Virginians* (1887); and other works. D. near Washington, D. C., Sept. 6, 1896.

**Goodell'**, WILLIAM, D. D.: missionary; b. at Templeton, Mass., Feb. 14, 1792; graduated at Dartmouth in 1817, and at Andover Seminary 1820; labored for the American Board as a collecting agent, and in 1822 went to Syria as a missionary, having (1822) been ordained to the Congregational ministry; labored (1823–28) at Beyrut, Syria, then at Malta, and (1831–65) at Constantinople; returned in 1865 to the U. S. His great work was the careful superintendence of the translation of the entire Bible into Armeno-Turkish, made by an Armenian bishop, and a scholarly Greek revised edition (1863). See *Memoirs* of him by his son-in-law, Rev. E. D. G. Prime (New York, 1876). D. at Philadelphia, Feb. 18, 1867. Revised by S. M. JACKSON.

**Goodell**, WILLIAM, M. D.: gynæcologist; b. in the island of Malta, Oct. 17, 1829; graduated at Williams College in 1851 and at Jefferson Medical College in 1854. For several years he practiced his profession in Constantinople, Turkey, and afterward in West Chester, Pa. In 1865 he was appointed physician in charge of the Preston Retreat, Philadelphia. In 1874 he was elected president of the Obstetrical Society of Philadelphia, and in 1875 president of the Philadelphia County Medical Society. Professor of Gynæcology, medical department, University of Pennsylvania, since 1874. Author of numerous professional papers.

**Good Friday**: the Friday before Easter Sunday, celebrated by many Christian churches as a fast in commemoration of the passion and death of our Lord. It is preceded by Holy Thursday and followed by Holy Saturday.

**Good Hope, Cape of**: See CAPE OF GOOD HOPE.

**Goodland**: city (laid out 1887, incorporated 1888); capital of Sherman co., Kan. (for location of county, see map of Kansas, ref. 4–A); on the Chi., Rock Is. and Pacific Railway; 180 miles E. of Denver. It is in an agricultural and stock-raising region; contains large railway machine-shops and two grist-mills, and has four churches, Clark Academy (Presbyterian), school-house that cost $12,000, opera-house, water-works, and two weekly newspapers. Pop. (1890) 1,027; (1900) 1,059. EDITOR OF "NEWS."

**Goodrich**, CHARLES AUGUSTUS: author; brother of Samuel Griswold Goodrich; b. at Ridgefield, Conn., 1790; graduated at Yale 1812; pastor of the First Congregational church, Worcester, Mass., 1816–20; in Berlin, Conn., 1820–48; and afterward in Hartford 1848. Chiefly known by his books: *History of the United States* (Boston, 1852–55, rev. ed. 1867); *Lives of the Signers* (Hartford, 1829; 2d ed. New York, 1836); *Universal Traveler, Geography, Family Encyclopædia*, and others. D. at Hartford, Conn., Jan. 4, 1862.

**Goodrich**, CHAUNCEY ALLEN, D. D.: lexicographer; b. at New Haven, Conn., Oct. 23, 1790; graduated at Yale in 1810; was college tutor 1812–14; pastor of a Congregational church at Middletown, Conn., 1816–17; Professor of Rhetoric at Yale College 1817–39; became in 1839 Professor of the Pastoral Charge in Yale Divinity School. Published a Greek grammar (1814) and Latin and Greek lessons (1832); *British Eloquence* (1852); was editor of *The Quarterly Spectator* (1829–38); was largely engaged from 1828 till his death upon the dictionaries of Noah Webster, his father-in-law. D. at New Haven, Feb. 25, 1860.

**Goodrich**, SAMUEL GRISWOLD: "Peter Parley"; a brother of Dr. Charles Augustus Goodrich; b. at Ridgefield, Conn., Aug. 19, 1793; became in 1824 a book-publisher in Hartford, Conn.; removed to Boston, Mass., and edited 1828–42 *The Token*, to which Hawthorne contributed some of his "Twice-told Tales"; and 1841–54 *Merry's Museum*; wrote, edited, and compiled 170 volumes, of which 116 bear the name of "Peter Parley"; was consul in Paris during President Fillmore's administration 1851–55; and published in 1852, in French, *Les États Unis, aperçu statistique, historique, géographique, industriel et social*. His works are histories, geographies, and tales, mostly for children, besides *Recollections of a Lifetime* (New York, 1857); *Sow Well and Reap Well; or, Fireside Education* (1838); *Sketches from a Student's Window* (1841); *A History of All Nations, from the Earliest Period to the Present Time* (1849); *The Outcast and other Poems* (New York, 1836), of which an illustrated edition appeared 1851; *Illustrated Natural History of the Animal Kingdom* (2 vols., New York, 1859). D. in New York, May 9, 1860.

**Goods and Chattels**: comprehensively every variety of personal property, as distinguished from real estate, which is often referred to by the phrase *lands and tenements*. The expression *goods and chattels* is, in fact, tautological, since the single word "chattels" denotes everything indicated by both terms; but as a consequence of long usage it is generally employed in legal instruments in preference to either word by itself. The term "goods" has the narrower meaning, since it has no application to such forms of personal property as estates for years in land, which are known as chattels real, nor is "goods" generally considered to include animals; and by some writers it is still further restricted in

signification, since it is by them held to apply not even to all inanimate movables, but rather to articles of merchandise. This, however, is not the general legal acceptation of the word, and the restricted meaning usually arises from the circumstances of its use, or the words with which it is coupled. In criminal statutes and indictments the phrase "goods and chattels" is employed generally with a narrower extent of signification from that which it possesses in deeds and wills, and is held not to include choses in action, as promissory notes, mortgage deeds, etc., nor, according to some authorities, anything which circulates as money. But with this exception it would embrace everything of a personal nature. See PROPERTY and CHATTELS.

Revised by F. STURGES ALLEN.

**Goodsell**, DANIEL AYRES, D. D.: a bishop of the Methodist Episcopal Church; b. at Newburg, Orange co., N. Y., Nov. 5, 1840; educated at the University of New York City, completing the course of study there in 1859; joined the New York East conference the same year, and labored in the pastorate until 1887. He was a delegate to the general conferences of 1876, 1880, 1884, and 1888. He was elected editor of *Zion's Herald* in the spring of 1887, and accepted the position with the understanding that his new duties would begin Jan. 1, 1888. A demand for his services as secretary of the board of education having been made, he was released from his prospective editorial work, and began his secretaryship July 1, 1887. He was elected bishop in 1888, and made Fort Worth, Tex., his place of residence, removing to San Francisco in 1892. He has been a frequent contributor to religious periodical literature.

ALBERT OSBORN.

**Goodsir**, JOHN: anatomist; b. at Anstruther, Scotland, in Mar., 1814; educated at the University of St. Andrews and the College of Surgeons in Edinburgh, and for a short time afterward practiced in his native town. Returning to Edinburgh about 1840 he was appointed conservator of the museum of the Royal College of Surgeons, where he pursued a course of original investigation into the structure of the tissues. In 1842 he published a memoir on secreting structures, and in the following year made an important contribution to the knowledge of the structure of the human placenta. He also wrote some valuable papers containing the results of his studies in comparative anatomy and zoölogy. In 1846 he was appointed Professor of Anatomy in the University of Edinburgh. D. at Wardie, near Edinburgh, Mar. 6, 1867.

**Goodson**, Va.: See BRISTOL, Tenn. and Va.

**Good-will**: the advantage which a business establishment engaged in a particular kind of trade or existing in a particular locality, possesses, on account of the natural tendency of former customers to continue their dealings there. The probability is that former customers will continue to seek an accustomed place to make their purchases, and to deal under methods with which they are familiar; and from this circumstance the value of the business there established may be much enhanced. The good-will of a trade therefore constitutes a valuable right of property, intangible it is true, and depending largely upon mere expectancy, but capable of having its worth determined, at least approximately, upon the theory of probabilities. It is consequently often made the subject of bargain and sale, its value being usually estimated at so many years' purchase upon the amount of the profits of the business. But unless there be some specific agreement to the contrary the sale of the good-will of a business does not prevent the vendor from carrying on a precisely similar trade in the immediate vicinity, so long as he does not profess to continue the identical business sold. Great injury may thus be done to the purchaser by the detraction of custom, and all his expectations may be unrealized; but a contingency of this nature can be guarded against by previous arrangement. When a shop or store is conveyed to another, and no reference is made to the good-will of the trade, it nevertheless vests in the purchaser as accessory to the interest thereby acquired in the premises. Questions concerning good-will frequently arise in relation to partnerships. In adjudicating upon the opposing rights and mutual claims of partners when one or more separate from the others, or a controversy arises as to their respective interests, courts of equity will generally take into consideration the value of the good-will. If one of the partners dies it is now settled that the good-will of the business does not survive exclusively for the advantage of the remaining partner or partners, but that the estate of the deceased participates in its value. If the partnership assets be sold and the proceeds divided, each partner must be allowed his proportionate share in the price which was received for the good-will, as well as for the more tangible articles of property. The doctrines of good-will are frequently connected with a right to the name under which the business has been carried on, and a class of legal questions comes into consideration closely analogous to those presented in the law of trade-marks. See TRADE-MARKS.

Revised by F. STURGES ALLEN.

**Goodwin**, DANIEL RAYNES, D. D., LL. D.: educator; b. at North Berwick, Me., Apr. 12, 1811; graduated at Bowdoin College in 1832; was for a year in Andover Theological Seminary; became a deacon July 13, 1847; was ordained priest Sept. 10, 1848; was tutor in 1835 and Professor of Modern Languages in Bowdoin College 1835–53; president of Trinity College, Hartford, Conn., 1853–60; provost of the University of Pennsylvania 1860–68; in 1862 was Professor of Apologetics: and in 1865 became Professor of Systematic Divinity in the Divinity School of the Protestant Episcopal Church, Philadelphia, which position he held until his death. Besides numerous learned review articles, he published *Notes on the late Revision of the New Testament Version* (New York, 1883). D. in Philadelphia, Mar. 15, 1890.

Revised by W. S. PERRY.

**Goodwin**, WILLIAM WATSON: Greek scholar; b. in Concord, Mass., May 9, 1831; graduated at Harvard in 1851, and continued his studies at Bonn, Berlin, and Göttingen, where he took his doctor's degree in 1855. He was a tutor at Harvard from 1856 till 1860, when he was appointed Eliot Professor of Greek. (Resigned in 1901.) He received the degree of LL. D. from Cambridge (England) in 1883 and from Oxford in 1892. Author of a *Greek Grammar* and a celebrated work on *Greek Moods and Tenses* (3d ed., enlarged and rewritten, 1890); revised a translation of *Plutarch's Morals* (5 vols., 1871; 6th ed. 1889).

ALFRED GUDEMAN.

**Goodwin Sands**: a range of very dangerous sand-banks in the Strait of Dover; 10 miles long and 5½ miles distant from the eastern coast of Kent, and divided by an inlet called Trinity Bay into the North Goodwin and South Goodwin. The lighthouses of the North and South Foreland and lightships stationed on the shoals guide passing ships, yet wrecks often occur here.

**Goole**: harbor-town of England, in Yorkshire (West Riding); on the Ouse, just above its mouth (see map of England, ref. 7–I). Its trade is important, the shipping interests being very considerable. Pop. (1891) 15,413.

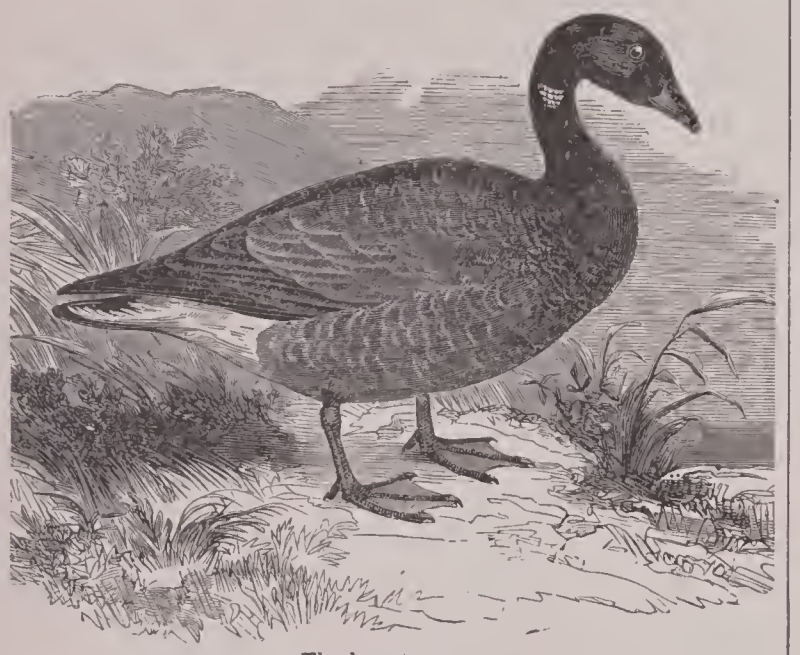
**Goor'khas**, or **Gurkhas**: the race who, with the Newars, occupy the dominant place in Nepaul. They are Mongols by blood, small in stature, full of courage, and were very faithful to the British in the Sepoy war of 1857–58; but they are not physically strong. In religion they are Hindus.

**Goosan'der** [formed artificially; *goose* + *gander*. See GOOSE and GANDER]: the large European merganser (*Merganser merganser*); also the very closely related American bird (*M. americanus*). See MERGANSER.

**Goose** [M. Eng. *gos* < O. Eng. *gōs*: O. H. Germ. *gans* (> Mod. Germ. *Gans*): Icel. *gās* < Teut. *gans-* < Indo-Eur. *ghans-* > Sanskr. *hansa-*: Gr. χήν: Lat. (*h*)*ans-er*: O. Bulg. *gąsĭ*: Lith. *żąsis*, goose]: the common name for a number of birds of the duck family (*Anatidæ*), forming the subfamily *Anserinæ*, whose most obvious characteristic is a short and strong bill, rather high at the base. The little tooth-like projections, or lamellæ, of the bill are very small. Geese are smaller than swans, with much shorter necks, and have a peculiarity in the arrangement of the feathers of the neck, these being narrow and disposed in oblique rows, this part of the plumage looking as if it had been dressed with a coarse comb. The legs are placed farther forward than in ducks, so that the geese are better fitted for walking and for a life on land. While some species are fish-eaters and unpalatable, many feed upon grass and are savory. The domesticated goose has been derived from the wild gray goose, or gray lag (*Anser cinereus*), although some of the larger breeds are probably descendants of the great Asiatic goose *Cygnopsis cygnoides*. The gray goose has a wide distribution, being found throughout Europe and the greater part of Northern Asia. The domestication of this bird must have taken place at an early date, for it is figured on ancient Egyptian monuments, but, in comparison with other domesticated animals, it has varied comparatively little. The domesticated goose is much larger than the wild bird, the plu-

mage is paler and more or less marked with white or completely white, but the general form has scarcely changed. The Romans paid much attention to the raising and fattening of geese, their feathers were in great demand, and great "herds" of the birds were imported from Gaul, being slowly driven for great distances. Geese are widely distributed throughout Europe, Asia, and America; in Northern Africa they are replaced by related birds of the family *Plectropteridæ*, which have larger legs and a spur on the bend of the wing. The New World has the greatest number of species, Asia the largest forms. The smallest, which are little larger than a teal, belong to the genus *Nettapus*, and are found in South Africa, Madagascar, India, and Australia. They are the most aquatic of all geese in their habits, and Jerdon, speaking of the Indian species, considers it probable that it never alights on the land. Several small forms of the genus *Chloëphaga* are peculiar to Southern South America, one, *C. melanoptera*, inhabiting the Andes of Bolivia and Peru, descending to the plains in winter, but in summer ranging upward to an altitude of 14,000 feet.

To the geese belong the Canada goose and its smaller relatives of the genus *Branta*, the European white-fronted goose (*Anser albifrons*), occasionally found in Greenland, and its North American ally, *A. gambeli*, the snow-goose, and related forms of the genus *Chen*.



The brent goose.

The emperor-goose (*Philacte canagica*) is a rare and handsome species limited to Northwestern Alaska and Northeastern Siberia. It is bluish gray with waves of darker color and crescent-shaped markings of black. The head and back of the neck are yellowish, throat black, and tail white. Owing to its diet of fish the flesh of this goose is unsavory.

The Australian *Cereopsis*, which has a short, curved, pointed beak with a green core, is, by some ornithologists, placed in a separate family near the extinct *Cnemiornis*. See Barnacle-goose, Canada Goose, Snow-goose, and Spur-winged Goose. F. A. Lucas.

**Goose Barnacle**: See Cirripedia.

**Gooseberry** [either *goose* + *berry*, or more prob. changed by analogy with *goose* from *groseberry* or *groiseberry*, from O. Fr. *groisele*, currant, gooseberry (> Fr. *groseille*), Span. *grosella*, from Germ. *Kräusel(beere)*, gooseberry, deriv. of *kraus*, crisp. Another explanation is from *gorse*, furze, bramble, but this is improbable]: the common name of those shrubs (and their fruit) which belong to the section Grossularia of the genus *Ribes* (family *Saxifragaceæ*), distinguished from the currants by the presence of thorns and bristly prickles on the stalk, and especially near the bases of the leaf-stalks; while in most the flower-stalks have only from one to three flowers each, though in some species the flowers are in racemes, like those of the currants. Some gooseberries have also prickly fruit, which currants never have, though a few species of currants have hairy fruit. Thus the distinction between gooseberries and currants is not strongly marked. North America has a number of wild species. Of these, *R. gracile*, with beautiful white flowers, is cultivated for ornamental purposes, and is worthy of attention for its fruit. Of other species, *R. oxyacanthoides* is the parent of the Houghton and other cultivated varieties; and several of the Pacific coast species have attracted some, though insufficient, attention as fruit-bearers. The Old World has also a number of species, some of them common also to the continent of North America. The English gooseberries are principally assignable to *R. uva-crispa*, an Old World species, of which some 150 varieties have been named. In Europe, and particularly in Great Britain, great attention is paid to their culture, and some of the sorts bear fruit of surprising size and excellence. The fruit is used when unripe for making tarts and pies, and when ripe is a good dessert fruit, and is also made into jams and preserves. A pleasant drink called gooseberry wine is also produced from it, and gooseberry vinegar is prized. European gooseberries almost uniformly fail in the U. S. from mildew, but native varieties, which are almost exclusively grown, suffer little from it. The mildew can be kept in check by spraying thoroughly, as soon as the leaves unfold, with half an ounce of potassium sulphide in a gallon of water. The leading North American gooseberries are Downing, Pale Red, Houghton, and Smith. They thrive best upon a cool loam which does not suffer from drouth. The plants are set about 4 or 5 feet apart. The gooseberry or currant worm is very troublesome, but it is easily kept in check by a dusting or spraying with white hellebore, or by Paris green, either before the fruit sets or after it is harvested. Revised by L. H. Bailey.

**Goose-feathers**: See Feathers.

**Goosefish**: See Angler.

**Go'pher** [from Amer. Fr. *gauphre*, gopher, a special use of Fr. *gaufre*, honeycomb (the reference being to the burrowing habits of the gopher) < O. Fr. *gaufre*, from Dutch *wafel*, honeycomb, kind of cake (whence Eng. *waffle*)]: the vernacular designation of certain burrowing animals. The name is specifically restricted in different parts of the U. S.: thus in the extreme Southern States it is used for the land-tortoises (*Testudo*, *Xerobates*, or *Gopherus carolinus* and *berlandieri*) which are peculiar to them, but in Georgia it is applied to a colubroid snake. In the Western States it is given to certain rodents, chiefly those of the family *Geomyidæ* and genera *Geomys* and *Thomomys*, but also (at least in some parts of Illinois and Wisconsin) to species of the genus *Spermophilus*. On the other hand, in the Southern States the species of *Geomyidæ* are termed salamanders (a name originally given to certain batrachians), although other names are conferred, as "hamster," "pouched rat," "muloes," etc. For further information, see Prairie-squirrel and Tortoise.

**Gopher-wood**: See Cypress.

**Gorakhpur'**: a city and district of Benares, Northwestern Provinces, British India. The district is between 26° 50′ and 27° 29′ N. lat., and 83° 7′ and 84° 29′ E. lon., between Nepaul and the Gogra river. Area, 4,598 sq. miles. The population is 2,750,000, and is rapidly increasing; 90 per cent. are Hindus. The chief products are cotton and foodstuffs. The climate is not unwholesome, but relaxing, and the forest-area is subject to malaria. Gautama Bûddha, the founder of the Bûddhist religion, died within the limits of this district. The capital is Gorakhpur, on the Rapti river, nearly in the center of the district (see map of N. India, ref. 6–G). Pop. (1891) 64,860.

**Go'ral** [the East Indian name]: the *Nemorhedus goral*, a small antelope of Nepaul, inhabiting rocky heights and lofty table-lands. It is also called the Nepaul bouquetin, and is hunted for its excellent flesh. An allied species, *N. crispus*, occurs in Japan.

**Gordian Knot**: See Gordius.

**Gordia'nus Africa'nus**, Marcus Antonius: known as the elder Gordian; a Roman emperor; a descendant of the Gracchi and Trajan; b. 158 A. D.; was consul 213 and 231; proconsul in Africa 232; and when eighty years old was invested with the purple at Tisdrus, without his consent, in place of Maximinus, but in less than two months was compelled by the victories of Capellianus to commit suicide (238 A. D.). He was a man of venerable character, and his death caused widespread grief.—His son, Marcus Antonius Gordianus (b. 192), was declared Augustus jointly with his father, and fell in battle just before his father's death. He was a man of loose morality, but was a popular favorite, an able magistrate, and the author of writings in prose and verse, none of which are extant.

**Gordianus**, Marcus Antonius: a grandson of the elder Gordian; b. about 226; was declared emperor in 238 after the death of Balbinus and Pupienus; set out for the East (242), where he won important advantages over the Persians and others, but in consequence of the machinations of Philip the Arab he was murdered by his own soldiers in Mesopotamia in 244 A. D. The younger Gordian was highly popular throughout the empire, and possessed many engaging qualities.

**Gor'dius** (in Gr. Γόρδιος): a common peasant who became King of Phrygia in this way: As he was plowing, an eagle alighted upon the yoke of his oxen. A soothsaying maiden of Telmissus declared this to be an omen of his elevation to royal power. Afterward, when the state was in political trouble, the messengers who were sent to consult the oracle were directed to proclaim as King of Phrygia the first man they should meet seated in a wagon as they were on their way to the temple of Zeus. Gordius was the man. He was duly installed as king, and became the founder of the city of Gordium and of a dynasty of powerful kings, whose fortified city, rock-cut tombs, and altars may be seen to this day. Gordius was a favorite of Cybele, the great goddess of Asia, who condescended to him and bore him a son, Midas (*q. v.*). Gordius dedicated the wagon in which he was riding when he met the Phrygian ambassadors to Zeus Basileus (the king), in whose temple in Gordium it was thereafter kept. The oracle declared that he who was able to untie the knot (Gordian knot) by which the yoke was tied to the tongue of the wagon should be master of all Asia. In 333 B. C. Alexander tried to untie the knot, and failing to do so, cut it with his sword. The site of Gordium has not been located with certainty. In 190 B. C. the Roman consul Manlius encamped on the right bank of the Sangarius opposite Pessinus, and received an embassy from the city, which he did not enter. On the next day Manlius encamped at Gordium, which therefore was a day's march from Pessinus, though just in which direction is not quite certain. Ramsay and Sterrett searched the country in 1883 for epigraphical or other evidence as to the site, but in vain. Ramsay, *Historical Geography of Asia Minor*, pp. 16 and 225 (London, 1890), locates it by conjecture at Yürme, and Hermann-Puchstein, *Reisen in Kleinasien und Nordsyrien*, pp. 33 and 36 (Berlin, 1890), at Tchakmak. For a discussion of the story of Gordius, see Rühl, *Die Sage von Gordios* in the *Zeitschrift für die Oesterreichischen Gymnasien*, 33, Heft 11; Preller, *Griechische Mythologie*, i., 532.

J. R. S. Sterrett.

**Gordius** [Mod. Lat., from Lat. *Gordius* (*nodus*), Gordian knot]: a genus of nematode worms, deriving its name from the knotted appearance often assumed by the individuals. The members of this and other genera of the family *Gordiacea* have the common name hair-snakes, and are frequently regarded as hairs transformed into worms. Comparatively little is known of their life-history. Some species pass a portion of their larval stages in the body of insects and spiders, and another part as parasites of fishes, while when adult they are found free in water and mud. It is uncertain what relations they bear to the other nematodes, from which they differ much in structure. J. S. K.

**Gordon**, Major-Gen. Charles George, C. B., R. E.: "Gordon Pasha"; soldier; b. at Woolwich, England, Jan. 28, 1833; son of Gen. Gordon, of the Royal Artillery; entered the Royal Engineers as second lieutenant in 1852; promoted first lieutenant in 1854; served in the Crimean war in surveying and settling the Turkish and Russian frontier in Asia, and in the British expedition against Peking, remaining on service in China after the termination of difficulties. Entering the service of the Emperor of China, he was made in 1863 commander of the "ever-victorious army," and was prominent in suppressing the Tai-Ping rebellion (1863–64), and recovering the great cities and silk districts from the insurgents. He was promoted captain Royal Engineers in 1859, major in 1862, and lieutenant-colonel in 1864. In December of the same year he was appointed British consul for the Danube delta; resigned 1874, and succeeded Sir Samuel Baker in the service of the khedive as governor of the tribes of Upper Egypt; in 1876 returned to England; was governor-general of the Sudan from 1877 till 1880, developing great activity for the suppression of slavery. In 1880 he went to India as secretary to the Marquis of Ripon, but held the position only a few months; in May, 1881, took command of the Royal Engineers in Mauritius, and in the same year was retired from active service with the rank of major-general; in 1882 went to the Cape of Good Hope to aid in settling the difficulty with the Basutos; in 1883 traveled in Palestine; and in 1884 returned to Khartum as the representative of the British Government, but was killed there Jan. 27, 1885. See his *Reflections in Palestine* (1884); *Last Journal* (1885); and *Letters to his Sister* (1888); Hill, *The Ever-victorious Army* (1868); Hake, *The Story of Chinese Gordon* (1884–85); Birbeck Hill, *Gordon in Central Africa* (1881); the *Life* by Sir Henry Gordon (1886) and by Sir W. F. Butler (1889).

**Gordon**, Lord George: youngest son of Cosmo George, third Duke of Gordon; b. in London, Sept. 19, 1750. He served for some years in the navy; entered Parliament in 1774; became distinguished as a noisy opponent of both Whigs and Tories; was made president of the Protestant Association 1779; became at once leader of the large and turbulent No-Popery party; presented a petition (signed by 120,000 persons) for the repeal of Saville's Roman Catholic Relief Bill 1780, arriving at the Parliament House at the head of 50,000 rioters, who (June 2–9) sacked the chapels and the houses of Roman Catholics and others, broke open the prisons, and fired London in many places. The military finally dispersed the rioters, but not till 450 were killed and wounded. Many more were afterward hanged. Gordon was tried for high treason and acquitted 1781; declared himself a Jew in religion in 1786, but was without question insane; was fined and imprisoned for libel 1788, and died in Newgate prison, Nov. 1, 1793.

**Gordon**, George Hamilton: See Aberdeen.

**Gordon**, George Henry: soldier; b. at Charlestown, Mass., July 19, 1824; graduated at West Point 1846; served in Mexico, on frontier duty in Washington (then a territory), and on U. S. Coast Survey; resigned from the army; entered Cambridge Law School; practiced law 1857–61; appointed colonel of Second Massachusetts Volunteers Apr., 1861; served in Shenandoah valley, Va., 1861–62; brigadier-general of volunteers and under Pope in 1862; engaged in battles of Cedar Mountain, Second Bull Run, and Antietam; served with Gen. Dix in the Peninsula, with Gen. Meade, and in department of the South. In 1864 he commanded U. S. forces in Florida; was at capture of forts in Mobile Bay, and in command of district of East Virginia; Apr. 9, 1865, brevet major-general of volunteers; in 1866 U. S. collector of internal revenue for Massachusetts. Author of several historical sketches of the civil war. D. at Framingham, Mass., Aug. 30, 1886.

**Gordon**, John Brown: U. S. party leader; b. in Upson co., Ga., Feb. 6, 1832; graduated at the State University; studied law, and was admitted to the bar; in 1861 entered the Confederate service as captain of infantry, and rose to the rank of lieutenant-general. At the surrender of Gen. Lee, Gordon commanded one wing of the army. In 1868 he was the Democratic candidate for Governor of his native State, and, as was believed, was elected by a large majority, but his opponent, Rufus B. Bullock, was awarded the office. He was a member of the national Democratic conventions in New York 1868 and at Baltimore 1872; was presidential elector for the State at large at the elections in 1868 and 1872; was elected to the U. S. Senate in Jan., 1873, for six years, and took his seat there Mar. 4, 1873, where he was recognized as an eloquent and leading member of the Democratic party; resigned May 20, 1880; nominated for Governor of Georgia by Democratic convention July 28, 1886: elected Oct., 1886; re-elected Oct., 1888; elected U. S. Senator 1890.

**Gordon-Cumming**, Constance Frederica: traveler and author; b. at Altyre, Scotland, May 26, 1837; daughter of Sir William Gordon-Cumming; traveled very extensively in the East. Author of *Viâ Cornwall to Egypt*; *In the Hebrides*; *In the Himalayas* (1876); *At Home in Fiji* (1881); *A Lady's Cruise in a French Man-of-war* (1882); *Fire Fountains of Hawaii* (1883); *Granite Crags of California*; *Wanderings in China* (1886); and *Work for the Blind in China* (1888). C. H. T.

**Gordo'nia** [Mod. Lat., named from James Gordon, a London nurseryman of the eighteenth century]: a genus of beautiful trees and shrubs of the family *Ternstræmiaceæ*. The U. S. have two species. The *G. lasianthus*, called loblolly bay, is a beautiful tree, from 50 to 70 feet high (often a shrub in cultivation), growing in "bay swamps" in barren regions in the Southern States. Its bark is useful for tanning leather. Its mahogany-colored wood is extremely

light, fragile, and perishable, but is recommended for some kinds of joiner-work, being quite handsome. The *Gordonia altamaha* is cultivated as a garden shrub, and has large white and richly fragrant flowers. It is unknown in the wild state, having been eradicated from its original station in Southeast Georgia. Revised by CHARLES E. BESSEY.

**Gordon Pasha**: See GORDON, CHARLES GEORGE.

**Gordy**, J. P.: See the Appendix.

**Gore**, CATHARINE GRACE: novelist; b. in Nottingham, England, 1799; the daughter of a wine-merchant named Moody; was married to Capt. Charles Gore 1823. Author of about seventy works, mostly novels: *The Cabinet Minister* (3 vols., 1839); *The Ambassador's Wife* (3 vols., 1842); *Birthright* (3 vols., 1843); *The Queen of Denmark* (3 vols., 1845); *The Hamiltons* (3 vols., 1850); *The Diamond and the Pearl* (3 vols., 1856); *Modern Chivalry*, etc. She wrote also several dramas. D. Jan. 27, 1861.

**Gore**, CHRISTOPHER, LL. D.: U. S. Senator; b. in Boston, Mass., Sept. 21, 1758; son of John Gore, a loyalist; graduated at Harvard 1776; was U. S. district attorney for Massachusetts 1789–96, the first to hold the office; was with W. Pinckney a commissioner to England 1796–1804 to settle the claims of the U. S. on Great Britain for spoliations; *chargé d'affaires* at London 1803–04; Governor of Massachusetts 1809; U. S. Senator 1814–17. D. at Waltham, Mass., Mar. 1, 1827, leaving nearly $100,000 to Harvard College. The library building, Gore Hall, was named in his honor.

**Gore**, GEORGE, LL. D., F. R. S.: electrician; b. in Bristol, England, in Jan., 1826; was entirely self-educated; lectured for many years on Physics and Chemistry at the Grammar School of King Edward VI., Birmingham; was elected a fellow of the Royal Society in 1865; and received the honorary degree of LL. D. from Edinburgh University in 1877. He distinguished himself by his discoveries, inventions, and writings in electricity, physics, and chemistry, and was author of *Theory and Practice of Electro-deposition* (1856); *The Art of Electro-metallurgy* (1877); *The Art of Scientific Discovery* (1878); *The Scientific Basis of National Progress and Morality* (1882); *Electro-chemistry* (1885); *The Art of Electrolytic Separation and Refining of Metals* (1890).

**Gorée**, gō'rā': an island in the Atlantic Ocean near the western coast of Africa; belongs to France, and is situated 1½ miles S. of Cape Verde. It is only 3 miles in circumference, and deficient in wood and water, but it contains a well-built and fortified town, with a good harbor, although it is not of so great commercial importance as formerly. Lat. 14° 40′ N., lon. 17° 25′ W. Pop. about 3,000.

**Gor'gas**, FERDINAND J. S., A. M., D. D. S., M. D.: dentist; b. at Winchester, Va., July 27, 1834; graduated at Dickinson College in 1854, at the Baltimore College of Dental Surgery 1855, and at the University of Maryland School of Medicine in 1868. In 1864 revised Harris's *Medical and Dental Dictionary*, and in 1872 edited the operative part of Harris's *Dental Surgery*; has been since 1866 the editor of *The American Journal of Dental Science*, and has filled his present chair, that of Dental Surgery and Therapeutics, in the Baltimore College of Dental Surgery, since 1860. Author of *Lectures on Dental Science and Therapeutics*; *Dental Materia Medica and Therapeutics* (1884).

**Gorge**: the local narrowing of a deep river valley, often called cañon in the Western U. S. The gorge of the Rhine from Bingen to Coblentz has been cut through the Hunsrück-Taunus plateau, whose uplift formed a barrier across the course of the river which then held a lake where the plain of the middle Rhine now stands. The gorge of the Danube through the Carpathians is similarly the outlet of an extinct lake, whose sediments now form the plain of Hungary. The lower cañon of the Yellowstone in Montana is a gorge of the same nature. The gorge of the Hudson through its Highlands has an entirely different relation to the wide valley lowlands above Newburg: both the gorge and the lowland are formed by the denudation of an elevated plateau; the upper valley has been wide opened, forming a lowland, because its rocks are weak, while the gorge remains narrow and steep-walled because its rocks are extremely hard; but both gorge and lowland are of the same age; the lowland was excavated only as fast as the gorge was deepened. The gorges of the Connecticut below Middletown, of the Delaware below Easton, and of the Potomac below Harper's Ferry are of the same class. Short gorges through narrow ridges are called water-gaps in Pennsylvania: as the Delaware, Lehigh, and Schuylkill water-gaps in Blue Mountain. Many smaller gorges result from the obstruction of an open valley by glacial drift, and the displacement of its stream to a new line of flow. It thereupon rapidly proceeds to erode a new trench, which for a time deepens faster by stream-cutting than it widens by weathering on the walls; in this way the many gorges in the Northern U. S. are formed, the greatest being that of NIAGARA (*q. v.*). The upper and lower gorges of the Genesee river in Western New York are of this character. Smaller gorges are called chasms in the Adirondacks, as the Ausable and Chateaugay chasms; or glens, as Watkins Glen in Western New York. See CAÑON, PHYSIOGRAPHY, RIVERS, and VALLEYS.

W. M. DAVIS.

**Görgei**, gör'gī, ARTHUR: general; b. at Toporcz, in Hungary, Feb. 5, 1818; educated at the military school of Tuln, and appointed to the Hungarian body-guard; promoted to be first lieutenant in the Palatinal Hussars. He resigned from the army to pursue the study of chemistry, but on the news of the rising in Hungary reaching him he hastened to place his services at the disposal of the Hungarian ministry. His conduct attracted the attention of Kossuth, and after the battle of Schwechat he assumed command of the Hungarian army. Unable to maintain himself at Raab, he was driven out by Windischgrätz; was again repulsed at Windschacht, saving his army by a bold retreat over the Stureez Mountains. Difficulties arising between Görgei and the civil authorities, he was twice superseded in command. On the resignation of the governor and council in 1849, Kossuth made Görgei dictator in his place. Soon after this the Hungarian forces laid down their arms. Görgei was stigmatized as a traitor for this, but this opinion afterward changed completely. In 1851 he published a volume narrating his connection with the insurrection, entitled *My Life and Acts in Hungary*. From that time he has lived in retirement, keeping completely aloof from politics. In 1885 a proposal was made formally to reinstate him in public favor, but it was not well received in Hungary.

**Gorges**, Sir FERDINANDO: "proprietor of Maine"; b. at Ashton, Somersetshire, England, about 1565; was a fellow conspirator with the Earl of Essex, against whom he was a witness 1601; served in the British navy, and in 1604 became Governor of Plymouth; was one of the leading spirits in the original Plymouth Company; sent a number of unsuccessful expeditions to the New England coast, and in 1620 obtained a charter "for the governing of New England," which was held to extend westward to the Pacific. He was also one of the original proprietors of Laconia, which was to extend from the Kennebec to the Merrimack, and in 1623 his son Robert was named general governor for New England. In 1639 Gorges was appointed lord-proprietary of Maine, the office to be hereditary in his family; and in 1642 he chartered the city of Gorgiana (now York, Me.). Gorges returned to England in 1643, served against the Puritan armies, and died in 1647. His grandson, Ferdinando (1629–1718), sold his rights in Maine to Massachusetts (1677) for £1,250, and was author of *America Painted to the Life* (1659).

**Gor'gias**: Greek rhetorician and sophist; b. at Leontini, in Sicily; was sent to Athens in 427 B. C. on an embassy to seek aid against the Syracusans; succeeded in his errand, and was so much sought after on account of the new eloquence which he represented that he forsook Sicily and traveled about Greece as a teacher of rhetoric and as a maker of holiday speeches. He died at the great age of 105 or 109 years, thus outliving Socrates, with whom he figures in the Platonic dialogue that bears the name of Gorgias. His style was elaborate and highly artificial, a style of balance and of jingle, which afterward fell into discredit, but the pattern once set was never forgotten, and the Gorgianic figures still survive in modern rhetoric. In a sense Gorgias is the creator of Greek artistic prose, and to him is largely attributable the diffusion of Attic as a literary language. The two declamations extant under his name, *Encomium of Helen* and *Palamedes* (ed. by Blass in the Teubner Antiphon), if not genuine, are at least admirable imitations of the style of Gorgias. His philosophy is sufficiently indicated by the title of his treatise on *Nature or the Non-Existent*, fragments of which have been preserved. See Foss, *De Gorgia Leontino* (Halle, 1828); Frei, *Quæstiones Protagoreæ* (Bonn, 1845); Wilamowitz, *Entstehung der griech-*

*ischen Schriftsprache*; Blass, *Attische Beredsamkeit* (vol. i., 2d ed., pp. 47–82); Jebb, *Attic Orators*, i., cxxiii, fol.

BASIL L. GILDERSLEEVE.

**Gorgon** [in Gr. Γοργώ, or Γοργόνη; deriv. of γοργός, fierce, terrible]: a daughter of Phorcys and Ceto, who lived on the other side of Ocean in the island of Sarpedon in the far distant west, not far from the garden of the Hesperidæ and the realm of the dead. She was a terrible monster, with serpents instead of hair, serpent scales on her face, boar-like tusks, brazen hands and arms, and wings on her head which enabled her to fly. Her aspect was so dreadful as to turn into stone every mortal who looked upon her face. She bore the name Gorgo because of her thunder-like bellowings. She had two immortal sisters like herself—Stheno (the Strong One) and Euryale (the Far Springer). Her own name was Medusa (the Ruler), or simply Gorgo, and unlike her sisters she was mortal. All the gods hated and avoided her, saving only Poseidon, who lay with her in the garden of the gods. While she was pregnant by Poseidon she was beheaded by PERSEUS (*q. v.*), when Chrysaor (of the golden sword) and PEGASUS (*q. v.*), who carried the thunder and lightning for Zeus, sprang into being from her blood and were reckoned as the offspring of Poseidon. The head of the Gorgon preserved even in death its terrible petrifying powers, and was used as the blazon on the ægis and shield of Zeus and Athene, and naturally, for both are deities armed with thunder and lightning, because the Gorgo is the personification of the thunder-clouds which conceal the sun, change the face of the earth, spread terror into the hearts of all living beings, and threaten even the dead masses with fearful devastation and destruction. The home of the Gorgon is in the west, and her parents are sea-gods, because in Greece thunder-storms come from the western sea. In archaic art the Gorgon Medusa appears often as a *whole* figure. She is almost always running, with one knee bent low down. She is always winged and snakes are wanting as attributes in the oldest representations, but occur on monuments of the sixth century B. C. She is occasionally found in half-figure; but in archaic art she does not usually appear as a whole figure, and her head is not figured in three dimensions, but as a flat face, in other words, as a mask, with widely opened mouth, protruding tongue, tusks, broad, full, fleshy face, and with few snakes in the hair. The middle type of the Gorgon begins with the middle of the fifth century B. C. The face is still broad and round, the mouth widely open, and the tongue protruding. The beautiful type begins with the end of the fifth century. Instances of the beautiful mask are the Medusa Rondanini in Munich, and the head in the Villa Ludovisi in Rome.

LITERATURE.—Roscher, *Die Gorgonen und Verwandtes* (Leipzig, 1890); Six, *De Gorgone*; Brunn, *Griechische Götterideale* (Munich, 1893), p. 53 ff.; Lauer, *System der griechischen Mythologie*; Schwartz, *Ursprung der Mythologie*; articles by Roscher and Furtwängler in Roscher's *Lexicon* under *Gorgones*. Other literature should be used with caution, such as Böttiger, *Furienmaske*; Levezow, *Über die Entwickelung des Gorgonideals*; Cox, *Mythology and Folklore* (New York, 1881), p. 221 f., and his *Mythology of the Aryan Nations* (London, 1882), p. 556 f.; Gädechens in Ersch and Gruber's *Allgemeine Encyklopädie* under *Gorgo*.

J. R. S. STERRETT.

**Gorgonia** [Lat. *gorgonia*, a coral which hardens in the air; deriv. of *Gorgo*, Gorgon, in reference to the Gorgon's power of turning those looked at to stone]: a group of coral polyps belonging to the class SCYPHOZOA (*q. v.*) and order *Octocoralla*, and characterized by having eight-tentacled polyps arranged upon an axis which consists of an outer, frequently spiculed, "bark" and an internal horny or calcareous portion. Accordingly as these axes are arranged the character of the colony varies, and we have flat "sea-fans" or lash-like "sea-whips," etc. Many genera and species are described, most of them from the tropics, but some come from the Arctic regions. The most common Floridan species is *Rhipigorgia flabellum*.

J. S. KINGSLEY.

**Gorham Controversy, The**: a controversy in the Church of England touching baptismal regeneration, which grew out of the case of *Gorham* vs. *The Bishop of Exeter*. In 1847 the Queen presented the Rev. George Cornelius Gorham, then holding a cure in the diocese of Exeter, to the vicarage of Brampford Speke in the same diocese, but Dr. Henry Phillpotts, Bishop of Exeter, refused to institute Mr. Gorham on the ground that "he held, and persisted in holding, that spiritual regeneration is not given in baptism—in particular, that infants are not made therein members of Christ and children of God—contrary to the teaching of the Church of England in her Articles and Liturgy, and especially contrary to the divers offices of baptism, the office of confirmation, and the Catechism." The case was brought before the court of arches (1849) and a decision given to the effect that baptismal regeneration is one of the doctrines of the Church of England, that the bishop was justified in his cause, and that the appeal must be dismissed with costs. Mr. Gorham then appealed to the judicial committee of privy council, which reversed the decision of the court of arches, and Mr. Gorham shortly after was instituted to Brampford Speke. This decision of the committee of the privy council was followed by the abandonment of the Church of England by not a few, on the ground that the Church did not maintain the Catholic faith. See the article REGENERATION.

**Gorilla** [from Gr. γορίλλα, gorilla, or chimpanzee (term used in Gr. translation of a Carthaginian work describing the voyage of Hanno along the northwest coast of Africa, fifth or sixth century B. C.) = Punic *gorilla* = the native African name]: a species of anthropoid ape (*Troglodytes gorilla*) which occupies the first place among the quadrumanous mammals. Though more bestial in appearance, especially in the extraordinary prominence seen in the cranial ridges, and in the extremely carnivorous aspect of its produced snout, it nevertheless has essential characters of superiority. In the light of modern research an old narrative of the Carthaginian navigator Hanno respecting the great apes becomes in a measure verified. Five hundred years before the Christian era this voyager records the discovery on the western coast of Africa of "an island full of wild men," "much the greater part of them," the text continues, "being females with hairy bodies, whom the interpreter termed *gorilloi*. The males were pursued, but not captured. Three females, who bit and scratched those who led them, were not willing to follow; however, having killed and flayed them, we conveyed the skins to Carthage." The history also relates that these skins were preserved in the temple of Astarte, where they remained until the taking of that city in the year 146 B. C., as stated by Pliny, who calls them *gorgones*. It is scarcely to be doubted that this short record refers to the great man-like apes. In 1589 an English sailor, during a detention as prisoner in Western Africa, observed two kinds of ape—one evidently being the chimpanzee, and the other, which he learned was called *pongo*, was undoubtedly a gorilla. "The pongo," he says, "is in all its proportions like a man, except the legs, which have no calves. But he is of gigantic height," etc. A minute and circumstantial account is given by this observer, the accuracy of which has been confirmed by subsequent travelers. Buffon had a clear conviction that there existed such a creature, inclining to regard it as a large species of orang. Cuvier was so entirely incredulous, and met the subject with so much ridicule, that for a long period it was again well-nigh regarded as a myth. In 1847 the gorilla was first made known to science and its characteristics made out by Dr. Thomas Savage (who with Dr. Wilson, another missionary, may be said to have rediscovered it) and Prof. Jeffries Wyman, the distinguished comparative anatomist. Their paper, in which the scientific name was first given, was published in 1847, and was followed in Feb., 1848, by a memoir by Prof. Owen. In 1849 a complete specimen, preserved in alcohol, was obtained by a surgeon of the French navy. Later yet, perfect crania and other portions were taken to the U. S. by Du Chaillu.

Considerable information of a reliable character has been recorded concerning the habits of the gorilla. Its food consists of the fruit of several species of palm, the "cabbage" portion of the same, the banana, and other succulent vegetables of similar character. The teeth of the animal indicate an omnivorous nature; its diet is therefore supposed to include to a moderate extent animal food, e. g. the eggs and the young of birds, if not that of more solid matter. It forms for itself a rude nest or sleeping-place much like that of the orang. The ferocity of the gorilla seems to have been much exaggerated, and while the strength of the animal is prodigious, it will not attack man unless cornered or wounded, and even then will frequently not pursue if the man slowly and steadily retires as the creature advances. In attacking the gorilla stands erect, much like a bear, and with its wrinkled forehead, bristling hair, and gleaming teeth, presents a truly terrible appearance. Ordinarily the gorilla seeks safety

in flight, and its senses of hearing and sight are so acute that it is by no means easy to stalk the animal, and white hunters have almost invariably failed in their efforts to shoot this huge ape. The adult male gorilla is said by good authority to attain a height of 6 feet and a weight of 400 lb.; but these figures seem excessive, and, as shown by the skeleton, 5 ft. 6 in. is the height of a large and old animal.

It is not gregarious. The young are seen in company with the parents until they attain adult size. In walking, the natural position is on all fours, the enormously long arms facilitating such locomotion very materially. When it chances to stand or progress as a biped, it is with an unsteadiness that betokens a lack of power and ability. The male is vastly larger as well as much more formidable in appearance than his mate, his large canine teeth being a characteristic feature. The habitat of the gorilla is a comparatively small portion of Western Africa, in the Congo district, lying between 2° and 5° S. lat., and running from the coast eastward to about lon. 16° E. It inhabits the dense forests, and seems to prefer high or mountainous localities. A few young gorillas have been taken alive to Europe, but soon succumbed to pulmonary diseases. F. A. Lucas.

**Go'ritz** (Germ. *Görz*): town of Austria; in the duchy of Görz; 22 miles N. W. from Trieste, on the Izonzo (see map of Austria-Hungary, ref. 8–D). Its manufactures of leather, silk, and rosoglio are extensive, and its trade very lively. Charles X., the ex-King of France, died here, in the monastery of Castagnavizza, in 1836. Pop. 21,825.

**Gorkhas**: See Goorkhas.

**Gor'kum** (Dutch *Gorinchem*): town of the Netherlands; in the province of South Holland; on the Merwede; 22 miles E. S. E. of Rotterdam (see map of Holland and Belgium, ref. 7–F). It is strongly fortified, has large salmon-fisheries, and a very brisk transit trade. Pop. (1890) 11,900.

**Gör'litz**: town of Prussia; in the province of Silesia; on the Neisse, which here is crossed by a viaduct 1,500 feet long, 115 feet high, and resting on 34 arches (see map of German Empire, ref. 5–H). It is fortified, and has iron-foundries, weaving and bleaching establishments, and considerable manufactures of cloth, cotton, linen, and leather. Among its buildings is the Church of St. Peter and St. Paul, built in the fifteenth century, a remarkable specimen of Gothic architecture. It has five naves, of which the principal one is formed by twenty-four palm-shaped pillars 77 feet high, and has a bell weighing 12½ tons. There is a fine statue of Emperor William I., with Moltke and Bismarck. Pop. (1895) 70,172.

**Gorman**, Arthur P.: U. S. Senator; b. in Howard co., Md., Mar. 11, 1839; attended the public schools in his native county for a short time; appointed page in U. S. Senate 1852, and continued in the service of the Senate until 1866, at which time he was postmaster; Sept. 1, 1866, was removed from his position and immediately appointed collector of internal revenue for the fifth district of Maryland, an office he held until the incoming of the Grant administration in 1869; in June, 1869, he was appointed a director in the Chesapeake and Ohio Canal Company, and in November was elected a member of the house of delegates of the Maryland Legislature as a Democrat; was re-elected in 1871; elected Speaker of the House of Delegates at the ensuing session; was elected to represent Howard County in the Maryland State Senate June, 1872, and re-elected for a term of four years Nov., 1879; was elected in Jan., 1880, to the U. S. Senate as a Democrat, to succeed Hon. William Pinkney Whyte; took his seat Mar. 4, 1881; re-elected in 1886 and in 1892. C. H. Thurber.

**Gör'res**, Jakob Joseph, von: author; b. at Coblenz, Germany, Jan. 25, 1776. From his early youth he was an eager student, a close observer, rich in sympathy, broad and bold in his views. Inspired by the French Revolution, he began as a radical, carrying his radicalism into all the spheres of human life, but soon felt discouraged at the development of affairs, became entangled in the dream-life and mysticism of the romantic school, was driven into bitterness and obscurity by its retrograde ideas, and ended by serving the reaction which after the fall of Napoleon pressed on Europe during a whole generation. In 1797 he founded a periodical, *Das rothe Blatt*, which in 1798 was succeeded by *Rübezahl im blauen Gewande*, both of which were suppressed on account of their radical views. In 1799 he went to Paris at the head of a deputation from the Rhenish provinces, with the purpose of effecting the incorporation of these districts with France, but failed. In despair he retired from politics, and became a teacher at the College of Coblenz. In 1806 he removed to Heidelberg, where he resided for two years. Here he made the acquaintance of Brentano and Achim von Arnim, and adopted all the Oriental and mediæval—that is, quietistic and reactionary tendencies of the romantic school. In 1807 he published *Die deutschen Volksbücher*; in 1810, *Mythengeschichte der asiatischen Welt*; in 1813, *Lohengrin*. Once more he was allured back into politics. Under the general rising against Napoleon which followed his disaster in Russia and his defeat at Leipzig, Görres established a new periodical, *The Rhenish Mercury*, whose success was so great that Napoleon called it the fifth great power. He was not radical now; he advocated the establishment of a German confederation of constitutional monarchies under an emperor; nevertheless in 1816 the paper was suppressed. His book *Deutschland und die Revolution* (1819) even occasioned the Prussian king to order his imprisonment in Spandau, but he escaped arrest. He fled to Switzerland, where he lived till 1827, when he was appointed Professor of History at the University of Munich. During his residence in Switzerland he published *Das Heldenbuch von Iran* (1820); *Europa und die Revolution* (1822); *Emanuel Swedenborg* (1827), etc. A new change took place with him. He had once believed in the spontaneous development of the people itself toward civilization and freedom, but that idea he had given up in despair. He next hoped to find constitutional government a guarantee for the happiness of the people, but this confidence he now lost. He looked down on all government with contempt, and considered the Church, the Roman Catholic Church, as the only means left of salvation. In this spirit are all his later books written —*Athanasius* (1838); *Die christliche Mystik* (1842); *Die Wallfahrt nach Trier* (1845), etc. They are still of a high character, interesting and suggestive, but they are essentially reactionary. D. at Munich, Jan. 29, 1848. His biography was written by J. Gallaud (Freiburg im Breisgau, 1876). Revised by H. H. Boyesen.

**Gorringe**, Henry Honeychurch: commander U. S. navy; b. at Barbados, West Indies, Aug. 11, 1841; educated at Barbados; went to the U. S. at an early age, and entered the navy as foremast-hand during the war, serving in the Mississippi squadron; rose rapidly; commanded the Cricket under Admiral Porter in the Red river expedition; at the close of the war appointed to the regular navy; served in various capacities, and while in command of the Gettysburg in the Mediterranean discovered a coral bank N. E. of Madeira; in 1878, on return from this cruise, he was given leave of absence, and through the liberality of William H. Vanderbilt removed (1879–80) to New York from Egypt the obelisk known as Cleopatra's Needle, now standing in Central Park. Subsequently he resigned from the navy and engaged in ship-building. Published *History of Egyptian Obelisks* (New York, 1885). D. in New York city, July 7, 1885.

**Gorst**, Sir John Eldon: British politician; b. in Lancashire, May, 1835; educated at Cambridge; in 1861–63 civil commissioner of Waikato, New Zealand; called to the bar 1865; queen's counsel 1875; in Parliament 1866–68 and 1875; member of the fourth party; Solicitor-General in Lord Salisbury's first administration; Under-Secretary for India in his second administration; made privy councilor 1890; became lord rector of Glasgow University 1893, and vice-president of the council 1895.

**Gorton**, Samuel: founder of a sect; b. at Gorton, England, about 1600; was a linen-draper in London; went in 1636 to Boston, Mass., whence he was soon expelled for heresy; was banished from Plymouth in the following winter; went to Aquidneck (now Newport, R. I.), where he was publicly whipped for saying that the magistrates were "just asses"; removed to Pawtuxet, R. I., and was involved in lawsuits about land; went (1642) to Shawomet (now Warwick, R. I.), whence he and ten of his followers, "Gortonians," were abducted by forty soldiers from Massachusetts, and were tried at Boston as "damnable heretics," and sentenced to hard labor in irons, but in 1644 the sentence was commuted to banishment; returned to Warwick, R. I., and became a preacher, a magistrate, and a person of much consideration. Author of several religious works. D. in Rhode Island in 1677. His sect survived for many years, and his followers were called "Nothingarians," because they repudiated religious forms of every kind and recognized no ministry. See his *Life* by J. M. Mackie in Spark's *American Biography* (2d ser., v., Boston, 1845).

**Gort'schakoff**, Alexander Michaelowitsch, Prince: statesman; b. at St. Petersburg, July 16, 1799; belonged to one of the oldest and most celebrated families among the Russian nobility. He was educated at the Academy of Tsarskoe-Selo, and entered the diplomatic service in 1824 as secretary to the Russian ambassador in London. In different diplomatic positions at Vienna, Florence, Stuttgart, and other cities he acquired a large experience and showed considerable dexterity, but it was his eminent success in keeping Austria neutral during the Crimean war, at which time he represented Russia at the court of Vienna, which first made him conspicuous as a diplomat. In 1856 he succeeded Count Nesselrode as Minister of Foreign Affairs, and in 1863 chancellor of the empire. His notes to the Western powers during the Polish insurrection in 1863 made a most decisive impression in Europe, and no doubt prevented foreign interference. In 1871 he attended the London conference, where he procured the revision of the Treaty of Paris and another abrogating the neutralization of the Black Sea. After the outbreak of the Turco-Russian war in 1877 his influence began to decline, and at the Congress of Berlin his designs were thwarted by Bismarck and Beaconsfield. In 1882 he was superseded as minister by M. de Giers. D. at Baden-Baden, Mar. 1, 1883.

**Gortyn, Gortys**, or **Gortyna** (in Gr. Γόρτυν, Γόρτυς, Γόρτυνα): one of the principal cities of Crete; situated at the southeast foot of Mt. Ida in the plain of the small river Lethæus. Gortyn was the rival of Cnossus, which was reckoned as the first city of Crete up to the time of the Roman conquest, when Gortyn became the metropolis on account of its nearness to Egypt and the Cyrenaica. In 1884 the greatest of Greek inscriptions, containing the law code of Gortyn, was discovered in the village occupying the site of Gortyn by Halbherr, an Italian epigraphist; he was assisted in copying it by Fabricius, a German archæologist, and both of them published it. The inscription is boustrophedon, and is written in the most archaic alphabet. This law code is of the utmost importance because it tells us much about the ancient laws of Crete, which was the lawgiver of all Greece. The inscription contains the laws with regard to slaves, rape and assault, adultery, divorce, rights of the widow, children born after divorce, division of property among children, heirs at law, partition of property, property rights, ransomed prisoners, miscegenation, responsibility for the acts of a slave, rights and obligations of heiresses, legality of gifts, and adoption. See Merriam's articles in *The American Journal of Archæology*, vol. i., p. 324 f., and vol. ii., p. 24 f.; Comparetti, *Leggi antiche della città di Gortyna* (Florence, 1885); Bücheler and Zitelmann, *Das Recht von Gortyn* in *Rheinisches Museum* (1885); Dareste, *La Loi de Gortyne* in the *Annuaire des études grecques* (xx., pp. 300–349); Baunack, *Die Inschrift von Gortyn* (Leipzig, 1885); Bernhöft, *Die Inschrift von Gortyn* (Stuttgart, 1886); Blass, *Zu der Gesetztafeln von Gortyn* in *Neue Jahrbücher* (1885); Simon, *Zur Inschrift von Gortyn* (Vienna, 1885); Leroy, *Stadtrecht von Gortyn* (Berlin, 1885); Roberts, *Introduction to Greek Epigraphy* (Cambridge, 1887, p. 39 ff. and p. 326 ff.); Merriam in *The American Journal of Archæology*, as cited above. J. R. S. Sterrett.

**Go'schen**, George Joachim, LL. D., M. P., P. C.: statesman; b. in London, Aug. 10, 1831, of German parentage; educated at Rugby and Oriel College, Oxford; entered mercantile life in 1853; was returned to Parliament for London (1863) as a Liberal; vice-president of the Board of Trade and director of the Bank of England 1865–66; became a privy councilor in 1865; chancellor of the Duchy of Lancaster 1866; president of the poor-law board 1868–71; first lord of the admiralty 1871–74; was sent to Cairo in 1876, together with M. Joubert, as delegate for the British and French holders of the Egyptian debts, to concert measures for the conversion of those debts, and succeeded in forming an agreement with the khedive concerning the reorganization of the finances of Egypt; went in 1880 to Constantinople as ambassador extraordinary, but did not succeed in inducing the Turkish Government to carry out the stipulations of the Congress of Berlin concerning the Græco-Turkish frontier. He seceded from the Liberal party and joined the Liberal-Unionists; became Chancellor of the Exchequer in Lord Salisbury's administration, 1887, and carried, 1889, a scheme for the reduction of the interest on the national debt. Elected lord rector of the University of Edinburgh 1890. First Lord of the Admiralty June, 1895. Author of *The Theory of Foreign Exchange* (1863; 14th ed. 1890) and several pamphlets.

**Gos'hawk** [M. Eng. *goshawk* < O. Eng. *gōshafoc*; *gōs*, goose + *hafoc*, hawk—so called because it was employed to capture geese]: a large hawk (*Astur palumbarius*) inhabiting Europe and Northern Asia. The general color of the adult is ashy gray above, white below, with black shaft lines, and bars of ashy brown. The goshawk is from 18 to 23 inches long, with a spread of wings of about 3 feet. It is the largest of the short-winged hawks formerly employed in falconry, and although belonging to the "ignoble" falcons, or those which fly down their quarry instead of swooping upon it, was in great demand owing to its dash and courage. The North American goshawk (*Astur atricapillus*) closely resembles its Old World congener in color, but is somewhat larger. It resides in the northern portion of the continent, and preys largely upon rabbits, grouse, and ptarmigans. F. A. Lucas.

**Goshen**: the Hebrew form of the name of the district of Lower Egypt which the Pharaoh of Joseph's time assigned to Jacob and his descendants (Gen. xlvii. 6), and from which the Israelites spread over a large part of the Eastern Delta. The explorations of Naville, under the auspices of the Egypt Exploration Fund, in 1885 indicate that the original Egyptian name was Ges or Kes, and that the center of the district was at the place now called Saft el-Henneh. Its exact limits can not be given, but it was near the Hyksos stronghold Bubastis (Pi-Beseth; cf. Gen. xlv. 10), and probably embraced the territory between the modern Zagazig, Belbeis, and Tell el-Kebir. Goshen is also the name of a district in Southern Palestine (Josh. x. 41; xi. 16) and of a town (Josh. xv. 51)—both uncertain.

Charles R. Gillett.

**Goshen**: city; capital of Elkhart co., Ind. (for location of county, see map of Indiana, ref. 2–E); on the Elkhart river and the Cl., Cin., Chi. and St. L. and the Lake Shore and Mich. S. Railways; midway between Chicago and Toledo. It is in an agricultural region; is developing large interests in the growing of celery and small fruits; and, facilitated by the excellent water-power afforded by the river, has manufactures of flour, machinery, agricultural implements, woolen goods, furniture, bicycles, carriages, and wagons. It has a trade in lumber averaging about 20,000,000 feet annually. There are several churches, a high school, public evening school, grammar schools, and school property valued at $80,000, court-house, hotel, opera-house, 4 banks, and 2 daily, 4 weekly, and 1 semi-weekly newspapers. Pop. (1880) 4,123; (1890) 6,033; (1900) 7,810. Editor of "News."

**Goshen**: village (settled 1772, incorporated 1809); Orange co., N. Y. (for location of county, see map of New York, ref. 7–J); on the Penn., Pough. and Bost. and the Erie Railroads; 60 miles N. N. W. of New York city. It is a half-shire town, with court-house and clerk's, treasurer's, and surrogate's offices; is in an agricultural and dairy region; has 5 churches, 2 public schools, 3 banks, and 1 semi-weekly and 2 weekly newspapers; and manufactures butter, cheese, brick, and tile. It also has water-works supplying an abundance of pure water. Pop. (1880) 2,557; (1890) 2,907; (1900) 2,826. Editor of "Independent Republican."

**Gos'lar**: town of the German empire; in Hanover, on the Gose; 27 miles S. E. of Hildesheim (see map of German Empire, ref. 4–E). Founded about 920 by Henry the Fowler, it was for a time the capital of the empire, and a place of much splendor and importance. It remained a free city of the empire until 1802, and was joined to Hanover in 1816. The fine old buildings perished one by one, or were put to base uses. The palace was used as a granary and defaced by modern unsightly additions. As a result of the national revival in Germany following the Franco-German war, great interest was aroused in the national antiquities and the palace, Kaiserhaus, at Goslar, was restored as nearly as possible in its original form and adorned with a number of magnificent frescoes illustrative of the history of the early period. The porch of the cathedral and one old tower of the fortifications are all that remain of the old public buildings, but the town contains a number of very ancient houses, and it remains one of the most interesting mediæval towns of Germany. The industries are mainly connected with the neighboring mines of silver, copper, and other metals. Pop. (1890) 13,311. C. H. Thurber.

**Gos'nold**, Bartholomew: an English mariner, who first appears as an associate of Raleigh in his unsuccessful attempt to found a colony in Virginia. In 1602 he sailed from Falmouth for New England in a ship containing twenty

colonists, and steered directly across the Atlantic, instead of taking the circuitous southern course previously chosen by navigators. He entered Massachusetts Bay, named Cape Cod, discovered No Man's Land, and named it Martha's Vineyard (a name since given to a much more important neighboring island), and planted his colony on Cuttyhunk (now in the township of Gosnold, Mass.); but the settlers became discouraged and soon returned. On Dec. 19, 1606, he sailed with another colony to Virginia, which, in spite of his remonstrances, chose for their first settlement Jamestown, a locality that proved unhealthful. D. in Virginia, Aug. 22, 1607.

**Gospel** [M. Eng. *gospel* < O. Eng. *godspel*, gospel (: *gōd*, good + *spel*, tidings), transl. of Gr. εὐαγγέλιον, gospel, liter., good news, dimin. of εὐάγγελος, bringing good news; εὖ, well + ἀγγέλλειν, bring a message, announce]: (1) a thanksgiving or sacrifice for good news; (2) glad tidings of salvation by Christ; (3) the historical records of this salvation, or of the life, death, and resurrection of Christ for the salvation of the world, or the gospel history, which we have in a fourfold form.

1. *The Canonical Gospels.*—They are properly only one and the same gospel, in its fourfold aspect and relation to the human race (the fourfold gospel, τετράμορφον εὐαγγέλιον, according to Irenæus). Hence they are styled in ancient manuscripts the Gospel *according to* (not *of*) Matthew, Mark, Luke, and John. The first and fourth are, according to the traditional view of the churches, by apostles; the second and third by pupils of the apostles, and thus indirectly apostolical. Mark is closely connected with Peter (as his "interpreter"), Luke with Paul (as his companion in missionary travel and work). The authorship rests on ancient testimony and internal probability, but is subject to criticism. The first three gospels were written between A. D. 60 and 70, certainly before the destruction of Jerusalem, to which they point as a future event. The last was probably written toward the close of the first century, at Ephesus. Before the end of the second century they were generally received and used in the churches as one collection. This is confirmed by the independent testimonies of the Ante-Nicene Fathers (Justin Martyr, Tatian, Irenæus, Tertullian, Origen, etc.), by the Gnostics and other heretics. Tatian about 170 wrote the first harmony of the gospels, which was much used in the Syrian Church, and was recovered in 1888 in an Arabic version. The gospels are not complete biographies of Jesus, but selections of characteristic features as they seemed most important to each evangelist for the purpose of leading his readers to the faith that Jesus of Nazareth is the promised Messiah and Savior of men.

Each Gospel has a marked individuality, corresponding to the author's education, talent, taste, and mission. Matthew wrote in Palestine and for Jews, to show them that Jesus is the fulfiller of prophecy and the true King and Lawgiver of Israel; Mark in Rome, for Roman readers, to exhibit Jesus as the mighty Wonder-worker and Son of God; Luke, for Greeks and Gentiles, to set Him forth as the universal Savior of all men; John, for Jewish and Gentile Christians combined, and for all future ages. Matthew (formerly a tax-gatherer and accustomed to keeping accounts) follows the topical and rubrical order; Luke (an educated Hellenist and a physician), the chronological order; John (the trusted bosom friend of Christ) combines both with an internal development of the growing antagonism between Christ and carnal Judaism; Mark gives, as from the first impressions of his master, the impulsive Peter, fresh, rapid, graphic sketches. The first three evangelists agree much in matter and language, and are consequently called *Synoptists* (their Gospels the *Synoptic* Gospels); John stands alone as the ideal and spiritual evangelist; his Gospel is the purest, deepest, and sublimest of all literary compositions, the Gospel of Gospels, "the one true, tender, main Gospel," "the heart of Christ." (See Schaff's special introduction to Lange's *Com. on John.*) Yet the first three are just as necessary, and give the historical basis, the divine humanity of Christ; while John, going back to the eternal Logos, presents the incarnate divinity of Christ.

The discrepancies among the Gospels in minor details confirm the independence and credibility of the authors. The genuineness and truthfulness of these books rest on stronger evidence than that of any other historical records, ancient or modern. This has been acknowledged by eminent writers who are free from all doctrinal or sectarian bias. Goethe says: "I regard the Gospels as thoroughly genuine, for we see in them the reflection of a majesty which proceeded from the Person of Christ—a majesty which is as divine as anything that ever appeared on earth." Rousseau remarks that "the gospel history can be no fiction, else the inventor would be greater than the hero" (*l'inventeur en serait plus étonnant que le héros*); or (as Theodore Parker says) it would take more than a Jesus to forge a Jesus. And yet the Jesus of the Gospels is admitted to be the purest and highest character conceivable. If there is no truth and reality in Him, it is nowhere else to be found. Take away the historical Christ, the Life and Light of the world, and human life and history are as dark as midnight, an inscrutable enigma. See HARMONY OF THE GOSPELS, MATTHEW, MARK, LUKE, JOHN, and BIBLE.

LITERATURE.—This has immensely increased since 1830 in connection with the very numerous *Lives* of Jesus by Schleiermacher, Strauss, Neander, Ewald, Lange, Renan, Keim, Ellicott, Andrews, Farrar, Weiss, Beyschlag, Edersheim, etc. See the critical introductions to the New Testament by De Wette, Reuss, Bleek, Davidson, Weiss, and Holtzmann; the commentaries on the Gospels by Olshausen, De Wette, Lücke, Tholuck (on John only), Bleek, Meyer, Lange, Godet (Luke and John), Alford, Westcott (on John), Holtzmann, etc.; and monographs on the several Gospels, especially that of John, too numerous to be mentioned here. Tischendorf, *When were our Gospels composed?* (4th ed. 1866, translated into several languages, even the Russian and Turkish) makes an able plea for the genuineness of the Gospels from historical evidence. Baur opened the modern attacks on John in a masterly critical essay (1844). Ezra Abbot has written the best book on the external testimony for the Johannean authorship of the fourth Gospel (1884). There are more recent discussions on this burning question by Holtzmann, Weiss, Schürer, Harnack, Gloag, Sanday. Compare the careful bibliographical lists of Hase, in his *Leben Jesu* (5th ed. 1865, p. 22, *seq.*); of Ezra Abbot, in Smith's *Bibl. Dictionary* (Abbot's and Hackett's ed., vol. ii., pp. 959–61); and of Schaff in the first volume of his *Church History* (revised 1890), pp. 575–79 and 607–12.

2. *Apocryphal Gospels.*—A number of spurious biographies of Jesus and the holy family, purporting to come from apostles or their pupils, but written in the second, third, and later centuries by unknown authors, to fill out, for the satisfaction of an idle and morbid curiosity, the vacancies left by the chaste modesty and veracity of the evangelists, especially in the history of the infancy of Christ and His descent into Hades. They are the first specimens of religious novels, replete with extravagant fancies and unnatural miracles which the boy Jesus is said to have performed for ostentation and amusement. They are also glorifications of Mary and the holy family. They are related to the canonical Gospels as the counterfeit to the genuine coin, as caricatures to the original. They have no historical value, but they furnish indirectly a strong argument for the canonical Gospels, and enable us to trace some of the traditions and superstitions of the mediæval Church to their proper source. This is their only use. The principal of these apocryphal productions are the *Gospel of James* (*Protevangelium*); the *Gospel of Pseudo-Matthew on the Infancy of Mary and Jesus*; the *Gospel of the Nativity of Mary*; the *Gospel of Joseph the Carpenter*; the *Gospel of Thomas*; the *Gospel of Nicodemus*; the *Acts of Pontius Pilate*; and his *Letter to Tiberius* on the death of Christ; and the recently discovered *Gospel of Peter*. The references in the Koran to the gospel history are from these apocryphal sources.

LITERATURE.—Thilo, *Codex Apocryphus Nov. Test.* (Leipzig, 1832); Tischendorf, *Evangelia apocrypha* (Leipzig, 1853); the same, *De Evang. apocr. origine et usu* (1851); R. Hofmann, *Das Leben Jesu nach den Apokryphen* (Leipzig, 1851), and his article in Schaff's *Encyclop.* (vol. i., 1882, pp. 105–07); for the *Gospel of Peter* see edition by A. Harnack (2d ed., Berlin, 1893). Also Wright, *Contributions to the Apocr. Lit. of the New Testament* (1865), and Lipsius, *Die Pilatusacten* (1871). There are English translations of the Apocryphal Gospels by Cowper (London, 1867), and by Walker in the Ante-Nicene Library (Edinburgh, 1870); of the *Gospel of Peter*, see H. von Schubert (Edinburgh, 1893).

PHILIP SCHAFF.

**Gos'port**: town of Hampshire, England, directly opposite Portsmouth (see map of England, ref. 14–I). It is the seat of the Royal Clarence victualing-yard, with its brewer-

ies and bakeries, and has large iron-foundries for the manufacture of anchors and iron cables, and extensive storehouses for naval provisions; also Haslar naval hospital. Pop. (1891) 25,457.

**Gossamer** [M. Eng. *gossomer*, gossamer (apparently), liter., goose-summer; *gos*, goose (here either meaning soft, downy, or changed by analogy of *gos* from some more original form) + *somer*, summer (but here like the Germ. *Sommer*, in *fliegender Sommer*, *Mädchensommer*, etc., meaning summer-film, gossamer, a use apparently arising from such words as *Sommerfäden*, gossamer, liter., summer threads]: the long light filaments spun by certain small spiders. Some of these float in the air and carry the spider with them, perhaps in search of prey. Others are stretched upon the ground, and are believed to serve to collect the dew, of which many spiders have been known to drink very frequently. In the folk-lore of various nations they are regarded as shreds of the Virgin Mary's neckcloth, which she cast away at the time of her assumption.

**Gosse**, Edmund William: English author; son of the naturalist; b. in London, Sept. 21, 1849; was appointed assistant librarian at the British Museum in 1867; translator to the Board of Trade in 1875, and Clark Lecturer in English Literature at Trinity College, Cambridge, in 1884. In 1884 he lectured in the U. S. at Harvard, Yale, and Johns Hopkins Universities. He has published *Madrigals, Songs, and Sonnets* (1870); *On Viol and Flute* (1873); *New Poems* (1879); two dramas, *King Eric* (1876) and *The Unknown Lover* (1878); *Northern Studies* (1879); *Seventeenth Century Studies* (1883); *From Shakespeare to Pope* (1885); *Lives of Raleigh* (1886) and *Congreve* (1888); an edition of Gray (1885); *History of Eighteenth Century Literature* (1889); *The Secret of Narcisse* (1892); *Questions at Issue* (1893); *In Russet and Silver* (1894); *Critical Kit-Kats* (1896); *A Short History of English Literature* (1897).

**Gosse**, Philip Henry, F. R. S.: naturalist; b. in Worcester, England, Apr. 10, 1810; lived in Newfoundland 1827–35, in Canada as a farmer 1835–38, and in Alabama as a school-teacher 1838–39, when he returned to England. Author of many books, including *Letters from Alabama*; *The Canadian Naturalist* (1840); *Birds of Jamaica* (1851; he was in Jamaica 1844–45); an *Atlas of Illustrations* for the foregoing work; *Naturalist's Sojourn in Jamaica* (1851); *Natural History* (4 vols., 1848–51): *Ocean Described*; *Rivers of the Bible* (1850); *History of the Jews* (1851); *Textbook of Zoölogy* (1851); *Assyria* (1852); *A Naturalist's Rambles* (1853); *The Aquarium* (1854); *Handbook of Marine Aquarium* (1855); *Marine Zoölogy* (1856); *Omphalos* (1857); *Evenings at the Microscope* (1859); *Actinologia Britannica* (1860); *Romance of Natural History* (1860–62); *Land and Sea* (1865); *Prehensile Armature of the Papilionidæ* (1885). D. in South Devon, Aug. 23, 1888.

**Gossellin**, gos'lăn', Pascal François Joseph: b. in Lille, France, Dec. 6, 1751; made extensive journeys (1772–80) for the observation of facts regarding ancient geography, and afterward carried on his studies for some years at the public expense. In 1790 he was chosen to the Academy. In 1799 he was made director and keeper of medals for the National Library. In 1816 he became one of the chief editors of the *Journal des Savants*. Among his most important works are *Géographie des Grecs analysée* (1790); *Recherches sur la géographie des anciens* (1798–1818), besides a large number of valuable monographs upon ancient geography, and an *Atlas des Cartes*, with seventy-five maps. D. in Paris, Feb. 7, 1830.

**Gossner**, Johannes Evangelista: b. at Hausen, in Bavaria, Dec. 14, 1773; held a small benefice in Munich, but lost it in 1817 on account of his evangelical tendencies. In 1826 he left the Roman Church and embraced Protestantism, and in 1829 he was made pastor of the Bethlehem church in Berlin. He wrote *Geist des Lebens u. der Lehre Jesu*, and published *Schatzkästlein*, *Goldkörner*, etc. D. in Berlin, Mar. 20, 1868. Revised by H. H. Boyesen.

**Gossyp'ium** [Mod. Lat., from Lat. *gossypion*]: the genus of plants to which the cotton plant belongs. See Cotton.

**Got**, gō, François Jules Edmond: actor; b. at Ligne-rolles, in the department of Orne, France, Oct. 1, 1822; was educated in the Collège Charlemagne, and held some position in the departmental government of the Seine, when in 1841 he entered the Conservatory and began to study under Provost. He made his *début* in the Comédie Française in 1844, and became *sociétaire* in 1850. He has played a great number of *rôles* in the classical comedy. In the modern drama among his brilliant creations are Giboyer in *Le fils de Giboyer* (1863); André Lagarde in *La Contagion* (1866); Bernard in *Les Fourchambault* (1878): Jean in *Rantzau* (1882); and Fermier in *Vincenette* (1888). In 1867 he formed a traveling troupe of actors, and gave representations of *La Contagion* in all the larger cities of France. In 1881 he was created a knight of the Legion of Honor, the first actor of France to receive such a distinction. He is the dean of the Société of the Comédie Française. His range of characters includes nothing of the tragic. Got is considered the foremost comedian in France.

Revised by B. B. Vallentine.

**Go'ta** (Swed. *Göta-elf*): a large river in Southern Sweden, carrying the water from Lake Wener to the Cattegat. It is celebrated for the romantic beauty of its shores and for its magnificent cataracts, of which Trollhätta (the witch's cap) is one of the most brilliant and imposing in the world. The river is made navigable and is connected with the Baltic through Lakes Wener and Wetter by a system of locks and canals (Trollhätta and Gota Canal).

**Gotama**: See Gautama.

**Go'tama**: an East Indian logician; the reputed author of the *Nyâya Sûtra*, which in its present form is, however, in part the work of commentators. The time of Gotama's life is quite unknown, but most scholars assign him a high antiquity. The related events of his life are purely fabulous. It was believed by Sir William Jones that Aristotle borrowed the syllogism from Gotama's writings, but this opinion is rejected by most critics, as is also the belief that Gotama was indebted to the Grecks.

**Gotha**, gō'tăa: town of Germany, near the Thuringian forest; one of the capitals of the duchy of Saxe-Coburg-Gotha (see map of German Empire, ref. 5–E). Its old walls and fortifications have been transformed into boulevards and promenades, and the whole city has a modern and elegant appearance. The ducal palace, Friedenstein, is a considerable building, and contains, besides a library of 200,000 volumes and about 6,000 manuscripts, a very fine collection of coins and medals. There is a museum with valuable collections, and an observatory. The manufactures include fire-engines, pipes, shoes, sugar, and toys. Margaret church, a fine building, was founded in the twelfth century. Gotha is the seat of much literary enterprise (the *Gotha Almanac*, the geographical establishment of Justus Perthes, etc.) and considerable industry and trade. It has a beautiful park and one of the most famous gymnasiums in Germany; also superior schools for young ladies and for teachers, etc. Pop. (1895) 31,671.

**Gotha Almanac** (*Almanach de Gotha*, so called from the place of its publication): an annual register containing lists of government officials, genealogies of German princely families, necrology, diplomatic intelligence, statistics, etc. It is a work of very great value. From 1764 to 1804 it was published in the German language. Since that time it has been published in both French and German.

**Gotha**, Duchy of: See Saxe-Coburg-Gotha.

**Go'tham**: a parish of Nottinghamshire, England, whose people (according to tradition) have been famous ever since King John's time for their stupidity, so that "a wise man of Gotham" became a synonym for a fool. Irving in his *Salmagundi* applied the name Gotham to New York, and the appellation is still a familiar one in the U. S.

**Gothenburg**, or **Gottenburg** (Swed. *Göteborg*, Goth-city): town of Sweden, in the province of Gothland, on the Gota, near its mouth (see map of Norway and Sweden, ref. 12–D). It was founded in 1619 by Dutch settlers, is regularly laid out, and has several canals. The place received its first commercial importance during the continental blockade of 1806. The museum contains important collections; chief among the public buildings are the town-hall and the exchange. Gothenburg has an excellent harbor and a very extensive trade, exporting iron, copper, timber, tar, and fish. Also as a manufacturing place it is rising; its ship-building and manufactures of sailcloth are especially important. Pop. (1896) 117,350.

The Gothenburg licensing system, which originated here in 1865, gives the exclusive control of liquor-shops to a company licensed by the town. The business is conducted by salaried managers, and all profits above 5 per cent. go into the town treasury. The effect of the system has been to

improve the quality and decrease the quantity of liquors consumed.

**Gothic Architecture**: the style of architecture which was developed out of the Romanesque in Western Europe in the twelfth century, and which existed, though much modified with time, until the classical revival in the sixteenth century put an end to it. (See RENAISSANCE.) The especial virtue of this style is its free use of rich sculpture so combined with the architectural forms as to make one with them. The word *Gothic* was first used in a contemptuous sense by those writers of a later time who wished to praise classical art at the expense of that of the Middle Ages. Early in the nineteenth century a disposition to use this style appeared in England, France, and Germany. In England especially this led to important results. See ARCHITECTURE, and GOTHIC REVIVAL.

**Gothic Language**: the language of that branch of the Teutonic race called the Goths, especially as known through a Visigothic Bible translation of the fourth century A. D. The earliest historical indications concerning the home of the Goths place them along the lower course of the Weichsel (Vistula) in modern Poland and Prussia between Warsaw and Dantzic. Here they remain as late as 150 A. D., but early in the following century, having been dislodged probably by the movements of their Finno-Hunnish neighbors, they are found on the northern side of the lower Danube and on the northwestern shore of the Black Sea in modern Roumania and Southwestern Russia as far E. as Odessa. To the W. on the Danube were the Visigoths, to the E. in Southwestern Russia the Ostrogoths. In 251 they defeated the Emperor Decius at Philippopolis, but in 270, after various incursions into Thrace and Greece, were driven back to their seat N. of the Danube. They were known to the ancient historians and geographers as Γούτωνες (Strabo), Γύθωνες (Ptolemy), *Gotones* or *Gothones* (Tacitus), and later as Γότθοι (Suidas), *Gothi* (Spartianus), which points to the native name **Gutans*, or **Gutōs*. The word *gutþiudai* (dative of *gutþiuda*, *gut* + *þiuda*, folk) preserved in a fragment of a calendar in *Codex Ambros.* A is the only indication in native sources.

The only sources of knowledge of the language are: (1) Portions of a Bible translation, of a paraphrasing interpretation of the Gospel of John, and of a calendar contained in fragments of manuscripts written in Italy in the sixth century, presumably by Ostrogoths. These are the *Codex Argenteus*, now in the university library at Upsala, the *Codex Carolinus*, in the library at Wolfenbüttel, five *Codices Ambrosiani*, in the Ambrosian Library at Milan, and the *Codex Turinensis*, at Turin. (2) The signatures of Gothic witnesses on two Latin records or receipts, one at Naples, one formerly at Arezzo, but now lost. A few Gothic words and names of alphabetic symbols in a Salzburg MS., now at Vienna. (3) A few Gothic words (*eils* and *scapiamatziaiadrincan skap jah matjan jah drigkan* (?)) in a Latin epigram, a large number of proper names from Greek and Latin sources, and in old Spanish documents and inscriptions. (4) The scanty records of a Gothic language, probably Ostrogothic, preserved as late as the sixteenth century in the Crimea, and reported by Augerius von Busbeck in his *Epistolæ quatuor* (Paris, 1589). Cf. Tomaschek, *Die Goten in Taurien*, 1881. The Bible translation, of which there remain portions of Matthew, Mark, Luke, John, Romans, 1 and 2 Corinthians, Galatians, Ephesians, Philippians, Colossians, 1 and 2 Thessalonians, 1 and 2 Timothy, Titus, Philemon, Esdras, Nehemiah, is associated always with the name of Ulfilas (Gr. Οὐλφίλας), i. e. Wulfilas, as translator. He was probably himself a Goth, born about 310 A. D., made bishop of the Goths 341, removed 348, with a large body of his followers avoiding persecution, into Mœsia, S. of the Danube; died 380 or 381. Cf. Waitz, *Ueber das Leben und Lehre des Ulfilas* (1840); Bessel, *Ueber das Leben des Ulfilas* (1860); Bernhardt, *Vulfila* (introd., 1875); Scott, *Ulfilas, Apostle of the Goths* (1885); Bradley, *The Goths* (1890).

Ulfilas not only did the work of translation, probably of the entire Bible, but he invented an alphabet for it, using as a basis the Greek uncial alphabet of his time with preservation of its order, as well as of the numerical and phonetic values of the letters. He adapted it, however, to its purpose by the use of forms taken from the Latin and the Runic alphabets, creating a system better for the purpose than either of the three. The alphabet is given in the next column, accompanied by the numerical values of the letters and their usual transcription.

| 𐌰 | 𐌱 | 𐌲 | 𐌳 | 𐌴 | 𐌵 | 𐌶 | 𐌷 | 𐌸 | 𐌹 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| a | b | g | d | ē | q | z | h | þ | i |

| 𐌺 | 𐌻 | 𐌼 | 𐌽 | 𐌾 | 𐌿 | 𐍀 | 𐍁 | 𐍂 |
|---|---|---|---|---|---|---|---|---|
| 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| k | l | m | n | j | u | p | – | r |

| 𐍃 | 𐍄 | 𐍅 | 𐍆 | 𐍇 | 𐍈 | 𐍉 | 𐍊 |
|---|---|---|---|---|---|---|---|
| 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 |
| s | t | w | f | χ | hw | ō | – |

The language is of the highest importance for the historical grammar of the Teutonic languages, because it represents the earliest extended record of any language within this group, and approaches in general, though not in every particular, nearest to the type of pro-ethnic Teutonic speech.

*Phonology.*—Following peculiarities are to be remarked: *ē* and *ō* are close long vowels; *ei* denotes *ī* (*i* in *pique*); *i* is always short; *a* and *u* are both long and short; *ai* and *au* denote either diphthongs (marked *ái*, *áu*) or the open vowels *ē*, *ō* (marked *aí*, *aú*), generally short; *b*, *d*, *g* denote the voiced aspirants *b̄*, *d̄*, *ḡ*, as well as the medials *b*, *d*, *g*; *j* and *w* (pron. like Eng. *y* in *yet* and *w* in *wet*) are the semivowels of *i* and *u*; *q* (like Lat. *qu* in *quis*) and *hw* (like Eng. *wh* in *what*) are not double consonants. The position of the language can be most readily appreciated from the following table, giving for each Gothic sound its commonest Indo-European progenitor or progenitors, with cognate words containing it in Greek or Latin, English and German:

| Goth. | I.-E. | Goth. | Gr. or Lat. | Eng. | Germ. |
|---|---|---|---|---|---|
| ă | ă | tagr | δάκρυ | tear | zähre |
| | ŏ | ahtau | octo | eight | acht |
| āh | ank, onk | fāhan | pango | fang | fangen |
| ĕ (aí)* | ĕ | aírþa | ἔραζε | earth | erde |
| | ĭ | maíhstus | ὀμιχεῖν | mixen † | mist |
| ē | ē | -sēþs | sēmen | seed | saat |
| ŏ (aú)* | u | daúr | θύρα | door | tor |
| ŏr | r | haúrn | κάρνος | horn | horn |
| ō | ō | fōtus | πώς (Dor.) | foot | fuss |
| | ā | brōþar | frāter | brother | bruder |
| ĭ | ĕ | midjis | medius | mid- | mitte |
| | ĭ | fisks | piscis | fish | fisch |
| ī (ei) | ī | swein | suīnus | swine | schwein |
| | ei | steigan | στείχω | sty † | steigen |
| ŭ | ŭ | juk | jugum | yoke | joch |
| ŭn | n | tunþus | dens | tooth | zahn |
| ū | ū | fūls | pūteo | foul | faul |
| w | u | wiljan | velle | will | will |
| j | i | aljis | alius | else | elend |
| l | l | laggs | longus | long | lang |
| r | r | raíhts | rectus | right | recht |
| m | m | mēna | μήν | moon | mond |
| n | n | nahts | nox | night | nacht |
| p | b | slēpan | lābi | sleep | schlafen |
| f | p | fadar | pater | father | vater |
| b | bh | bōka | φᾱγός | beech | buche |
| | -p′- | sibun | ἑπτά | seven | sieben |
| k | g | kniu | genu | knee | knie |
| q | ḡ | qiman | (g)venio | come | kommen |
| h | k | nahts | nox | night | nacht |
| hw | q | hwas | qui | who | wer |
| g | gh | gasts | hostis | guest | gast |
| | -k′- | tigus | δεκάς | -ty | -zig |
| t | d | taíhun | δέκα | ten | zehn |
| þ | t | þata | τό(δ) | that | das |
| d | dh | daúhtar | θυγάτηρ | daughter | tochter |
| | -t′- | hund | ἑκατόν | hundred | hundert |
| s | s | sitan | sedeo | sit | sitzen |

* Before *r* and *h*. † Obsolete.

*Morphology.*—The inflection of nouns is distinguished by its relatively close approach to the original Indo-European system. Of the cases it preserves the nom., voc., genit., accus., and dat., the latter including the original instrumental and locative, and to some extent the ablative. The following declensions are preserved: Those in *-o-*, *-ā*, *-iə-*, *-i-* (*-eį-*), *-u-* (*-eu̯-*), *-n-*, and traces of the other consonant declensions. The original accus. plur. ending is preserved, as in no other Indo-European language except certain Greek dialects; cf. *anstins*, *sūnuns*, *dagans*. The old genit. of *i-* and

*u*- stems *anstáis*, *sūnáus*, appears as in Sanskrit *gatēs* and *sūnōs*. The *i*-stems tend to merge with *o*-stems, and the old consonant stems to pass into the *u*- declension; cf. *fōtus*. The verbal inflection retains the dual and many of the middle forms, also of the optative and imperative. The *mi*-conjugation remains only in traces. The original *-o-*, *-e-* verbs form the class of "strong" verbs, and a new specifically Germanic conjugation called "weak" verbs has been formed by combination of the old participles in *-tós* with a preterite constructed from what was in Indo-European a single personal ending, *-thês* > Skr. *-thâs*, Gr. *-θης*; cf. Kuhn's *Zeitschrift*, xxx., 313.

LITERATURE.—(1) Texts: Bernhardt, *Vulfila* (Gothic and Greek text, introduction and commentary, 1875); Heyne, *Ulfilas* (with grammar and glossary; 8th ed. 1885); Uppström, *Codex Argenteus* (1854), *Decem codicis argentei rediviva folia* (1857), *Fragmenta gothica selecta* (1861), *Codices gotici ambrosiani* (1864–68). (2) Grammars: Braune, *Gotische Grammatik* (3d ed. 1887; also in Eng. transl.); Dietrich, *Ueber die Aussprache des Gotischen* (1862); Meyer, *Die gotische Sprache* (1869); Sievers, *Geschichte der gotischen Sprache* (*Grundr. der German Philol.*, i., 407 ff); Wright, *Primer of the Gothic Language* (with grammar notes, and glossary, 1892), an excellent introductory book; Douse, *An Introduction, Phonological, Morphological, Syntatic, to the Gothic of Ulfilas* (1886). (3) Dictionaries: Schulze, *Gothisches Glossar* (1847, the most complete); Diefenbach, *Vergleichendes Wörterbuch der gotischen Sprache* (2 vols., 1851, out of date); Balg, *A Comparative Glossary of the Gothic Language* (1887–89); Feist, *Grundriss der gotischen Etymologie* (1888). BENJ. IDE WHEELER.

**Gothic Revival**: an attempt to resume the use of the Gothic style in modern times; particularly the movement begun in England about 1840 and strongly advocated as a return to true principles of building and decoration, and as a return to a supposed national English style. The result has been that the great majority of churches in the British isles have been of some mediæval style, and that a great many have been built or rebuilt between 1840 and 1890, and that a number of town-halls, schools, etc., have also been Gothic in general character, but the hopes of the enthusiastic reformers have been disappointed in this, that no generally accepted style, common to all and followed by all, has grown up, and that the modern Gothic work remains chiefly archæological in character, and without life of its own.

RUSSELL STURGIS.

**Goth'land**, or **Gottland** (Swed. *Götartke*): the southernmost, richest, and most populous of the three provinces of Sweden. Area, 37,000 sq. miles. The northern part is mountainous, rich in iron, copper, alum, and nickel, and covered with forests of pine. The southern part is very fertile and well suited for agriculture. Pop. (1891) 2,595,236.

**Goths, The** [*Goth*, from Lat. *Go'thi* = Gr. Γόθοι. Goths, from Goth. **Gutos*, Goths (stem appearing in *Gut-þiuda*, Goth-people]: a Germanic people which, as early as the fourth century B. C., had established itself upon the lands along the south shores of the Baltic Sea. They continued to occupy this territory until the first century of the Christian era. Of their earliest history nothing of importance is known except that in the second century they began a southward movement, which brought them a century later to the lands lying N. of the lower Danube. Here they came into contact with the Romans. It was in the year 238 A. D. that the Goths first encroached upon Roman territory. They were defeated by Decius in 251, but between 253 and 260 they constructed a fleet, and after overrunning the northern part of Asia Minor, appeared in the Bosphorus and the Archipelago. In a short time they overran Athens, Corinth, Argos, and Sparta, and laid waste the intervening country. They destroyed the celebrated temple of Diana at Ephesus in 263, and in the years following they overran Macedonia and Thrace, but were defeated in Moesia by the Emperor Claudius in 269. By Aurelian they were then driven back over the Danube. A period of friendly relations followed, but in 321 they again crossed the Danube, only to be defeated by Constantine. A succession of contests and treaties ensued, but it was not until 369 that peace with the Romans was secured. Under their celebrated King Hermanrich the Goths extended their power far into Russia, but in 375 they were met and overthrown by the advancing Huns. According to their annals, the king, disheartened by his defeat, took his own life at the age of 110.

Christianity was carried to the Goths before the middle of the fourth century. About 370 Bishop Ulphilas, after creating an alphabet for the purpose, translated the Bible into the Gothic tongue. But the Goths were too turbulent for much advancement in the arts of civilization. By the invasion of the Huns they were divided on a purely geographical basis into two portions: the Visigoths or Western Goths, and the Ostrogoths or Eastern Goths. It was not, however, till after nearly a century of turmoil that the Goths came to a settlement in the territories that are historically identified with these great names. The Ostrogoths were the first to submit to the Huns. The Visigoths besought the protection of the Roman emperor. After some hesitation the prayer was granted. It is estimated that an army of 200,000 men, with their women and children, amounting in all to a million souls, became Roman subjects on the south side of the Danube. But the food allowed the new colonists was not satisfactory, and a revolt soon ensued. The imperial army was sent to bring the insurgents to terms, but the result was most disastrous. Of the battle of Adrianople, fought Aug. 9, 378, Gibbon has remarked that it "equaled in actual loss and far surpassed in fatal consequences" the battle of Cannæ. Two-thirds of the Roman army were destroyed, and the victorious insurgents advanced as far as to the walls of Constantinople. But the consequences of this victory were soon neutralized by the wise vigor of the Emperor Theodosius. In the course of the half-century that followed, the Goths were at times regarded as friendly confederates, at times as enemies. In 451 the Huns were defeated in the great battle of Châlons, and the Goths were thus in a measure relieved of their most formidable enemy. The Visigoths soon yielded the territory of Gaul to the Franks and Romans and took possession of the Spanish peninsula, which they continued to hold with unimportant results until the advent of the Moors in the eighth century. The career of the Ostrogoths was far more important. Through the leadership of Theodoric they not only conquered Italy, but held it for a term of years in comparative peace and prosperity. Theodoric was a member of the Gothic line of kings, being the fourteenth of the royal line of Amali. His education adapted him in a peculiar manner for the position he was to occupy. At the age of eight he was yielded to the Roman emperor as a pledge of good faith in an alliance with the Roman power. Theodoric received not only such mental training as would come to him at Constantinople in that illiterate age, but such bodily development as would result from all the exercises of war. At the age of eighteen he was restored to the Ostrogoths, and on the death of his father, in A. D. 476, he was proclaimed king. The death of the Eastern Roman Emperor Leo, in 474, was followed by the weakness and indecision of Zeno, whose reign continued till 491. It was during this period that Theodoric, at the head of a ferocious people, resolved to take advantage of the weakness of the empire and make himself master of Italy. Crossing the Danube with his entire people he marched 700 miles in the depth of a rigorous winter, and after surmounting the formidable barriers of the Julian Alps presented himself with an invincible host on the borders of Italy in the spring of 489. Three important battles, followed by the successful siege of Ravenna, made Theodoric master of Italy. His power was reluctantly acknowledged by the Eastern emperor. It was during the next thirty-three years of peace and prosperity that Theodoric won the esteem of his own times and the permanent establishment of his great name. Under his wise and powerful rule the sovereignty of the Goths was established from Sicily to the Danube and from Sirmium to the Atlantic. But the government, however wise under a great monarch, was not of a nature to establish permanent prosperity. Theodoric retained in his own hand the whole substance of imperial power; therefore, when he died, the excellences of his rule could not be continued. When in the year 500 Theodoric visited Rome, the people hailed him as a second Trajan. But even the best of the emperors seemed fated to be attended by treachery and imbecility. The Gothic king issued edicts ordering his subjects to preserve the monuments of the people whom they had conquered, and he brought to his court for the purpose of encouragement the best scholarship of the time. But when the scepter fell from his dead hand in 526, the essential barbarism of his people soon became evident. A period of great turbulence ensued which was not brought to an end till the final victory of Narses over Totila in 552 A. D. This battle completed the destruction of the Gothic power in Italy, and placed the keys of Rome once more in the hand of the

Roman emperor. The subject is treated by nearly all the contemporary writers of the period. Of modern authorities the best are Gibbon, *Decline and Fall of the Roman Empire* (chaps. x. and xxxix.); Millman, *History of Latin Christianity* (bk. 3); Dahn, *Die Könige der Germanen* (4 vols., 1866); Manso, *Ges. d. Ostgothischen Reichs in Italien* (1824).

C. K. Adams.

**Gottenburg**: See Gothenburg.

**Gottfried of Strassburg**: German poet or Minnesinger; flourished in the latter part of the twelfth and beginning of the thirteenth centuries. There is no authentic account of his life, but Strassbourg is supposed to have been his birthplace, and he is thought to have held there a position of considerable influence. His chief work, the epic poem of *Tristan und Isolde*, was begun between the years 1204 and 1215, and was unfinished at the time of his death, which occurred within the first quarter of the thirteenth century. It was one of the finest specimens of mediæval poetry extant, being considered by many critics the equal of Eschenbach's *Parcival*. The style is light and graceful, and the descriptions are singularly vivid. The extensive influence that it exercised upon German literature is attested by the number of writers who afterward treated the same theme in Gottfried's manner. In its unfinished state the poem contains between 19,000 and 20,000 lines, to which additions were made by Ulrich von Türheim (about 1736) and Heinrich von Freiberg (about 1270), but their continuations were far inferior to the original. Of his other works a few short lyrics are all that remain.

**Göttingen**, göt'ting-*en*: town of Prussia; in the province of Hanover, on the Leine (see map of German Empire, ref. 4–E). It has a neat and quiet appearance, and some manufactures of woolens, tobacco, and leather. It is chiefly noted for its university, with which are connected an excellent library of 550,000 volumes, a museum, a botanical garden, an observatory, an anatomical theater, a chemical laboratory, and other scientific institutions. It was founded in 1737 by George II., King of England and Elector of Hanover, and the magnificent scale on which it was established and maintained made it soon one of the most celebrated universities of Germany. In 1837 seven of its most celebrated professors—among them the two Grimms and Gervinus—were expelled for political reasons. From this blow the institution has never recovered, and the number of students, which in 1823 was 1,547, declined to 737 in 1864. In 1898 the number of students increased to 1,383, and the university is still an institution of great repute and influence, though Berlin and Leipzig have taken the lead. Pop. (1890) 23,689.

Revised by C. H. Thurber.

**Gott'land**, or **Gothland**: an island in the Baltic belonging to Sweden, and situated in lat. 56° 55′ N. and lon. 18° 10′ E. Area, 1,227 sq. miles. Capital, Wisby (*q. v.*). The climate is mild, and the inhabitants are engaged chiefly in agriculture, shipping, fishing, and lime-burning. Pop. (1891) 51,337.

**Gottschalk**, got'shăălk, **Got'teschalk**, or **Godescalc** (*Gotheschalcus Fulgentius*): theologian; son of Count Berno of Saxony; b. about 806; became, in consequence of parental vows, an inmate of the Benedictine monastery of Fulda, and received the tonsure, but later he denied the validity of the rite enforced upon him and desired to leave the convent. His case was decided in his favor by the Synod of Mentz in 829, but he was restrained by the Abbot Raban, who, however, permitted him to exchange the monastery of Fulda for that of Orbais; there he devoted himself to the study of Augustine and the propagation of the predestinarian doctrines in their most extreme form, involving a denial of the freedom of the will and the universality of the atonement; was everywhere opposed, especially by Nothingus, Bishop of Verona, and by his old master Raban, now Archbishop of Mentz; condemned by the Council of Mentz 848; tried by Hincmar of Reims and Charles the Bald at Quiercy (849); flogged in presence of the king and bishops, and imprisoned for life in the abbey of Hautvilliers, where he died 868 or 869, Hincmar denying him the consolations of the Church in his last hours because he would not recant. Remigius of Lyons, Prudentius of Troyes, and Ratramnus of Old Corbie were among his defenders, and Scotus Erigena wrote a treatise against him. A *Life* of Gottschalk, by Archbishop Ussher, appeared in 1631, and Mauguin in 1650 published the existing fragments of his works. See his *Leben und Lehre*, by von Borrasch, (Thorn, 1868).

Revised by Samuel Macauley Jackson.

**Gottschalk**, Alexandre: civil engineer; b. at St. Petersburg, Aug. 13, 1832; graduated at the École Centrale of Arts and Manufactures in Paris in 1853. He was first employed on railway works in Russia, afterward superintendent of traction of the South Austrian Railway; in 1880 president of the society of Ingénieurs Civils of France; member of the consultative committee of the Ministry of Public Works on the technical operation of railways; officer of the Legion of Honor; and engineer counsel of various railway and investment companies.

W. R. Hutton.

**Gottschalk**, Louis Moreau: pianist; b. in New Orleans, May 8, 1829; studied in Paris and made his first public appearance there in 1845. He returned to the U. S. in 1853 and at once became the most popular pianist in the country. He went on many concert tours, always playing his own compositions. He also traveled extensively in Mexico, the West Indies, and South America, and died in Rio de Janeiro, Brazil, Dec. 18, 1869, being seized with his fatal illness while at the piano playing his last composition, *La Morte*. His compositions include a few songs, a symphony entitled *La Nuit des Tropiques*, a triumphal cantata, an overture, and many piano solos. These solos became very popular.

D. E. Hervey.

**Gottsched**, got'shet, Johann Christoph: critic; b. at Judithenkirch, near Königsberg, Prussia, Feb. 2, 1700; studied languages and literature at the University of Königsberg; in 1730 became Professor of Philosophy and Poetry at the University of Leipzig, and in 1734 Professor of Logic and Metaphysics. He also edited several periodicals, using them in his endeavors to reform polite literature and the drama, and from 1729 to about 1740 had supreme influence in Germany. He attacked and actually crushed the second Silesian school of poets, whose characteristic was a wild bombast. He himself represented French taste, and endeavored to make the French drama a model for the German stage, but becoming extravagant and overbearing in his criticisms, he opposed the Swiss writers Bodmer and Breitenger, whose taste was English, and refused to acknowledge the genius of Klopstock and Lessing. He in turn met with opposition, then with ridicule, and finally lost all influence. He wrote a drama, *Der sterbende Cato* (The Dying Cato) 1732; a number of educational works, and compiled a catalogue of German plays, *Nöthiger Vorrath zur Geschichte der Deutschen dramatischen Dichtkunst* (1757–65). His wife, Louise Kulmus (1713–62), aided him in translating dramas from the French, and herself translated *The Spectator* and Pope's *Rape of the Lock*. Gottsched died at Leipzig, Dec. 12, 1766. See Danzel, *Gottsched und seine Zeit* (1848).

**Götz von Berlichingen**: See Berlichingen, Götz von.

**Gouda**, gow'dăă, or **Tergouw**, ter-gow': town of the Netherlands; in the province of South Holland, on the Yssel; 13 miles by rail N. E. of Rotterdam (see map of Holland and Belgium, ref. 6–E). Its Church of St. John is celebrated for its stained-glass windows of the sixteenth century. Gonda has large manufactures of bricks, cheese, tiles, pottery, and clay pipes. Pop. (1890) 18,847.

**Goudy**, Henry: See the Appendix.

**Gough**, gof, Hugh, Viscount: soldier; b. at Woodstown, Ireland, Nov. 3, 1779. He joined the British army in 1794; served with distinction at the Cape of Good Hope 1795, and in Spain 1809–13, where he was thrice wounded; became a major-general 1830; went to India 1837; led the land forces in the Chinese opium war 1841; was made a baronet and G. C. B. 1842; and commanded the British forces against the Mahrattas 1843, and the Sikhs 1845; was made a baron 1846; commanded in the second Sikh war 1848–49, but in consequence of the terrible losses inflicted upon the British by the Sikhs his generalship began to be criticised, although all his battles were victories; and Sir Charles Napier in 1849 took his place. Gough was created viscount and handsomely pensioned (1849), made colonel of the Horse Guards 1854, K. P. 1857, privy councilor 1859, G. C. S. I. 1861, field-marshal 1862. D. near Dublin, Mar. 2, 1869.

**Gough**, John Bartholomew: temperance lecturer; b. at Sandgate, Kent, England, Aug. 22, 1817; removed in 1829 to the U. S.; became a bookbinder in New York in 1831, and after some years of poverty, caused by intemperance, he reformed, and in 1843 became a temperance lecturer, and labored with great zeal and success all over the U. S. In 1853 he visited the British islands and lectured there to large audiences. In 1857–60 he again visited Great Britain. His last visit was in 1878. See his *Autobiography* (1846, en-

larged 1870); *Orations* (1854); *Temperance Lectures* (1879); *Sunlight and Shadow; or, Gleanings from my Life-work* (1880). D. at Frankford, Pa., Feb. 18, 1886.

**Goujon**, goo'zhōn', Jean: sculptor and architect; b. in Paris in the sixteenth century. He decorated the Château d'Anet for Henri II. and Diana of Poitiers. One of his most noted works is the fountain of the Innocents at Paris, executed in 1550, which, however, has been rebuilt in a different form. He designed the Hôtel Carnavalet. The ornamentation of the outer doorway of the courtyard of the Louvre is his. Many of his works were destroyed during the Revolution. According to common tradition he died in 1572 on St. Bartholomew's day, wounded by an arquebus while working on a scaffolding on the ornamentation of the Louvre, a victim either to religious fanaticism or to some secret jealousy; but late writers have shown that there is no sufficient evidence for this date. W. J. Stillman.

**Goulard's Cerate**: See Lead, Medicinal Uses of.

**Goulard Water**, or **Goulard Extract**: See Acetate.

**Gould**, Augustus Addison, M. D.: zoölogist; son of Nathaniel Duren Gould, a teacher of music and writing; b. at New Ipswich, N. H., Apr. 23, 1805; graduated at Harvard 1825; was for some time instructor in Harvard University, and in 1856 became one of the physicians of the Massachusetts General Hospital, Boston. He published many scientific papers; a *System of Natural History* (1833); *Report on the Invertebrate Animals of Massachusetts* (1841); reports on mollusks collected by the Wilkes and the Ringgold and Rogers expeditions; *Otia Conchologica* (1863); translated works of Gall and Lamarek; with L. Agassiz published *Principles of Zoölogy* (1848). D. at Boston, Sept. 15, 1866.

**Gould**, Benjamin Apthorp, Ph. D., LL. D.: astronomer; son of Benjamin Apthorp Gould, master of the Boston Latin School; b. in Boston, Sept. 27, 1824. After graduating at Harvard College in 1844, he devoted himself to the study of astronomy at the observatories of Greenwich, Paris, Berlin, Göttingen, and Altona, returning home in Dec., 1848. In 1849 he established at Cambridge *The Astronomical Journal*, a periodical dedicated solely to original investigations, which he maintained, chiefly at his own expense, until 1861, when the civil war rendered its suspension necessary. In 1851 he took charge of the longitude operations of the Coast Survey, to which Bache and Walker had just begun the application of the electric telegraph. This method he extended and perfected, until in 1866 about twenty longitudes had been determined in the U. S. with the highest precision yet attainable by modern science. Immediately on the successful completion of the transatlantic cable in that year he established an observatory at Valentia, in Ireland, and established its longitude from Newfoundland on the one hand and Greenwich on the other, thus completing a series of telegraphic longitude measurements from the Royal Observatory to New Orleans, and connecting these with the new European series from Greenwich to the Ural Mountains. In 1855 the Dudley Observatory at Albany having been organized, its management was committed to a scientific council consisting of Messrs. Bache, Henry, Peirce, and Gould, and its directorship was confided to Dr. Gould, who accepted it without remuneration, planning the principal instruments and superintending their construction. Here, for the first time, a normal clock, placed in a position as free as possible from atmospheric influences, gave its time telegraphically to dials in the observing-rooms. Important modifications, almost universally adopted since that time, were introduced in the meridian instruments, and the now celebrated difference-engine of Scheutz was procured, and used in calculating astronomical tables. In 1863, the sanitary commission having requested Dr. Gould to take charge of their statistics, he organized in connection with these an elaborate system of anthropological measurements, which were subsequently computed and tabulated. From the discussion of the ages of soldiers in the Union army in connection with the census, he deduced the curious formula which seems to control the distribution of a population according to ages, and which has been singularly verified by subsequent censuses of the U. S. and other countries. The law of growth in human stature was also elicited by these researches, as also the normal relation between height and weight, and the typical proportions of the human body. In 1870 he went to South America to establish a national observatory for the Argentine Republic at Cordova and to complete the catalogue of the southern stars. He completed a series of maps of the stars visible to the naked eye from the observatory, and took observations on more than 83,000 of them. He also organized there a national meteorological office, and made various telegraphic determinations of longitude. In 1885 he returned to his native country, and, two years later, resumed the publication of *The Astronomical Journal*. He was a member of the international metric commission, and president of the American Metrological Society, the object of which is to promote the use of the metric system of weights and measures. Among his works are *On the Transatlantic Longitude* (1869); *Military and Anthropological Statistics of American Soldiers* (1869); and *Ancestry of Zaccheus Gould* (1872). D. in Cambridge, Mass., Nov. 26, 1896. Revised by Simon Newcomb.

**Gould**, John: ornithologist; b. at Lyme, Dorsetshire, England, Sept. 14, 1804: removed to the vicinity of Windsor; in 1827 became curator to the Royal Zoölogical Society's Museum; spent his whole life in the study of ornithology, and published *A Century of Birds from the Himalaya Mountains* (1832); *The Birds of Europe* (1832–37); *Birds of Australia* (1840–48, 7 vols. fol.), besides a number of monographs: *On the Partridges of America* (1844–46); *On Humming-birds* (1849), etc. He left unfinished works entitled *The Birds of Great Britain*, *Birds of Asia*, and *Birds of New Guinea*. D. in London, Feb. 3, 1881.

**Gounod**, goo'nō', Charles François: composer; b. in Paris, June 17, 1818; son of a painter. His early passion was for sacred music; his first great success was a mass performed at the Church of St. Eustache in 1849. He began to write for the operatic stage in 1850, and persevered in it, in spite of the unpopularity of much of his work and the impulses of a deeply religious temperament, which, it has been remarked, more than once nearly prevailed to make him a recluse. His compositions show a mastery of musical science, uncommon resources of melody, and affluence of ideas. The best known work is *Faust* (1859), which was performed, as first written, nearly 200 times at the Théâtre Lyrique, and in 1893 reached its one thousandth representation. Other operas are *La Nonne sanglante* (1854); *Le Médecin malgré lui* (comic) (1858); *Philémon et Baucis* (1861); *Mireille* (1862); *La Reine de Saba* (1862); *La Colombe* (1866); *Roméo et Juliette* (1867), the last the most celebrated after *Faust*; *Polyeucte* (1878); *Le Tribut de Zamora* (1881). Gounod wrote a lyric drama (*Sapho*, 1850), three symphonies, several masses and cantatas, and a number of songs. He was a member of the Academy of Fine Arts, was decorated with the Legion of Honor, Aug. 15, 1857, and was made an officer Aug. 13, 1866. In May, 1866, he was elected a member of the French Institute. Gounod's latest works of large dimensions are the oratorios of *The Redemption* and *Mors et Vita*. These, though measurably successful, did not enhance the author's reputation. D. in Paris, Oct. 18, 1893.
Revised by Dudley Buck.

**Goupil**, goo'pee', Jules Adolphe: genre and portrait painter; b. in Paris, May 7, 1839. Pupil of Ary Scheffer; first-class medal, Salon, 1875; second-class, Paris Exposition, 1878; Legion of Honor 1881. His pictures are good technically, and harmonious in color. His *Last Days of Madame Roland* (1880) is in the Luxembourg Gallery in Paris. D. at Neuilly, Apr. 30, 1883.

**Gour**, gowr, or **Gaur**: a mediæval city of importance, now an insignificant village; in Malda district, Bengal, British India, between the town of Malda and the Ganges river, in about lat. 24° 50′ N. and lon. 88° 10′ E. (see map of North India, ref. 7–I). It is first mentioned in history in 1243, but it had apparently long been a dynastic center under the name of Lakhnaoti. It was abandoned in the sixteenth century as a result of a pestilence, probably the cholera. The ruins cover a space 7 miles by 2, and include many structures and inscriptions of great archæological interest. M. W. Harrington.

**Gou'ra**, goo'ra [Mod. Lat., from the native name]: the common as well as generic name of the large crowned pigeons constituting the family *Gouridæ*. They are the largest of living pigeons, measuring over 2 feet in length, and are distinguished by a large, erect, fan-like crest of loose feathers. The general color of the various species is slaty blue, marked across the wings with whitish and chestnut stripes. The half-dozen known species are confined to New Guinea and a few of the adjacent islands, are ground-frequenting birds, and live on fruits. F. A. Lucas.

**Gou'rami**, or **Gor'amy** (the Javanese name): a valued food-fish (*Osphromenus goramy*) of the brackish and fresh

waters of Farther India, Cochin China, and the islands of Java, Madura, Sumatra, and Borneo. The shape is a deep oval, the scales are large, and the first soft ray of the ventral fins is produced to the end of the body. The gourami is said to attain a length of 5 or 6 feet and a weight of 100 lb., but specimens 2 feet long and weighing 12 to 15 lb. are considered large. This fish builds a nest of plants and mud in which the eggs are deposited, and the parents guard the young with great care. On account of the delicacy of the flesh, numerous attempts have been made to introduce the gourami into foreign countries, but these have succeeded only in Mauritius and the adjacent island of Bourbon.

F. A. Lucas.

**Gourd**, gōrd or goord [M. Eng. *gourd*, from O. Fr. *gourde*, earlier *gougourde* and *cougourde*, Mod. Fr. *courge* < Lat. *cucur'bita*, whence Germ. *Kürbiss*, gourd]: a name applied indiscriminately in Great Britain to many members of the natural family *Cucurbitaceæ*, but in the U. S. restricted to the genus *Lagenaria* and to the small, hard-shelled and inedible forms of *Cucurbita pepo*. *Lagenaria* is derived from the Latin *lagena*, a bottle, and refers to a frequent shape of the fruit, of which the shell is used not only for bottles, but, after soaking to remove the bitter principle, for dishes, cups, and especially for dippers, for which the natural handles especially adapt it. In the Southern U. S. a gourd is almost always found suspended at a spring for the use of travelers. The *Lagenaria* climbs extensively over walls and shrubbery by means of its compound tendrils. The clammy pubescent herbage has a powerful odor of musk. It has rounded leaves, long-stalked flowers greenish white in color, and fruit differing greatly in size and shape; hence the great variety of purposes to which it can be applied by cutting the rind and removing the contents. The sterile flowers are on a long peduncle, the fertile on a short one, and are musk-scented like the leaves. The plant is a native of Africa and Asia. The small egg-shaped and pear-shaped gourds which are used for ornaments belong to the same species as the field pumpkin (*Cucurbita pepo*). There are many forms, all of the easiest culture. Various other small hard cucurbitaceous fruits are frequently called gourds in the U. S. Revised by L. H. Bailey.

**Gourd Family**: the *Cucurbitaceæ*; a group of herbs or undershrubs with climbing or trailing tendril-bearing stems, and dicliuous flowers, the pistillate with the compound ovary inferior. The 633 species are mainly tropical, comparatively few being natives of temperate regions. Squashes, melons, gourds, etc., are familiar examples of species of this family. Twenty-eight species are natives of North America, one of the most remarkable of which is the "wild pumpkin" (*Cucurbita fœtidissima*) of the great plains, whose perennial root is from 6 to 8 feet long and as thick as a man's body, while its fruit is as large as an orange. Both root and fruit are intensely bitter. Charles E. Bessey.

**Gourko**, goor'kō, Count Joseph Vassilyévich: Russian general; b. in 1828; educated in the Imperial Corps de Pages; entered the army and rose rapidly, becoming colonel 1861; major-general 1867, joining the emperor's suite; took part, though not prominently, in the Crimean war, and won distinction in the Russo-Turkish war. His successful passage of the Balkans in the middle of the winter of 1877–78 was one of the greatest deeds ever performed by a Russian soldier. He was created count in 1878 and afterward appointed governor of Warsaw. Field-marshal, Dec., 1894.

**Gout**, gowt [M. Eng. *goute*, from O. Fr. *gotte*, *goute* > Fr. *goutte*, drop, gout, Ital. *gotta* < Lat. *gutta*, drop, the disease being considered due to a defluxion]: a nutritional disease, characterized by excessive formation of uric acid, and by attacks of acute inflammation of the joints. Gout was long confounded with rheumatism, though now clearly recognized as an entirely distinct affection. Many elements doubtless enter into the causation of the disease, but its repeated occurrence in members of the same family is remarkable. It has been found that in fully 50 or 60 per cent. of all cases the disease existed in the parents or grandparents. Besides heredity food and drink are important etiological factors. The excessive use of food, and particularly meats, has been long recognized as a potent factor. Usually combined with improper or excessive eating, and of great importance, is the excessive drinking of alcohol, especially fermented liquors. For these reasons gout is most common in Great Britain and Germany, where much ale and beer are drunk. For the same reason the disease is common among the rich and indolent, though it must not be thought to be exclusively present in this class. Among the ballast-heavers of London, among whom poor food, bad hygiene, and excessive indulgence in malt liquors are marked elements in the daily life, gout is exceedingly common. In the U. S. it is a comparatively rare disease, a fact which is due to the more active and hygienic life, and the better food as well as the lighter quality of the beers drunk. Chronic lead-poisoning is sometimes an etiological factor of importance.

The essential nature of the disease is not definitely known, but there appears to be a widespread nutritional disorder leading to excess of uric acid in the blood, the alkalinity of this fluid being thereby diminished and a tendency to deposit of urates established. This indefinite state of the system has been called the *gouty diathesis*, or *lithæmia*. This condition may be manifested by a great variety of symptoms referable to the gastro-intestinal, urinary, vascular, or nervous systems, and the patient may never be the subject of an acute attack, the true nature of the ailment being recognized by the habits of the patient, and the fact that members of his family suffer with distinct gouty attacks. In other persons this lithæmic state, after varying periods of time, may terminate in a seizure of acute gout. The latter comes on late at night, usually after midnight, the patient awaking with most severe pain in the metatarso-phalangeal joint of the great toe. The part swells rapidly, is hot, tense, and shiny; the most intense pain continues and the patient feels as though the joint were gripped in a vise. The pain grows worse and worse, becoming after a few hours almost intolerable, and the weight of the bedclothes can not be endured. Toward morning the attack subsides, the slight fever which was present disappears, and the patient falls asleep. The next night a recurrence is apt to come on, and so on for several days, usually six to eight. Sometimes other joints are involved, particularly the big toe of the other foot, rarely the larger joints. After the attack the skin of the toe desquamates, and intense itching continues the patient's discomfort. Similar attacks may come on several times a year, or only at long intervals. A rapid subsidence of the symptoms during an attack is always regarded with apprehension, as it is a frequent indication of *retrocedent* or *masked gout*, in which serious derangements of the gastro-intestinal or cardiac systems may appear, and sometimes lead to a fatal issue.

Between acute attacks the various conditions of the lithæmic state are noted, and not rarely a peculiarly depressed mental condition, these symptoms all disappearing with the acute outburst. A distinguished English statesman was for two years so profoundly depressed by such irregular gouty disease as to have caused the fear that his mind had been irreparably diseased, when an acute attack cleared away the mists and left him with all his wonted mental vigor. With repetitions of the joint affection comes the deposition of concretions of urate of soda in and about the joint, until distinct masses are produced and the disfiguring appearances characteristic of the disease in its most chronic stages result. These chalky masses or *tophi* may finally cause ulceration of the skin, and thus become exposed. The *tophi* are also formed in the ears, more rarely the eyelids, nose, and other parts. In this stage of the disease the patient may become bedridden, tormented by the recurring acute attacks, and in the interval subject to the most depressing mental conditions and irregular internal disorders. Among the latter may be mentioned the form of chronic Bright's disease called *gouty kidney*, from the frequent association with this affection; also forms of heart disease, gastric and intestinal complaints, and occasionally disorders of various parts of the nervous system and diseases of the skin.

The treatment of the disease is directed to correction of the diathetic disorder and to the amelioration of the acute outbursts. It need hardly be remarked that the diet and drink of the patient require strictest supervision. Excessive amounts of meat should be avoided, as also relative excess in starchy food, since an undue proportion of the latter makes complete digestion of the former difficult or impossible. Malt liquors must be prohibited and alcohol in other forms severely regulated. Exercise, by stimulating the general vitality and tissue activity, has a most beneficial influence, as its withdrawal is a factor in the production of the disease. Mineral waters, such as potash or lithia waters, and milk are particularly desirable, as they flush out and promote tissue change. The skin may be kept active by exercise and by occasional Turkish baths. The acute attack is generally treated by elevation of the limb, with protection in cotton, and one drug, colchicum, is particularly useful.

This should be given with care, as excessive amounts may lead to serious consequences. Morphia is not advisable.

WILLIAM PEPPER.

**Gouverneur**, goo-ver-noor': village (settled 1806, town founded 1810, named after Gouverneur Morris, the first proprietor); St. Lawrence co., N. Y. (for location of county, see map of New York, ref. 1–H); on the Oswegatchie river and the Rome, W. and O. Railroad; 34 miles S. E. of Ogdensburg. It is popularly known as the "marble city," because of its numerous marble quarries and mills, and has the only talc mines and mills in the U. S., and large lumber, wood-pulp, and dairy interests. It has handsome buildings and streets, free seminary and free union schools, 5 churches, 2 banks, and 2 weekly newspapers. Pop. (1880) 2,071; (1890) 3,458; (1900) 3,689.

EDITOR OF "FREE PRESS."

**Gove**, AARON, LL. D.: educator; b. at Hampton Falls, N. H., Sept. 26, 1839; educated in the Boston public schools and Illinois State Normal University; adjutant Thirty-third Illinois Infantry in the civil war 1861–65; became city superintendent of schools at Denver, Col., in 1874, and has developed one of the most perfect systems of city schools in the U. S.; president of the National Educational Association in 1888. C. H. T.

**Government** [from O. Fr. *governement* > Fr. *gouvernement*: Ital. *governamento* < Lat. deriv. of *guberna're*, steer, govern, from Gr. κυβερνᾶν, pilot, steer]: in its true and most comprehensive sense, the operation of laws; but in the restricted sense in which it is proposed in this article to treat of government, and of the laws which shape its form as well as control its action, the term is intended to be applied only to the government of men in their relations, conduct, and intercourse with one another in organized society.

*The Nature of Government.*—By government in this restricted sense is meant, therefore, the exercise of that inherent, absolute power existing in every distinct and separate organized society or state, of self-determination and self-control for self-preservation which springs by nature from its own social forces, and the laws which control their action.

Every individual person is a complete living organism within itself, endowed by nature with powers of self-determination for its own preservation. But man, by nature, is less capable of self-preservation when isolated than when associated with others. Mutual protection and mutual interests therefore form the natural and only just basis for all organized associations of men. An organization formed on this basis constitutes a separate community, the state, which is to all intents and purposes an organism composed of the individual organisms that enter into it. It becomes a political and moral person, subject not only to its own special laws, but also to the general moral law to which all human action is subject, and which prescribes the limitations of natural justice. As each single organism in its powers of self-determination is controlled by its own internal laws respectively, so the aggregate organism is controlled in its powers of self-determination by those social forces or laws which give existence and life to the political body so constituted. The operation of these laws in such a political organism, in its origin as well as in its after-growth and development, physically, intellectually, and morally, is what is understood by the government of such state. The controlling power—the paramount authority, the "*jus summi imperii*"—in each state so organized, is what is known as the sovereignty thereof.

*The Development of Constitutions.*—Sovereignty, then, may be defined to be the inherent, absolute power of self-determination in the state. It is that innate attribute of the commonwealth or aggregate organism which corresponds with the will and power of self-action in the personal organisms constituting it; and by its very nature is indivisible: just as much so as the *mind* is in the individual organisms respectively. The limitations of natural justice prescribed by the universal moral law apply as well to the political persons of organized societies as to separate individuals in a supposed state of nature. In the organization of single societies, whatever may be the form assumed, the act itself is known as the social compact. The type or form of government so instituted, at first, and in its after developments, in all cases depends upon the nature and character and relative power of the social forces from which its existence springs. These forces are threefold, to wit: moral (or religious), intellectual, and physical. As these forces relatively predominate in the formation of society, so will be the character of its organic structure. This organic structure is what in all cases is known as the *constitution* of each particular state or kingdom, whether it be written or unwritten; and the sovereign power is exercised through the channels established for it by this constitutional structure, which becomes the fundamental law of the organization until changed by the same social forces which brought it into existence. In the beginning, when the physical predominates, a monarchical form of government is almost the necessary development. When the intellectual and moral predominate or are equally balanced, mixed forms of government of some sort are the consequent development. The study of these forces and the various forms of government springing from them has occupied the attention of the profoundest thinkers from the earliest times. The subject constitutes a science of the utmost importance, as nothing of an earthly character more deeply involves the interests of every people than the government under which they live. Chiefly from this spring all those institutions, moral, intellectual, and material, which mark the progress of their civilization.

It is not the purpose of this article to do more, after the foregoing premise, than briefly to set forth (1) some general views on what should be the objects of all governments of whatever form; (2) to present some of the essential principles of governments constituted for such objects, without reference to their forms; and (3) to present an outline view of the different forms of government, with especial reference to their classification as single or confederated.

I. *The General Objects of all Governments.*—It having been shown that all organized societies, and the governments resulting therefrom, are founded upon the basis of the better protection and enjoyment of the individual rights of their constituent members, the conclusion clearly follows that the chief object in every case should be the security and maintenance of all "those absolute rights which were vested in them by the immutable laws of nature." These consist of the rights of things as well as the rights of persons—the right of property as well as the rights of life and liberty.

Many writers maintain that individuals, upon entering into society, give up or surrender a portion of their natural rights. This seems to be a manifest error. In forming single societies or states men only enter into a compact with each other—a social compact—either expressed or implied, as before stated—for their mutual protection in the enjoyment by each of all their natural rights. The chief object of all good governments therefore should be the protection of all the natural rights of their constituent members; or, in other words, the object in all cases should be the establishment of what may be styled civil liberty, which is nothing more nor less than natural liberty secured by the guaranty of all the powers of organized society. No person has any natural right wantonly to hurt or injure another. The object of society and government is to prevent and redress injuries of this sort; for, in a state of nature, without the superior restraining power of government, the strong would viciously impose upon the weak. Wrongs upon rights could not be so efficiently prevented nor so adequately redressed. Upon entering into society, however, for the purpose of having their natural rights secured and protected, or properly redressed, the weak do not give up or surrender any portion of their priceless heritage in any government constituted and organized as it should be.

A succinct view may here be pertinently presented of what should be the correct understanding of what is termed civil liberty. There are few themes upon which more has been said and written than this, and few, it is believed, upon which less has been distinctly and correctly stated. Many definitions have been given to the terms liberty, natural liberty, civil liberty, and political liberty. Many of these definitions, put forth by learned men, seem to be exceedingly erroneous, many more exceedingly confused, while only a few, rightly understood, express the truth.

Burlamaqui's definition of liberty, in the sense in which it is now treated, seems fully to cover the whole ground with clearness as well as accuracy. He says, "Moral or natural liberty is the right which nature gives to all mankind for disposing of their persons and property after the manner they judge most consonant to their happiness on condition of their acting within the limits of the law of nature, and that they do not any way abuse it to the prejudice of any other men."

The great truth that all men are created equal must ever

be borne in mind in investigations upon this subject. This equality, as is manifest, does not consist in size, form, or any personal characteristics, in a physical, moral, or intellectual view. It does, however, consist in an equal right in the administration of justice. Justice is the great regulator in the government of human affairs, as gravitation is in the government of the material universe. The same simple law of gravitation which molds an atom also shapes a world. To the silent but potent influence of the same magic principle are due that harmony and concord which pervade the planetary and stellar spheres. In like manner, justice, rightly administered, stays discord and produces peace, quiet, order, and happiness in communities, states, and kingdoms. The rule of justice is the divine injunction, applicable alike to all: "As ye would that men should do to you, do ye also to them likewise."

An inquiry into what particulars certain classes, such as are to be found in all communities, from want of sufficient mental and moral development can be rightly and therefore justly restrained in their volitions and actions for their own good as well as that of the rest of society, and which their natural rights in point of fact require (as in the case with children, to say nothing of others), would lead to the gravest problems which ever engaged the attention of philanthropists, lawgivers, and statesmen. That, however, lies not within the scope of this article. The *principle* which should govern in every case is all that is at present intended to be set forth.

II. *The Essential Principles upon which all Governments should be based.*—Of these the following may be set forth as among the most important: 1. The basis should be the fundamental principle that the sovereignty is an attribute of the entire aggregate organism, and can not be divided. 2. From this follows another essential principle or truth, that all governments derive their "just powers from the consent of the governed." 3. These principles or truths being established, it further follows that all exercise of governmental power is a trust, and can be justly exercised only for the benefit of the governed. 4. Another of the essential principles or truths referred to, and the only remaining one which will be here mentioned, is this, that while sovereignty itself is indivisible, as has been shown, yet its powers are divisible. It is a point of no inconsiderable importance in discussions of this kind to bear constantly in mind the difference between the powers of sovereignty and the great source itself from which these powers emanate. The three chief powers of sovereignty when properly divided may by appropriate classification be termed the law-making power, the law-expounding power, and the law-executing power. In all properly constituted governments the exercise of these powers should be confided to separate, independent, and coordinate departments, known as the legislative, judicial, and executive. The powers exercised by each of these departments are equally sovereign, and when so divided and exercised they constitute the trinity in unity of organized society and present the grandest feature in governmental structures.

III. *Single and Confederated Forms of Government.*—The most marked differences between the different forms of government are those which indicate the propriety of their being arranged generically into two classes—single and confederated. A single government is that of a distinct state founded upon the social compact. A confederated government is that of a union of two or more single governments founded upon what is known as the federal compact. Writers usually divide single governments into five general kinds—to wit, monarchies, aristocracies, or oligarchies, as they are sometimes styled, democracies, republics, and mixed governments, or those partaking of the qualities of two or more of the others. Monarchies are usually subdivided into various kinds, such as absolute, limited, hereditary, and elective. Democracies are also subdivided into several kinds. Two only of these kinds of the latter will be here mentioned—pure and representative. (See DEMOCRACY.) A pure democracy is where all questions pertaining to public affairs are decided by the body of the people in general assembly convened. A representative democracy is where the functions of government are performed by agents, deputies, or delegates selected by such electors from the body of the people as may be empowered to make the choice by the fundamental law or constitution. The power of choosing such deputies is what is known as the franchise. It is an office conferred by organized society, and therefore a matter of trust and not a matter of natural right.

Republics are but a species of democracy, and may be subdivided into various kinds. The two most general of these kinds are those which distinguish all governments—single and confederated. The great and leading object of confederation of any sort, applicable alike to republics and all other forms of government, is the better to protect and maintain the great inherent right of self-government or self-determination possessed by each of the parties entering into it, just as the great and leading object of all single governments formed by the social compact is the better to protect and maintain inviolate the innate, absolute, and indestructible rights of the individuals entering into organized society. What are known as the natural rights of individuals correspond with what may be characterized as the sovereign rights of states or kingdoms.

*Confederated Republics.*—These have existed from the earliest times of which history has taken any notice. A characteristic feature of all of them was that under the federal compact no power was conferred, by the parties to it, upon the conventional state thereby created, to act directly in the execution of the powers that were conferred upon the individual members of society or citizens of the several republics so confederating respectively. This was left to the good faith of each of the parties severally, and it was found to be a great defect in the workings of this kind of confederations. This form of confederation is what by the German publicists is styled a *Staatenbund*, or union of states. To remedy these defects in some degree, another form of confederation has been resorted to, characterized by the same writers as a *Bundesstaat*, or federative union, in which the entire sovereignty of the separate states is merged in the new and conventional state so created. It was reserved for the statesmen of the U. S. in the latter part of the eighteenth century to remedy the evils of both the *Staatenbund* and *Bundesstaat* systems, under what is known as the federal constitution of 1787, with the amendments subsequently ratified in pursuance of its provisions. Space will not allow any extensive consideration of the striking and wonderful new features in this model of federal republics. Suffice it to say that, anterior to 1789, when the new constitution of 1787 went into operation, the U. S. of America, after the declaration of their independence, were a confederated republic upon the model of that set forth by Montesquieu, Vattel, and others; or, in other words, they constituted what the Germans style the *Staatenbund*. The defect or vice of this system was the want on the part of the general government of the power to execute, by its own functions and machinery, the many other specific powers which had been conferred upon it under the first Articles of Confederation. The great fundamental changes made in the constitution of 1787 were the clothing of the Federal government with this additional power, and the creation of the necessary machinery for its execution. This required a subdivision of all powers conferred upon the general government, limited and specific as they were, into legislative, judicial, and executive departments, and by this arrangement the Federal government is now empowered within its limited sphere to act as directly upon the citizens of the States respectively as the States are on all other matters reserved to themselves and not confided to the general government. Another peculiarity of the systems of the U. S., applicable alike to the general and State governments, is that in the subdivision of the sovereign powers before referred to the judicial power is co-ordinate and coequal with the others. No one of them, in its assigned sphere, is superior to the other, in either the Federal or State governments. This is another new feature in the political system of the U. S. In all other countries where a judiciary exists it is held to be subordinate to what is called the political power of the state. See CONSTITUTION.

*The United States System.*—In conclusion, suffice it to say in reference to the model of a confederated republic, presented by the U. S., that it is far in advance of anything ever before developed in the annals of history. It presents an entirely new species of confederated republics. It rests, as the French philosopher de Tocqueville said, upon "a wholly novel theory which may be considered as a great discovery in modern political science," and for which there is as yet no specific name. His language is:

"This constitution, which may at first be confounded with the federal constitutions which have preceded it, rests, in truth, upon a wholly novel theory, which may be considered as a great discovery in modern political science. In all the confederations which preceded the American constitution of 1787, the allied states, for a common object, agreed to obey the injunctions of a federal government;

but they reserved to themselves the right of ordaining and enforcing the execution of the laws of the union. The American States which combined in 1789 agreed that the Federal government should not only dictate but should execute its own enactments. In both cases the right is the same, but the exercise of the right is different; and this difference produced the most momentous consequences." "The new word," said he, "which ought to express this novel thing does not yet exist. The human understanding more easily invents new things than new words, and we are hence constrained to employ many improper and inadequate expressions." See CONSTITUTION OF THE UNITED STATES.

Lord Brougham seems to have been similarly impressed with the novel character of our confederate republic in its specific differences from all others which had preceded it, when in speaking of it he said: "It is not at all a refinement that a federal union should be formed; this is the natural result of men's joint operations in a very rude state of society. But the regulation of such a union upon preestablished principles, the formation of a system of government and legislation in which the different subjects shall be, not individuals, but states, the application of legislative principles to such a body of states, and the devising means for keeping its integrity as a federacy, while the rights and powers of the individual states are maintained entire, is the very greatest refinement in social policy to which any state of circumstances has ever given rise, or to which any age has ever given birth."

From this exposition very clearly appears the proper solution of the vexed question whether the U. S. constitute a nation or not. It is clearly seen not only that they do constitute a nation, but also what sort of a nation it is. It is not a nation of individuals blended in a common mass, with a common sovereignty springing from the whole, but a nation the constituent elements or members of which are separate and distinct political organizations or States united under a Federal compact, on a model never before exhibited.

ALEXANDER H. STEPHENS.

To the above article, prepared with so much ability and care, and retained here because of its excellence, it seems appropriate to add some account of the distinctive differences between the several kinds of government at the present day. It is still convenient to use Plato's form of classification and group the several kinds of government under the terms absolute monarchy, limited monarchy, and republic; and yet in modern times the distinct differences between individual governments within each class are so striking, and the modifications of each class by the principles of the others are so numerous, as to make the classification somewhat imperfect and unsatisfactory.

*Absolute Monarchy.*—This term is ordinarily applied to those governments in which the sole right of authority is vested in the ruling monarch. Plato and the other writers of antiquity applied the term despotism to this form of government; but in all civilized countries, even where absolute monarchy is firmly established, the monarch is hedged about with usages and methods that may be said to form constitutional limitations. In China, e. g., the emperor is the embodiment of authority; and yet the Chinese Government is made up of a series of methods and usages from which even the emperor could hardly make any very radical departure without imperiling his position. In local affairs the democratic principle so far prevails that home rule within certain limitations may be said to have been firmly established. The same characteristic is made even more obvious by a brief outline of the absolute monarchy of Russia. The czar is theoretically the source of all executive, legislative, and judicial power, and so exercises absolute authority within his realm; and yet the government is carried on by a series of specific organizations, the functions of which are as clearly defined as those of a cabinet or congress in a constitutional monarchy or a republic. In the first place, e. g., there are four great boards, or councils, each possessing separate functions. The first, denominated the *Council of the Empire*, consists of a president and an unlimited number of members, usually from fifty to seventy-five, appointed by the emperor, besides the members of the ministry and the princes of the imperial family. The council is divided into three departments, having charge respectively of legislation, civil and ecclesiastical administration, and finance. The chief function of the council is to examine the projects of laws submitted by the ministers, and to discuss the budget and the various expenditures. The council is purely advisory, having no authority to modify or take the initiative in regard to any change in the laws of the realm. The second of the great boards is known as the *Ruling Senate*, the duties of which are partly deliberative, partly executive, and partly judicial. To be valid a law must be promulgated by the senate, at the head of which sits the chief justice of the realm. It is also the high court of appeal for the empire. Besides sitting for general purposes *in plenum*, it is divided into nine departments, each devoting itself to a special branch of government and each presided over by a lawyer of distinction. The senate also has the power of remonstrance with the emperor. The third of the boards is the *Holy Synod*, consisting of all the higher ecclesiastics and a full representation of the bishops, with the duty of administering all ecclesiastical affairs. Its decisions, however, have no authority till approved by the emperor. The fourth board consists of the *Committee of Ministers*, eleven in number. All of these boards have direct access to the emperor, and advise him on all subjects in prescribed form. But these boards are not the only limitations on arbitrary power. In local government a great variety of usage prevails, the method being adapted to the characteristics of the particular locality, whether in Asia or in Europe. Of the sixty-eight governments with 625 districts in European Russia, each has its own method of legislation and administration, under a viceroy or governor-general. Subordinate to the districts, the cantons and the communes enjoy many of the privileges of local government, which are administered by officers elected by all the householders from their own number. Thus in all affairs of local government Russia may be said to be quite democratic, although the local governments are never permitted to interfere with matters of national importance. This brief account is enough to show that even in a typical example of absolute government there are ways in which the nature and character of the government are constantly subject to the modifying influences of public opinion. Nor is this influence the peculiarity of Russia alone. On the contrary, it will be found to prevail to a certain extent even in the most despotic governments of Asia. In the nature of human relations it is impossible for one man to rule except with the concurrent approval of what may be called the dominant element in public opinion. In many countries, especially where primitive conditions prevail, the masses have no ideas that enter into and make a part of this dominant element; but as time progresses and intelligence becomes more general, the number of people with thoughts about government increases, and consequently even absolute monarchies are becoming more and more amenable to popular influence. Nihilism in Russia is but one phase of a popular discontent which in one form or another is showing itself wherever absolutism is intrenched. This discontent must increase with the extension of education and the expansion of public opinion.

*Limited Monarchy.*—In nearly all civilized countries government is now limited, either by the restrictions of a written constitution or by legislative enactments having the force of constitutional authority. In continental Europe the history of the decline of absolutism during the nineteenth century is peculiarly interesting and important. During the French Revolution of 1789 the Government of Germany, without exception, experienced the effect of those popular ideas which overthrew the old French monarchy. It was for this reason that large numbers of Germans, and not a few German states, allied themselves with the cause of the French. The overthrow of Napoleon and the restoration of the Bourbon dynasty seemed to thwart all these popular aspirations. Further obstacles of the same nature were the adoption of the HOLY ALLIANCE (*q. v.*), and the effect of the reactionary statesmanship of Metternich. It was impossible, however, to prevent the growth of public opinion. The revolution of 1848 was a popular uprising in nearly all parts of continental Europe against the despotic methods then so prevalent. The revolution bore its fruits. Nearly every one of the German rulers, whether emperor or prince, was obliged to submit to the adoption of a written constitution which, in form at least, prescribed the limitations under which his authority was henceforth to be exercised. Nor was the influence of this general movement limited to Germany. In Italy and even in Spain and Portugal the same tendencies insisted upon recognition, and finally triumphed. The strongholds of absolutism one after another gave way, until parliamentary limitations had been placed upon all the European governments west of

Russia and Turkey. The details of these constitutional limitations are exceedingly diverse, and yet they have certain characteristics in common. There are almost invariably two houses of parliament, in one or both of which the emperor, king, or ruling prince, as the case may be, is directly represented. This presence of the monarch either in person or by representative in the legislative body is ordinarily the chief or most essential difference between parliamentary and congressional government. See LEGISLATURES. But while in limited monarchies the chief executive officer is uniformly present in the legislature, here the uniformity seems to end. In some cases, as in the German empire, the consent of parliament is absolutely essential to any important change in the methods of administration; but at the same time the power of the emperor is such that he is able to bring an almost irresistible influence to bear upon the legislative body or upon the people for the accomplishment of his purposes. In other cases, as in Great Britain, the representative of the monarch in parliament must be in political sympathy with the predominant parliamentary power. In this class of governments the minister is required to resign and give place to a representative of the other party if the political party represented by the prime minister is defeated on any governmental question. But in the other class such a requirement does not exist. The chancellors hold their position at the head of parliament, not by virtue of their being at the head of a dominant party, but by virtue of the will of the emperor. They have ordinarily been able to secure for their measures parliamentary approval, but if at any time they should fail there is neither usage nor constitutional provision requiring them to resign. In Great Britain, on the other hand, a resignation under such circumstances would be inevitable. But, notwithstanding this fundamental difference, it should be noted that there is everywhere a strong tendency toward the British form; and it may be doubted whether at the present time the difficulties that would confront any large government in case of a permanent antagonism between the ministry and parliament would not be so great as to block the wheels and force a resignation. But such a resignation in Germany would be simply a matter of policy and not one of constitutional necessity. The mere fact that in case of a declared antagonism a resignation would probably be tendered shows that the British principle of ministerial responsibility to parliament already has a prominent place in the policy and purposes of statesmen everywhere. The history of the growth of this principle is nothing less than the history of those limitations which have been imposed upon monarchy in Great Britain from the thirteenth century to the present time. In the course of this long history government has become more and more sensitive to popular opinion, until at the present time in Great Britain, and in all governments modeled after the same pattern, the people may rest assured that when the popular will is so clearly expressed as to be unequivocal, it will be made the basis of parliamentary legislation. Under the broadly expanded system of suffrage which has come to prevail, government in all limited monarchies has become very sensitive to the influence of public opinion. It should be understood, however, that this influence does not extend directly beyond the heads of departments. Public opinion in Great Britain can overthrow any ministry as soon as it can secure an adverse vote in parliament; but the removal of a ministry makes no change in the tenure of office of the great majority of those employed in the civil service. The overthrow of a government either in Great Britain or in continental Europe results in the removal of scarcely more than a hundred persons at the head of the most important departments. See CIVIL SERVICE.

*Republic.*—The republican form of government is founded upon the idea that the people have a right to a voice in the government by which they are ruled. The beginnings of government among primitive peoples are always obscure, but so far as we are able to judge from the knowledge at our command we must infer that monarchical power had its origin in military leadership. If we go back a step further, we shall find that military leadership resulted from a popular recognition of fitness to lead. Thus the right to rule in any form of government rests in a final analysis upon popular choice or popular appreciation. When once a choice has been made the length of tenure determines the form of government that is to be perpetuated. If the right of choice is retained by the people, the result is what we know as a republican form of government; if the popular right is abandoned after being exercised for a time, the person chosen perpetuates his authority, and monarchy is established. Thus it will be seen that whatever the ultimate form of government with any people, the origin of that form was in the republican principle of the consent of the governed. But the republican principle, where it has retained its vitality and succeeded in giving permanent form to political institutions, has manifested itself in a great variety of ways. The Grecian republics, although they all rested upon the frequently expressed will of the people, reveal every variety from an elective monarchy to the most turbulent democracy or ochlocracy. The Roman republic had characteristics that amply reward the most careful study. The senate was an aristocratic body to which no one was admitted that had not given evidence of public esteem by being chosen to high office. The assembly of the centuries was a military body organized on the basis of a property qualification which gave to persons of wealth a preponderant influence. The assembly of the tribes was more popular in its nature, but it had unlimited authority within the somewhat prescribed sphere of its activity. The senate was theoretically in constant session, and every act before it could become a law was required to receive senatorial approval. The ratification of one of the other bodies was also required. No government in modern times has ventured to imitate this system very closely, but its efficiency was evinced by nearly five hundred years of extraordinary success. The power of the government was unquestionably due to the greatness of the senate, but the conservative power of even this remarkable body was not enough to withstand or direct the movement in favor of more popular methods. For two hundred years before the fall of the republic the agitation in behalf of the poorer classes was the most constant factor in Roman affairs. Civil and social wars abounded until the populace, when they had gained virtual control, sought guidance and protection by throwing all their political rights at the feet of Julius Cæsar. The empire succeeded the republic not so much by usurpation as by the gradual absorption of popular authority. In the Middle Ages the Italian republics revealed a great variety of methods, ranging from the aristocratic organization of Venice to the extreme democracy of Florence; but while these governments encouraged commercial and literary activity, they possessed very few characteristics that have been perpetuated in the republics of modern time. The Government of Switzerland, the oldest of modern republican governments, has one peculiarity that is well worthy of note. Provision is made in the constitution that any federal law "shall be submitted for acceptance or rejection by the people, if the demand is made by 30,000 voters or eight cantons." In all the cantons, except Freiburg, the people have the same privilege of voting upon any general law on similar conditions. This method of procedure, known as the referendum, has not only been extended to the right of initiative in Switzerland, but has been seriously advocated for introduction into Belgium, Great Britain, and the U. S. The Government of Switzerland, like that of the U. S., is federal in its nature, each of the cantons enjoying as large a measure of local independence as seems compatible with the interests of the others. Four of the cantons have general assemblies of all the citizens. In the U. S. the most noteworthy of the distinguishing characteristics of the Government is the power of the Supreme Court to decide upon the constitutionality of the acts of the Legislature. This feature has proved an element of immeasurable strength and stability to the Government by weakening the tendencies to disintegration and strengthening the bonds of union. The same authority on the part of the State courts has prevented careless infractions of the constitutions by the State Legislatures. In all the States, as well as in the Federal Union, provision is made for amendments of the constitutions whenever such amendments are duly called for. But such amendments can not be made by the legislatures. In France it was a radical error of the several forms of government, republican as well as monarchical, during the revolutionary period that the legislative body was given the power to amend the constitution, and it was to this peculiarity that the instability of the republics of that period was very largely due. The French Government differs from that of the U. S. in another very important respect. The legislature is parliamentary in form, whereas that of the U. S. is congressional, the difference consisting in the fact that in the former the ministry, as in Great Britain, is responsible to the legislative body, whereas in the latter no such responsibility exists.

It follows that in France the ministry may at any time be overthrown by parliamentary action, but in the U. S. the President and his cabinet are quite independent of Congress. It has often been urged that a representation of the cabinet in the Senate or House of Representatives would afford the executive branch of the Government a much needed opportunity of presenting and urging governmental measures; but, on the other hand, it is said in reply that the fundamental peculiarity of the Constitution of the U. S. is the essential separation from one another of the three great branches of government. By many of the ablest publicists it is doubted therefore whether such a representation would be advantageous. For a further presentation of the peculiarities and methods of the several kinds of government, see the articles LEGISLATURES, LAW-MAKING, CIVIL SERVICE, POLITICAL SCIENCE, PRIMARY ELECTIONS, and MUNICIPAL GOVERNMENT.

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**Government's Island**, properly **Rock Island**: an island belonging to Rock Island co., Ill., in the Mississippi river; lying between Rock Island, Ill., and Davenport, Ia. The island belongs to the U. S. Government, and contains large U. S. armories and arsenals. It was used as a military prison during the civil war. The island is reached by several excellent bridges. It is 3 miles long, and has a very fertile soil. Area, 960 acres.

**Governors** [viâ O. Fr. *gouvernour*, from Lat. *guberna'tor*, deriv. of *guberna're*, govern. See GOVERNMENT]: instruments attached to prime movers for the purpose of preserving regularity of motion by adjusting the amount of power exerted to the work to be done, where the latter is variable. They are a more economical class of regulators than are brakes, which accomplish a similar result by absorbing and wasting an excess of power, which must always be arranged for where the speed is intended to remain invariable under a variable load.

Governors differ, as regulators, from fly-wheels in preserving uniformity of motion without necessarily permitting change of mean speed. The latter form of regulator necessarily permits variation, which becomes greater as the weight and speed of the wheel are smaller in proportion to the changes of energy, and is rarely so small as to make the governor unnecessary.

Governors are usually intended to produce, as nearly as possible, absolutely uniform speed. None do so perfectly, but the approximation to uniformity is frequently very close. A good governor should not permit a variation of 1 per cent., even when the load is entirely thrown off, and 2 per cent. is generally considered the maximum range in fine work, while the regulation of electric-lighting and power machinery must usually fall well within the smaller limit. Marine-engine governors are usually intended to prevent very sudden and very great fluctuations of velocity, rather than to preserve an exact rate of speed. Rankine designates the latter class "fly-governors," to distinguish them from the other forms called *governors proper*.

Governors proper are divided into three classes—*position governors*, *disengagement governors*, and *differential governors*. Position governors are those in which the position of the regulating valve or regulating piece is determined by rigid connection with the governor; as, for example, the common fly-ball governor used upon the steam-engine. Disengagement governors are those which, when the speed rises above a certain fixed maximum, throw into gear a train of mechanism which shuts off the supply of impelling fluid, and causes a diminution of speed; and, when the speed falls below a stated minimum, it throws into gear another train producing the reverse effect. When at proper speed, neither train is in operation. The usual forms of water-wheel governors are examples of this class. Differential governors are those which move the regulating mechanisms with a speed proportional to the difference between the actual and the proper speed of the engine.

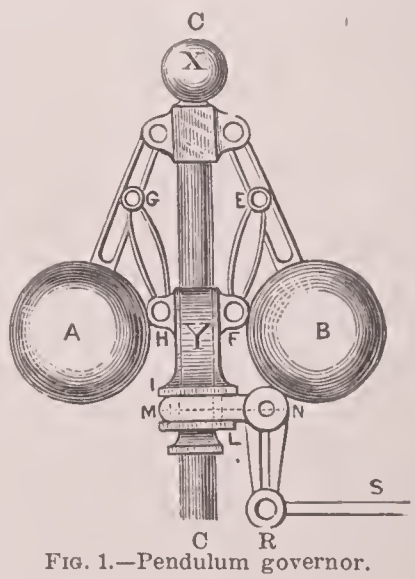


FIG. 1.—Pendulum governor.

A second classification divides governors into gravity governors—in which gravity and centrifugal force are opposed—and balanced governors, in which centrifugal force is balanced by a spring or by other force than gravity.

Pendulum governors are the oldest and most common class of governors. The conical pendulum, the centrifugal governor, or the fly-ball governor, as it is variously called, was invented by Huyghens about 1650, and applied by him to the regulation of horological mechanism. It was subsequently (1789) applied by Hooper to control the motion of windmills, and Watt about the same time (1784) applied it to the regulation of the steam-engine.

The pendulum governor consists of two heavy balls (A B, Fig. 1) suspended by short links from the spindle C D. Other links, E F and G H, connect with a sleeve, H F, in such a manner that any movement of the balls will produce a vertical movement of this sleeve, which is attached to an arm, M N, forming part of the train of mechanism, M N R S, through which the adjustment of power is effected. In the case of the steam-engine the rod

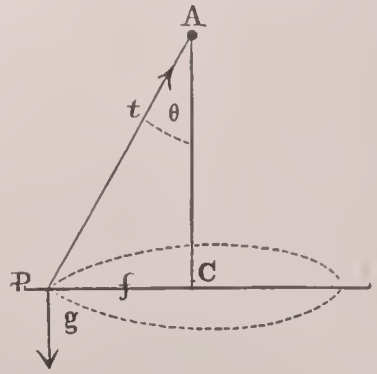


FIG. 2.

R S is attached to the "throttle-valve" or to the expansion gear; in the water-wheel it connects with the mechanism operating the "gate" by means of which the supply of water is adjusted; in the windmill this train of mechanism changes the pressure existing between the millstones, or it changes the position or the area of the "sails."

In this governor there exists at every position, with uniform motion, an exact equilibrium of the vertical component of the force acting along the suspending arm B C, the force of gravity, and centrifugal force. The height of the point at which the line of the arm crosses the spindle—the virtual point of suspension—above the plane of revolution of the balls bears a ratio to the radius of the circle in which the centers of the balls move that is equal to the ratio of the weight of the balls to the centrifugal force—i. e. Fig. 2.

$$t \sin\theta - \frac{mv^2}{r} = 0,$$

$$t\cos\theta - mg = 0,$$

$$v^2 = \frac{gr\sin\theta}{\cos\theta} = g.\ AP\frac{\sin^2\theta}{\cos\theta},$$

$$\text{and } t = \frac{2\pi v}{U} = 2\pi\sqrt{\frac{AP\cos\theta}{g}} = 2\pi\sqrt{\frac{\text{A.C}}{g}}.$$

The number of revolutions per second $N = \sqrt{\frac{0{\cdot}815}{H}}$, and the height of the point of vertical suspension above the plane of revolution of the balls $AC = H = \frac{0{\cdot}815}{N^2}$ foot $= \frac{9{\cdot}748}{N^2}$ inches $= \frac{0{\cdot}248}{N^2}$ meters. Also $H = \frac{35186}{R^2}$, where $H =$ height in inches and $R =$ number of revolutions per minute, and $\frac{187{\cdot}5}{\sqrt{H}} = R$. Thurston's *Manual of the Steam-Engine*, vol. ii., chap. iii.

The speed of the governor should be carefully determined, either by experiment or by calculation, when first designed, in order that the transmitting mechanism which determines the velocity-ratio of governor and driving-shaft may be precisely proportioned to its work.

The weight of balls is determined by the character of the resistance to be overcome. It is proportional to the resistance to be overcome, but can seldom be computed, and is usually determined by experiment.

The simple pendulum governor has comparatively little power, and does not give truly isochronous motion. Being rigidly connected with the regulating valve, the speed can only be precisely maintained under one set of conditions. Any variation of load or of steam-pressure will produce a limited but unavoidable change of speed. The limits of variation are determinable by the arrangement of the connecting mechanism, and are usually but slightly removed from the proper speed.

To secure greater sensitiveness and strength in action a weight is sometimes mounted upon, or suspended from, the collar I L (Fig. 1), which enables the speed of the governor to be greatly increased with the same height of suspension and with a smaller size of balls, giving, at the same time, quickness and much greater strength of action. This form has been extensively adopted both in the U. S. and Europe. It is shown in Fig. 3. In this case the effect of gravity is increased, while the effect of centrifugal force, at the same speed of revolution, remains unchanged, and the height $AC$ is increased in the ratio $A + \frac{AW}{W'}$ to 1; $A$ representing the ratio of increase of the action of gravity, $W$ the weight of balls, and $W'$ the total weight of balls and the increased action of gravity produced by the added load. Then $H = \frac{9{\cdot}7848}{N^2} \times \frac{W + W'}{W'}$. A change of speed in the engine causes a greater change of position of balls than in the unloaded governor, in the proportion of $W'$ to $W' + AW$. The governor is thus rendered more sensitive in this proportion. The suspending arms of this governor are forked, and the pins are thus made double. This construction is no less an essential feature than the preceding. It enables sudden variations of speed to produce change of altitude without serious retardation due to friction on the joints. Another important advantage possessed by this instrument is the comparatively slight resistance to change of speed, which is a consequence of the comparatively small weight of balls and of their small orbit. Strain upon the connecting gearing, or slipping of the governor-belt, is thus avoided, and the governor is enabled to act promptly and effectively where the ordinary form would be slow in action, or where it might break its belt and cease to act. Porter's governor is of this form.

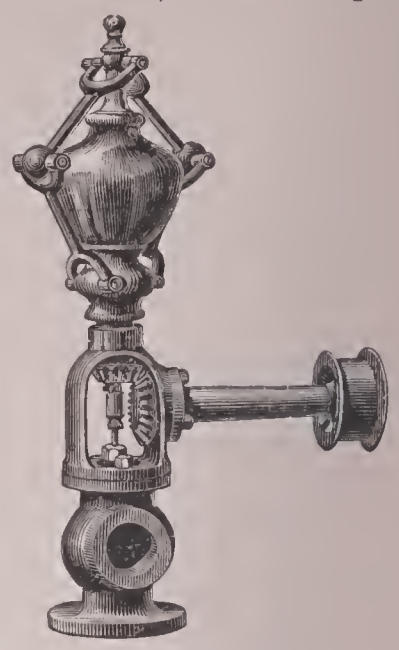


Fig. 3.—Loaded governor.

Approximate isochronism is secured in the governor of Farcot, of Paris, by crossing the arms, thus carrying the points of suspension of each ball to the opposite side of the vertical spindle from the ball, and thus causing the trajectory of the ball, as it rises and falls in its circular orbit, to coincide with the paraboloid of which the subnormal is equal to the altitude A C (Fig. 1). This form of governor is used to some extent in Europe. In the Farcot governor minor adjustments are secured, to eliminate faults in its action due to the arrangement of the mechanism transmitting movement of the controlling valves. The links connecting the ball-rods to the collar on the main spindle are crossed, and a helical spring on the spindle resists slightly the tendency of the balls to rise, its tension increasing as the balls separate.

Precise isochronism is obtained by the parabolic governors, in which the height H remains constant in all positions. In these governors the path of the balls in the vertical plane is such that they describe the arc of a parabola. The height A C (Fig. 1) is then the subnormal of this parabola. The subnormal is of constant magnitude, and only at that speed which gives a height, H, equal to this quantity is a position of equilibrium held. It consequently follows that any change of speed from that due the height A C will destroy equilibrium, and it can only be restored by a return to the proper speed. These governors therefore continue their action upon the connecting mechanism until normal speed is obtained or until the extreme of their range is reached. An altitude of the points of suspension above the plane of motion of the balls equal to twice the focal distance of the parabola is the only one in which the balls can remain steady. The force with which the balls tend to move is proportional approximately to $\frac{W\delta}{N}$; in which $W$ is the aggregate weight of balls, $\delta$ is the amount of deviation of speed, and $N$ the proper speed of revolution.

The balls are given their parabolic path in Davey's governor by suspending them from a spindle by steel springs, which, as they diverge, unwrap from the edge of a guide-cheek having the form of the evolute of the parabola. The balls may also be carried on a guide-curve, as in Madden's governor.

The parabolic governor may be loaded, like Porter's governor, to attain higher speed of rotation, and increased strength and sensitiveness. This will produce an increase of altitude in the proportion of the aggregate new weight to the original weight, and the speeds of revolution will be increased as the square root of those quantities. The added load gives a means of adjustment of speed by varying the amount of that load. One method of applying it is by means of a sliding weight upon a lever, thus making the load upon the governor easily and accurately adjustable. By causing the ball to move in a high portion of the parabolic arc, also, increased strength of action and sensitiveness may be secured. Since the centrifugal force varies inversely as the square of the periodic times, the greater the speed of revolution thus secured, the greater the power of the governor. Smaller balls can thus be used with higher speed, as in the loaded pendulum governor, and their less weight gives greater sensitiveness, in consequence of their slight inertia, as well as because of their greater speed of revolution.

In the Babcock & Wilcox governor the balls always move in a horizontal plane, as shown in Fig. 4; the ball-rods, $n$ $n$, being jointed to a spindle, $o$, which slides vertically within a hollow driving-spindle, and which is counterbalanced by weights at $w$, carried in a scale-pan on the end of a lever, through which they act upon the lower ends of the sliding

spindle. The ball-rods are jointed at the middle to links P, which are secured at their opposite ends to the main driving-spindle, which takes its motion, through bevel gearing and intermediate shafting, from the main shaft of the engine.

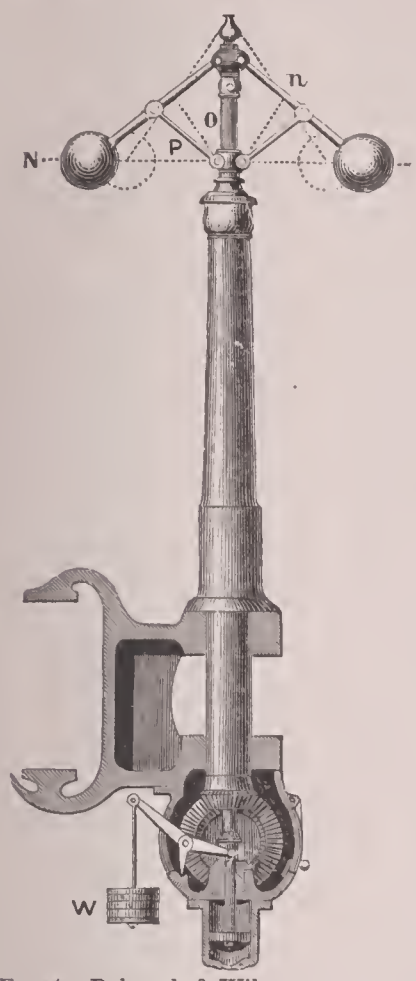



Fig. 4.—Babcock & Wilcox governor.

A dash-pot, seen at the foot of the sliding spindle, prevents sudden fluctuations of speed from throwing the governor beyond the proper position for adjusting speed, and prevents the oscillation of speed which attends the use of very sensitive governors not thus controlled. When the engine is precisely at speed the action of centrifugal force is equilibriated in every position by the action of the weight. At any other speed this equilibrium is destroyed, and the action of the governor is similar to those just described. It continues acting until the proper speed is resumed, or until it reaches the extremity of its range. Adjustment of speed is obtained by varying the weight upon the scale-pan.

Pickering's governor (Fig. 5) is the invention of Mr. T. R. Pickering, of New York. In this governor the balls are carried upon flat springs which are curved in the form of a double cyma, and are attached at one extremity to the vertical driving-spindle, and at the upper end to a sliding collar which supports the stem of a balanced throttle-valve. The peculiar form of spring employed keeps the parts in proper relative position, and permits the use of steel so thin that it is not liable to set or break. Where an increase of centrifugal force is required, it is obtained by increasing the number of springs, using two or more together for each ball. Three balls are generally used. This governor has the sensitiveness and strength of the loaded pendulum governor, and is cheap in construction. It has come into extensive use in the U. S.

In the later so-called high-speed engine employed for driving electrical machinery and other apparatus demanding rapid rotation, the Hartnell & Guthrie governor is commonly used in widely various forms. It usually consists of a set of balanced weights, *A B*, carried on a frame or a disk, *E*, turning with the main shaft of the engine in a vertical plane, and so pivoted at *C* and *C′* that they may move outward under the action of the centrifugal force, or inward when that force is more than counterbalanced by properly set springs, *E F E′ F′*. At the correct speed these forces precisely balance, and the engine is not affected by movement of the governor balls. A link system, *C D*, insures a standing balance between the pair of weights and arms. As these motions take place, the working point *G*, as in the Westinghouse governor, is carried through the path proposed, to bring about a properly varied distribution of steam. By proper adjustment of weights, and especially of spring-tension, these governors may be made exceedingly sensitive and perfect in action; and variations of insensible amount between full load and no load are secured. It will be noted that the weights are so set that any sudden jump of the engine will tend, by the action of their inertia, to throw the balls outward or inward, as the case may be, in such manner as to insure instant readjustment of the steam-valve in the proper direction. So perfectly is this effect attained, occasionally, that no observable change of speed can be detected, however great or sudden the change of load. McEwen and others have made of the inertia governor, in which this characteristic is prominent, a new class of great value.

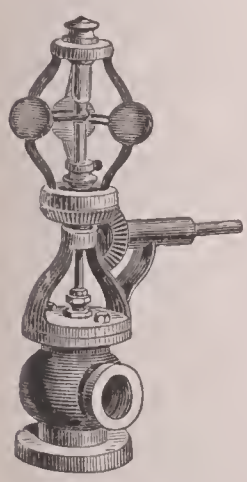


Fig. 5.—Pickering governor.

Silver's marine governor in its earlier form consisted of two crossed arms carrying balls at each extremity, and balancing about the pin by which they were carried on the spindle. The action of centrifugal force was balanced by a helical spring coiled upon the spindle. It was designed to regulate the engines of steam-vessels, and was one of the earliest introduced.

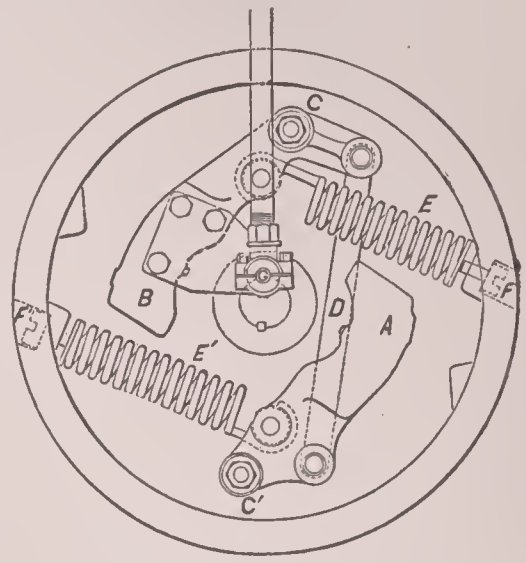



Fig. 6.—Hartnell & Guthrie governor.

In the chronometric governor a train of gearing is driven by a clock or other uniformly moving apparatus. Another train is driven by the engine or machine to be regulated. The two trains are connected by intermediate mechanism in such a manner that, so long as both move at the same speed, no motion of the intermediate gearing occurs. A difference of velocity in the two trains being produced by a change of speed of the engine, a motion of the intermediate gear takes place, adjusting the regulating apparatus to restore the proper speed. This arrangement evidently gives isochronism.

In Siemens's differential pendulum governor the balls of a pendulum governor are suspended within a cylinder, and their friction against its interior surface produces a resistance which, acting through a dynamometer train, moves the valve. In the governor of Sir William Thomson the principles illustrated in Siemens's governor are applied to a governor attached to physical apparatus.

Hydraulic governors are of several forms. They usually consist of a pump or bellows which forces water or oil into a reservoir, from which it issues at a uniform rate by an orifice the size of which is adjustable. At the proper speed the liquid is pumped into the reservoir at precisely the speed at which it issues from it. An increase of speed produces an excessive supply, and a decrease of speed causes a deficiency of fluid to be forced into the reservoir. Connected with the reservoir is a pump-barrel containing a weighted piston or plunger. As the reservoir fills this piston is forced up and shuts off the supply of steam or water. As the reservoir empties itself the loaded piston descends, opening the supply-valve. The Pitcher hydraulic regulator is of this form. These governors are isochronous.

A hydraulic governor of quite a different form is the Huntoon governor. A screw, resembling the ordinary screw-propeller in form, revolves in a horizontal cylinder filled with oil. The shaft on which it is mounted is arranged to slide longitudinally, and thrusts against a vertical arm which is connected with a horizontal lever carrying a weight. Motion is communicated to the screw through a pulley-shaft which gears into a pinion on the screw-shaft. As the screw revolves it tends to traverse the cylinder in the axial line, and this tendency becomes greater or less as the resistance of the liquid increases or diminishes with changes of speed. At the proper speed this resistance is just sufficient to counterbalance the weight. A greater speed raises the weight, and a slower speed allows it to fall. These movements are transmitted by a vertical link to the arm of a register throttle-valve, by means of which the supply of steam is adjusted to the requirements of the engine. This governor is isochronous.

Pneumatic governors, in which the resistance of air is made useful in producing an equilibrium with the force exerted by a weight or spring, are of several forms. The best-known form consists of several hemispherical cups carried at the outer ends of radial arms revolving about a central spindle, as in the anemometer. At the proper speed the re-

sistance of the air is just sufficient to counterpoise a weight attached to the apparatus, while at higher or lower speed the rise or fall of the weight moves the mechanism connecting the governor with the supply-valve.

The marine steam-engine requires a governor of somewhat different qualities from those demanded in the regulation of the stationary engine. The motion of the marine engine when the vessel is in smooth water is uniform so long as the pressure of steam remains constant, as there is then a perfect uniformity in impelling power and of resistance, and no governor is required. At sea, however, in rough weather, the vessel is tossed about by the waves, and meets with a varying resistance. Frequently all resistance to the motion of the engine is removed by the pitching of the ship and consequent lifting of the propeller out of the water. At such times the engine, if uncontrolled, starts off with great velocity, causing danger of accident and a wasteful expenditure of steam. While revolving at this high velocity the engine is next suddenly checked by the return of the vessel to a position in which the propeller is again immersed, and the resulting shock is even more dangerous than that due to the effect of inertia at the higher speed. This is the kind of fluctuation of speed which the marine governor is intended to prevent. No governor in which gravity acts can be used at sea, on account of the motion of the vessel. The ordinary forms of balanced governors are not usually satisfactory, because the inertia of the heavy parts, which must be suddenly made to move at higher velocity when a jump of the engine occurs, is liable either to prevent their prompt action or to strain and break the connecting mechanism.

Momentum governors have been usually found most satisfactory. Silver's momentum-wheel governor is an illustration of this class. This consists of a fly-wheel fitted loosely upon a shaft driven by the engine. The wheel carries flat vanes, so set that the resistance of the air when they are turning at the proper speed shall just equilibrate the effort of a helical spring by which the wheel is connected to the shaft, and through which it is driven. Any sudden increase of speed taking place, the inertia of the wheel prevents a proportional increase of its velocity. The shaft running ahead of the wheel, the spring is coiled up; and this change is made, by suitable mechanism, to change the position of the throttle-valve. A sudden decrease of the speed of the engine occurring, the inertia of the fly-wheel causes it to overrun the shaft, and the spring is uncoiled and the throttle-valve opened.

The governor is used in steam-engines of the best class to determine the point of cut-off, instead of moving the throttle-valve, which latter method produces loss of efficiency by throttling the steam and diminishing the gain due to higher pressure and greater expansion. In some cases the governor changes the position of the eccentric which moves the valve-gear. In other cases it adjusts the link-motion, producing a similar change of action in the valve, and consequently in the distribution of steam. The attachment of a governor to a detachable cut-off valve-gear—with which arrangement the grade of expansion of steam is determined without necessarily demanding from the governor the employment of any considerable moving force—is the most generally satisfactory method of regulation of steam-engines.*

The force required in the regulation of water-wheels is so great that water-wheel governors are arranged to simply throw trains of mechanism connected with the motor into gear with the water-wheel gate, opening or closing it as required.

R. H. Thurston.

**Governor's Island**: an island of Suffolk co., Mass., in Boston harbor, directly N. of Castle island and of the main ship-channel or President Roads. It is occupied by fortifications (of which Fort Winthrop, a small inclosed quadrangular work with exterior open barbette batteries, is the *keep* or *réduit*), forming part of the system of defense of Boston harbor and its maritime approaches.

**Governor's Island**: a small island in New York harbor, three-fourths of a mile S. of the southern extremity (now occupied by the esplanade known as the Battery) of Manhattan Island; separated from the borough of Brooklyn (Long Island) by a narrow channel called Buttermilk Channel. A mile and a half to the westward are the small islands Ellis's and Bedloe's on the eastern margin of the extensive shoals known as the Jersey Flats; and between them and Governor's island is the ship-channel leading from the bay northward to Manhattan Island. The prominent position of Governor's island marked it out in early days as the key to the maritime defense of Manhattan Island, and it was occupied for such purposes by the Dutch. In 1614 they built their first rude fort on Manhattan Island, probably where the Battery now is, and doubtless, as their settlement increased, occupied Governor's island. The English took possession in 1674, and under them the first regular fort, on the site of what is now Fort Columbus, was built, and the island (probably through the residence of the early governors, who were also military commanders) became known as Governor's island. The present Fort Columbus (which has, however, since undergone extensive repairs and modifications), occupying the center of the island, and Castle Williams, on the western point, were built in 1807–10 (as also Fort Clinton (Castle Garden) and Fort Gansevoort, 3 miles higher up) by Col. Jonathan Williams, the first chief engineer of the U. S. army. Castle Williams was the first casemated battery erected in the U. S., and was planned after the system of Montalembert, with which Col. Williams had made himself acquainted in France. Besides the fortifications and small garrisons, the ordnance department has one of its dépôts here, and the island has for some years been the headquarters of the department of the East. The island is also the headquarters of the Military Service Institution, whose library and extensive collection of war relics, etc., occupy two buildings.

**Gowan**, James Robert, LL. D.: Canadian jurist; b. in County Wexford, Ireland, Dec. 22, 1815, and educated in Canada. He was admitted to the bar in 1839; appointed judge of Simcoe district in 1843, an office which he held till his retirement in 1883. He assisted in the consolidation of the statutes of Canada, of those of Ontario, and of the criminal law. He was chairman of the board of judges for Ontario 1869–87; a member of the commission to inquire into the constitution and jurisdiction of the several courts of law and equity in Ontario in 1871; a member of the commission to investigate the charges against the ministry in connection with the Canadian Pacific Railway contract; and appointed to the high court of justice in 1882. He was admitted to the Dominion Senate in 1885.

Neil Macdonald.

**Gowan'da**: village; on the Buffalo and Southwestern Railroad; in Cattaraugus and Erie cos., N. Y. (for location of counties, see map of New York, ref. 5–C), which are separated by the Cattaraugus creek; 30 miles S. of Buffalo. It contains large agricultural implement and machine works, tanneries, flouring-mills, carriage-factories, cheese-box factory, saw and planing mills, etc., and has splendid water privileges. Principal business, farming and dairying. Pop. (1880) 1,243; (1890) not separately returned; (1900) 2,143.

**Gower**, John: an English poet; b. about 1325. The place of his birth is variously given as having been in Wales, Kent, and Yorkshire. He was probably a man of property, and it is said that he became chief justice of the common pleas, and some state that he was knighted. He was a friend of Chaucer, who, in dedicating his *Troilus and Cressida* to him, calls him "the moral Gower," a compliment returned by Gower at the close of the *Confessio Amantis*. His poetry was written in English, French, and Latin, the latter versified according to quantity. His principal work, undertaken by command of Richard II., who directed him to "book some new thing," was in three parts: the *Speculum Meditantis*, now lost; the *Vox Clamantis* (Latin), never printed entire, but existing in MS.; and the *Confessio Amantis*, completed 1394, first printed by Caxton (1483), best edition by Pauli 1857. The Roxburghe Club in 1818 published his *Cinquante Balades*, written in French. He became blind in 1400, and spent the last years of his life at St. Saviour's. D. in Oct., 1408, and was buried in St. Saviour's church, London.

**Gow'rie Conspiracy**: an attempt made (Aug. 5, 1600) by John Ruthven, Earl of Gowrie, and others, either to assassinate the king, James VI. of Scotland (afterward James I. of Great Britain), or more probably to make him prisoner, for the purpose of permitting the Government to be administered in a manner more thoroughly in the interest of Presbyterianism. The affair took place at Gowrie House, Perth, and the earl and his brother Alexander were both killed in the affray. It is possible that Gowrie's motive in this affair was revenge for the death of his father, who was executed as a traitor in 1584, but this is not generally believed to have been the cause.

* See *Manual of the Steam-engine*, part ii., chap iii., for very extended discussion and for references.

**Goyanna**, gō-yaa′năă, or **Goiana**: a city in the northeastern part of the state of Pernambuco, Brazil; on the river Goyanna, 12 miles from the sea and 65 miles nearly N. of the city of Pernambuco (see map of South America, ref. 4–H). The river is navigable for small vessels to this point, but the entrance to it is by an intricate and difficult channel. The surrounding district is fertile, and is largely devoted to sugar-planting. Sugar, spirits, cattle, hides, and small quantities of dyewoods are exported to Pernambuco. Goyanna is one of the oldest towns in Brazil, and it was a point of importance during the struggles with the Dutch in the seventeenth century. Pop. (1893) about 12,000.

HERBERT H. SMITH.

**Goya y Lucientes**, gō′yăă-ee-loo-thĕĕ-en′tes, FRANCISCO José, de: genre, portrait, and historical painter; b. at Fuendetodos, Aragon, Spain, Mar. 30, 1746. Pupil of Lujan Martinez at Saragossa, and of the Academy of Parma, Italy. His works are highly esteemed by artists, and though often eccentric in style are remarkable for their portrayal of character. Pictures by Goya are in the principal Spanish museums and cathedrals, and two works are in the Louvre. D. at Bordeaux, France, Apr. 15, 1828.

**Goyaz**, goi-yăăz′: a central state of Brazil; bounded N.W. and N. by Pará, E. by Maranhão, Piauhy, and Bahia, S. E. by Minas Geraes, and S. W. and W. by Matto Grosso; area, 286,948 sq. miles. The state is irregularly wedge-shaped, the eastern side of the wedge being formed by the river Tocantins and its branch, the Manuel Alves Grande, with the Canastra Mountains, while the western side is the river Araguaya, which joins the Tocantins at the apex of the wedge. Between the Tocantins and Araguaya there is mountainous land of unknown northern extent. Probably the culminating peaks of this mountain-system are the Pyreneos, near Villa Boa de Goyaz. Recent explorers (1892) state that the highest point is only 5,250 feet above the sea. Aside from these mountains, the whole of Goyaz is included in the great Brazilian plateau, but this is much broken and varied by the river-valleys; the average elevation is probably 2,700 feet. Much of the surface is open, or covered only with scattered trees; but lines of forest follow every stream, broadening to extensive areas northward. The climate is temperate, and in most places very healthful; the only common disease is goitre, or swelled neck. Nearly all the civilized population is gathered about a few centers in the southern part; immense regions, especially in the northern part, are unexplored, and by far the greater portion of the state is deserted, or has only scattered villages of savage Indians. A large percentage of the civilized population consists of half-breeds and Negroes, who cultivate small plantations in a very slovenly way. Aside from this, tobacco planting, cattle-raising and gold-mining are almost the only industries. Quartz crystals, known in commerce as Brazilian pebbles, are exported in considerable quantities. Goyaz has great areas of fertile land and pastures, and it is undoubtedly rich in minerals and forest products; but, unfortunately, it is the most isolated of the Brazilian states. European goods are brought by mule-trains from the railroads of Minas Geraes, or even from the river Paraguay at Cuyabá. Small steamers ply on the Araguaya and Tocantins, and attempts have been made to open a regular navigation to Pará; but this scheme presents great difficulties, owing to rapids on the lower Tocantins. Manuel Correa reached Goyaz from São Paulo in 1670; Bartholomeo Bueno da Silva discovered gold mines and made the first settlement in 1682, and the mines soon drew numerous adventurers. The captaincy of Goyaz, corresponding to the present state, was formed in 1740. Estimated population of state (1888) 211,721, besides wild Indians, who probably do not number more than 25,000. See Saint-Hilaire, *Voyage aux sources du Rio S. Francisco et dans le province de Goyaz* (1847–48); Cunha Mattos, *Chorographia historica da provincia de Goyaz*, in *Revista do Instituto Historico do Rio de Janeiro* (1874 and 1875). HERBERT H. SMITH.

**Goyaz**, VILLA BELLA DE: capital and only important town of the state of Goyaz; on the little river Vermelho, a branch of the Araguaya (see map of South America, ref. 5–F). It owed its foundation to the gold mines discovered here in 1682. The site is one of the worst in the state, being a bare, rocky valley, nearly surrounded by mountains. The heat during the day is often very oppressive, though, owing to the radiation, the nights are apt to be unpleasantly cold. Pop. about 7,000. H. H. S.

**Gozo**, or **Gozzo**, got′sō: an island in the Mediterranean, 14 miles N. W. of Malta, belonging to Great Britain. Area, 20 sq. miles. It is beautiful and fertile, and has two good harbors. The remains of the cyclopean wall called the "Giant's Tower" are interesting. Principal town, Babato. Pop. (1881) 17,620.

**Gozzi**, got′sĕĕ, CARLO, Count: Italian dramatist and competitor of Goldoni; b. in Venice in Mar., 1722. His *Memoirs* (1797, Eng. trans., 2 vols., 1889), in connection with Goldoni's memoirs, give a very interesting and instructive picture of the state of the Italian theater at that time. It was his idea that improvisation is a natural talent with the Italians, and for this reason he left open certain parts of his dramas, especially the comical parts, to be filled out by the momentary inspiration of the actors. Gozzi opposed Goldoni, who strove to put French dramatic works upon the Italian stage. His dramas are no longer played, though they bear evidence of a talent of a higher and finer order than that of Goldoni. The best two of his dramas are *The Three Oranges* and *The Princess Turandot*. D. Apr. 4, 1806.

**Gozzoli**, got-sō′lĕĕ, BENOZZO: painter; b. in Florence in 1424; was a pupil and assistant of Beato Angelica and of Masaccio. Tuscany abounds with his work. He painted in the Church of San Frediano, and in the Medici Palace (now called Riccardi) there is a chapel with decorations by him containing portraits of people of his own time in gorgeous costume as then worn. In Rome he painted in S. Maria in Aracoeli several subjects from the life of St. Antony; at Montefalco, near Foligno, he decorated a church; and at Pisa he afterward decorated, in less than two years, a whole side of the Campo Santo with representations of the "creation of the world," "the divine wrath opening the cataracts of heaven," "the tower of Babel," "the birth of Moses," and all the Hebrew stories of Moses and Solomon. He also executed many other works at Pisa. The Pisans erected a fine monument to him in their Campo Santo in grateful remembrance of his work there. He was the first painter in whose works is found evidence of the actual use of the model in making the designs for his pictures, and there is no doubt that he made many careful drawings of his contemporaries, so that his pictures may be regarded as collections of the portraits of the men of Florence of his time. He also made the first advance toward a naturalistic treatment of landscape in the backgrounds of his pictures, and must be considered as one of the most important painters of his time, and the link between the Giottesque art of Fra Angelico and the naturalistic of Filippo Lippi. D. at Pisa about 1496.

W. J. STILLMAN.

**Graafian Vesicles**, graa′fi-an-ves′i-kl′z, or **O′visacs** [*vesicle* is from Lat. *vesicula*, dimin. of *ve′sica*, bladder; *ovisac* is from Lat. *ovum*, egg, ovum + *saccus*, sack]: numerous small globular transparent follicles (hence also called *Graafian follicles*) found in the ovaries of mammals probably representing the inner part of the calyx of oviparous animals. They are named from Regnier de Graaf, their discoverer (1641–73). They are filled with a transparent albuminous liquid. Very small at first and deeply bedded in the ovary, they gradually approach the surface, and finally burst and discharge the ova.

**Graal**, or **Grail**: See SANGREAL.

**Graccha′nus**, M. JUNIUS: author; lived in the time of C. Gracchus (B. C. 123); enjoyed his friendship, and from this circumstance, according to Pliny, derived his cognomen. He was the author of a treatise, *De Potestatibus*, addressed to Pomponius, the father of Pomponius Atticus, in which he gave a history of the constitution and the great offices of state from the time of the kings, which is highly commended by Niebuhr (*Hist. Rome*, vol. ii., p. 10–11). The original work is lost, but is often referred to by Varro, Cicero, and others, and a portion of it is preserved in the Greek treatise of Joannes Lydus, *De Magistratibus*. See Gerlach, *Geschichtschreiber der Römer*, p. 84, *seq.*; L. Mercklin, *De Junio Gracchano* (Dorpat, 1840–41); and Huschke, *Jurisprudentia anteiustiniana*, pp. 8–10.

Revised by M. WARREN.

**Grac′chus**: the name of a Roman family of plebeian origin belonging to the gens Sempronia. From the middle of the third century B. C. members of this family had attained distinction in war and in the state. TIBERIUS SEMPRONIUS GRACCHUS, b. about 210 B. C., became tribune of the people 187 B. C.; married Cornelia, daughter of Scipio Africanus;

consul 177; censor 169, when he brought about important political reforms; consul again 163 B. C. The time of his death is not known. He was the father of twelve children, among whom were Tiberius and Gaius, the "Gracchi" *par excellence*. Their mother, Cornelia, says Plutarch, "brought them up with such care that education was allowed to have contributed more to their perfections than nature. Tiberius," he goes on to say, "had a mildness in his look and a composure in his whole behavior; Gaius as much vehemence and fire. The language of Tiberius was chaste and elaborate; that of Gaius splendid and persuasive."—The elder brother, TIBERIUS SEMPRONIUS GRACCHUS, distinguished himself first by his courage and fidelity in the campaigns in Spain, which were concluded by the capture of Numantia in 134. He does not seem perhaps to have been more conscious of the evils under which Rome was laboring than others of his time, but, with a characteristic impetuosity, his recognition of them was a call to immediate action for their remedy. To this end he secured election to the tribunate of the people for the year after his return from Spain (133), an office which, by reason of its veto power, was able to control the other magistracies, and which was also well suited to initiate positive legislation. The first of his measures of reform, and the only one he lived to carry through, was the revival of the Licinian law (which had never been repealed) limiting the amount of public land which might be held by any individual. In this way Tiberius hoped to break up the princely estates which the nobles had secured, and, by reducing their holdings of public lands to lawful amounts, to provide small estates, of about 15 acres each, for the landless proletariat of the city. To prevent their falling again into the hands of the nobles these estates were not to be sold, but were to be held in the name of the Roman people and granted in perpetual lease. This measure was vetoed by one of the tribunes, but, bent on carrying through his reform, Tiberius secured the removal of his obstinate colleague by unconstitutional means, since there was no provision for the impeachment of a Roman magistrate. Thus the Licinian law was revived and the execution of it intrusted to a commission of three men, Tiberius, his brother Gaius, and his father-in-law, Appius Claudius. But before they were able to proceed to the execution of the law Tiberius was attacked by a body of the nobles, under the leadership of Scipio Nasica, and beaten to death in the Forum. However, the commission went on with its work and, in spite of many obstacles, succeeded in recovering enough public land to give homes to more than 75,000 citizens and allies. The efforts of Gracchus had therefore not been in vain, although it must be confessed that the revolutionary methods first introduced by him are a grave offset to these benefits.—In 123 B. C., ten years after his brother's death, GAIUS SEMPRONIUS GRACCHUS was made tribune of the people. Of his life before he became tribune Plutarch says: "In Sardinia Gaius gave a noble specimen of every virtue, distinguishing himself greatly among the other young Romans, not only in his operations against the enemy and in acts of justice to such as submitted, but in his respectful and obliging behavior to the general. In temperance, in simplicity of diet, and love of labor he excelled even the veterans." In ability and in oratorical genius he surpassed his brother, while the fate of the latter did much to embitter and accentuate his natural intensity and fierceness of spirit. The reforms which he proposed were of a more radical nature than those entertained by his brother, and seem to have aimed at nothing less than a subversion of the old constitution. As the corner-stone of them all he first carried through a provision allowing re-election to the tribunate of the people, a position from which he hoped apparently to exert his influence as a leader of the state in some such way as Pericles had swayed the Athenian democracy. By regular distributions of grain he won over the rabble, and, by re-enforcing his brother's land law and by founding colonies in Italy, as well as beyond its boundaries, he provided homes for many of the city proletariat. These were but preliminary measures, however, to the humiliation of the senate, the object of which was not only to diminish its power, but also, by means of new recruits, to improve its character and efficiency. This was to be brought about by adding to it an equal number of knights who represented the aristocracy of wealth, and by depriving it at the same time of some of its most powerful and most profitable prerogatives. The latter plan was carried out in a number of measures restricting the judicial and administrative functions of the senate. Had Gaius been able to maintain himself in the tribunate he might perhaps have anticipated the monarchy of Cæsar by almost a century. But, in his absence in the interests of his colonial policy, the fickle mob were induced, by the promise of larger favors from a candidate of the senatorial party, to withdraw their support from Gaius, who had in a measure contributed to their disaffection by his proposition to enfranchise the Italian allies. Graechus was defeated, and on the inauguration of the new consul, L. Opimius (Jan., 121 B. C.), measures were taken against him which resulted in an open conflict between the two parties, and the defeat and death of Graechus and his followers. G. L. HENDRICKSON.

**Grace** [from O. Fr. *grace* < Lat. *gra'tia*, favor, esteem, grace, transl. of Gr. χάρις, grace, favor]: a word which, as a translation of Heb. חֶסֶד and Gr. χάρις, is employed in the Scriptures in most of the senses in which it appears in English—as loveliness (Luke iv. 22); good-will (Acts vii. 10); favor as an act (2 Cor. viii. 4); the kindness of God; what is due to grace, as the condition of one governed by grace (Rom. v. 2); a benefit (1 Cor. xvi. 3; 1 Pet. v. 10); thanks.

I. *History.*—Though the doctrine of grace was held from the beginning in the Christian Church, its first clear formulation was the result of the controversy between Augustine and Pelagius (A. D. 412–430). Pelagius held, in order to give full force to the feeling of responsibility for sin, that the human will itself first inclines toward God, and that then grace, by which he meant the co-operation of God, was bestowed as a merited reward for this act. Augustine held that man was unable to help himself, that his will was fixed in sinful volitions, was diseased, and needed healing. Thus the initiative in salvation must be God's, and this initiative was the gift of grace which operated curatively upon the will and brought forth holy volitions. It preceded every holy motion in man, and hence was not merited but given freely (*gratia gratis datur*). While Pelagius held that the giving of the Gospel was grace, Augustine limited the term to the direct operation of God as a personal agency upon the will itself, not excluding, however, means such as "persuasions." During the following period till the Reformation, while Roman Catholic theology was in process of development, the tendency was toward Pelagianism rather than Augustinianism, as was natural while the idea of merit was more and more dominating the system. But Luther reasserted the Augustinian doctrines with even greater emphasis than their first formulator. Man lost all real activity, and the divine initiative was fully maintained with the associated doctrines of election, which Luther conceived in strong supralapsarian form. Melanchthon, successively modifying his theory of the mind and the will, sought to give more play to a true freedom, and introduced what has been called "synergism," but improperly so, since he maintained the divine initiative decidedly, though ascribing an activity to the will in response thereto. Calvin agreed more fully with Augustine, and under his influence Augustinian methods of thought and expression became common till Arminius (d. 1609) sought to remove the objectionable features of the doctrine of predestination. He made election, strictly termed, to be restricted to the choosing of certain nations as recipients of grace; taught a universal prevenient grace, enabling the wills of all men who hear the Gospel to believe, which act of faith they exercise by virtue of their restored freedom. The tendency since Arminius's day has been toward a fuller acknowledgment of the freedom of the will, and a consequent modification of extreme forms of stating the doctrine of grace. New school Calvinism in the U. S. makes the grace of God individual and prevenient, teaches that as an historical fact the will of man never takes the initiative toward God, but emphasizes the abstract power of contrary choice at every moment.

II. *Evangelical Import.*—This, derived from the New Testament, may be concisely stated as *divine favor shown to the ill-deserving*.

(1) *Grace is a consequence of the divine character.* It is an outflow of the love of God (John iii. 16) which sent the Redeemer, and embraces in its scope even the guilty (Rom. v. 8). (2) *Men are saved by grace.* This doctrine is specially emphasized by Paul, whose teachings may be thus summarized: It is conceivable that men might be saved by works, since perfect obedience to the divine law would entitle men to salvation. But, as a fact, all men have sinned. They have thus, on the one hand, failed to render perfect obedience, and, on the other, have laid themselves open to the condemning sentence of God. Salvation is thus in no sense due to them. If they have it at all it must be freely given to them

of God, or it must be of grace. When, now, God does save men out of his love, it is "apart from works of the law" (Rom. iii. 28). These are not considered, one way or the other. Obedience to the moral law will result from the spirit which animates the Christian (Rom. viii. 4), but such obedience does nothing to merit salvation, which belongs in an entirely different sphere (Gal. v. 2 ff., 18). Salvation is through faith as the necessary condition, but salvation itself remains of grace (Eph. ii. 8). Grace thus provides the way of salvation through Christ, calls forth the faith of the believer (Rom. viii. 30), and then freely gives him what he has not thus merited. (3) *Grace also maintains the Christian life.* Although there is a new principle implanted in the renewed man, still his perseverance and success are the work of God in him (Phil. ii. 13), and without grace he can do nothing (John xv. 5). Hence the spirit of grace is emphasized as the agent of victory (Eph. vi. 10 ff).

III. *Theological Terms.*—(1) *Special or efficacious grace* (*gratia efficax*), the divine influence which, in the soul, changes it from sin to holiness. Arminians, though affirming grace to be initial or "prevenient" (enabling), admit no special grace—only one common to all hearing the Gospel. An equivalent term is (2) *irresistible grace*, signifying that grace effects its object in spite of all opposition. It implies, however, the application of force to the will, a conception which theologians have almost universally denied. Hence most prefer *unresisted* grace (*irresistita*), indicating the work as wrought within the sphere of moral freedom and in harmony with it. (3) *Gratia antecedens*, prior to regeneration; *operans*, the same *in* the soul's renewal; *co-operans*, the Spirit's work subsequently, in which the renewed will co-operates. (4) *Sovereign grace*, not deserved, and applied as God wills. (5) *Covenant of grace*, supposed to have been made by God with the Son in view of the Fall, by which he covenanted to give to him all who should believe as a reward for his work of redemption. Frank Hugh Foster.

**Graces**, or **Grace Notes**: in music, certain short notes generally written in small characters, and introduced occasionally by way of ornament before some of the principal notes of a melody. The name is a very general one, referring to appoggiaturas, trills, turns, beats, half-beats, springing notes, and similar embellishments, which are inserted for the purpose of developing or intensifying the effect of some particular notes in an air.

**Graces, The** [Lat. *Gra'tiæ*, transl. of Gr. Χάριτες, Gra'ees, personified plur. of χάρις, grace, pleasure, favor]: in Greek and Roman mythology, the female personifications of beauty and grace. Their names and number and their whole mythus are variously given. Hesiod makes them daughters of Zeus and Eurynome, and names them Euphrosyne, Aglaia, and Thalia. In art they were once represented as draped, but afterward as nude figures, in the bloom of early youth.

**Gracias**: a western department of Honduras; bounded N by Santa Barbara, E. by Comayagua, S. by Salvador, and W. by Copan. Area about 3,000 sq. miles. It formerly included Copan. The surface is varied with mountains and warm, fertile valleys. The principal agricultural products are tobacco, sugar, cocoa, and coffee. The indigo plantations were formerly important, but have been generally given up. Gold has been mined on a small scale, and silver is reported. Pop. about 40,000.—Gracias, the capital, on a branch of the river Ulna, has about 7,000 inhabitants, and a considerable trade with the surrounding district (see map of Central America, ref. 4–F). It was founded in 1536, and called Gracias á Dios, whence the modern name.

Herbert H. Smith.

**Gradien'tia** [Mod. Lat., walkers, neut. plur. of *gra'diens*, pres. partic. of *gra'di*, walk, step]: a name sometimes employed for the batrachian order Urodela (*q. v.*), in allusion to the fact that, unlike the frogs (the *Salientia* of this nomenclature), they walk rather than jump. J. S. K.

**Gradual** [from Mediæv. Lat. *gradua'le*, deriv. of *gra'dus*, step; so called because originally chanted from the steps of the pulpit; primitive reading-desk]: in the office of the mass that portion of Scripture which follows the Epistle and precedes the Gospel. It is generally a part of a psalm. The name is also given to the music, and to the book containing the music for the Gradual.

**Grady**, Henry Woodfen: journalist; b. in Athens, Ga., in 1851; educated in the universities of Georgia and Virginia; entered journalism after the close of the civil war; and became editor and part proprietor of *The Constitution*, of Atlanta, in 1880. In 1886 he delivered an address before the New England Society on *The New South*, in which he displayed marked eloquence and oratory; and a few days before his death, in Atlanta, Ga., Dec. 23, 1889, he spoke before the Merchants' Association of Boston on *The Future of the Negro.* These addresses were widely circulated, and caused him to be especially beloved in the Southern States and highly esteemed in the Northern. A monument and a public hospital have been erected in Atlanta to his memory, and Joel Chandler Harris has published a biography of him.

**Græ** (in Gr. Γραῖαι): the three sisters of the Gorgons (*q. v.*); daughters of Phoreys and Ceto, divinities of the sea. They had beautiful cheeks, they were gray from their birth, and had but one eye and one tooth, which were used turn about. They were stationed as guardians of the road that led to the abode of the Gorgons and of the weapons that could slay the Gorgon Medusa. Perseus (*q. v.*) took their eye and tooth away as they slept, and refused to restore it to them until they pointed out to him the road to the Gorgons and gave him the deadly weapons. Their shining white *tooth* and their one *eye* are both symbols of the flaming lightning, as has been definitely proved by Roscher, and these sisters are naturally closely connected with the Gorgons. See Roscher, *Die Gorgonen und Verwandtes* (Leipzig, 1890); A. Kuhn, *Herabkunft des Feuers* (p. 202); Dilthey, in *Annali dell' Instituto* (1871, p. 216); Schwartz, *Ursprung der Mythologie*; Lauer, *System der Griechischen Mythologie* (p. 325); Rapp, in Roscher's *Lexicon* under *Graiai.* J. R. S. Sterrett.

**Graebner**, Augustus L.: clergyman; b. in Michigan in 1849: educated at Concordia College, Fort Wayne, Ind., and Theological Seminary, St. Louis, Mo.; professor in Northwestern University, Watertown, Wis., 1875–78; in Theological Seminary, Milwaukee, Wis., 1878–87; in Theological Seminary, St. Louis, Mo., since 1887. He is the author of a history of the Lutheran Church in America (vol. i., 1892).

**Graefe**, Albrecht, von: See the Appendix.

**Graevius**, Johann Georg (*Grāve*, or *Greffe*): classical scholar; b. in Naumburg, on the Saale, Germany, Jan. 29, 1632; studied law at Leipzig; went to Holland, where he became a pupil of the famous philologist Joh. Friedr. Gronov. Appointed professor in Duisburg in 1656, and the successor of his teacher at Deventer in 1658. Professor in Utrecht from 1661 till his death, Jan. 11, 1703. Editor of *Hesiod*, *Cicero* (his masterpiece), *Cæsar*, *Catullus*, *Tibullus Propertius*, *Suetonius*, *Florus*, *Justinus*, and others, and the compiler of the monumental *Thesaurus antiquitatum romanarum* (12 fol. vols., 1699), and of the *Thesaurus antiquitatum et historiarum Italiæ* (Leyden, 12 fol. vols.), completed by P. Burmann, who also wrote his *Life* (1703).

Alfred Gudeman.

**Graf**, Arturo: Italian poet and critic; b. in Athens in 1848. His early years were spent in part in Trieste and in Roumania. Subsequently he studied law in the University of Naples, then returned to Roumania for several years. In 1874 he settled in Rome, teaching as privat docent in the University of Rome. In 1876 he went to Turin as Professor of Romance Languages, but in 1882 became Professor of Italian Literature. Graf's poetical works are *Versi* (Braila, 1874); *Poesie e Novelle* (Rome, 1876); and *Medusa* (Turin, 1880). In these volumes he appears the poet of modern pessimism, but loving beauty both in nature and in art. Few modern Italian poets have his precision of touch or his perfection of form. No less noteworthy is his critical work, of which perhaps the best representative is his *Roma nella memoria e nella imaginazioni del Medio Evo* (2 vols., Turin, 1882–83). Valuable also are his *Studj dramatici* (Turin, 1878); his *Dell' Epica neolatina primitiva* (Rome, 1876); his *Miti, leggende e superstizioni del Medio Evo* (2 vols., Turin, 1891–93). He has contributed much and well to the *Giornale storico della letteratura italiana* (Turin, 1883, *seq.*), of which he is one of the founders and editors, as well as to the *Nuova Antologia* and other journals. A. R. Marsh.

**Graffiti**, grăaf-fee'tĕe [Ital., liter., scratches, deriv. of *graffia're*, scratch < Low Lat. *graphia're*, scratch, scribble, write, deriv. of *gra'phium* = Gr. γραφεῖον, style for writing (scratching on wax), deriv. of γράφειν, scratch, grave, write]: the rude inscriptions found upon ancient buildings and stones, chiefly in Italy. The fact that they are in the Latin, Greek, or old Italian languages proves their great antiquity. They are of rude and almost always intrinsically worthless character, and are evidently in many cases the work of idle

scribblers. Except in the case of those found in the Catacombs their antiquity confers upon them the chief interest they possess. They are found in the substructures of Roman ruins; as, for instance, in the Golden House of Nero, the palace of the Cæsars, the Palatine, and in still greater numbers in Pompeii and in the Roman catacombs. They sometimes give striking glimpses of the mode of thinking and the manner of living in ancient times. Thus was discovered in a chamber of the palace of the Cæsars a caricature of Christian worship accompanied by an explanation; the caricature represents a man worshiping an ass hanging on a cross. Several collections have been published, from which a little archæological knowledge has been gained. A small collection of *graffiti* from Pompeii was published in 1837 by Dr. Wordsworth, but the most complete and most interesting is that by Father Carrucci, a Jesuit from Naples, published in Paris in 1856. They are partly Latin and partly Greek. The term is also applied to deeply engraved lines and patterns intended for ornament, as in plaster spread upon walls. In this sense called also *graffito decoration*.

**Grafting**: the operation of inserting a bud or cion* into a plant, or stock. A "bud," in technical language, is a single bud cut from the side of a small twig and having little or no wood attached to it. A cion is a detached portion of a plant,

FIG. 1.—Cleft-graft cion.

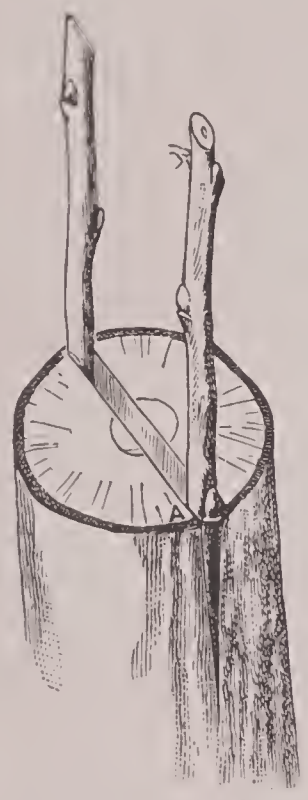


FIG. 2.—Cleft-grafting.

FIG. 3.—A waxed stub.

bearing woody tissue and two or more buds. A stock is a plant or part of a plant upon which a cion or bud is set; in most cases it is a seedling plant of unknown or inferior merit in its fruit, flowers, or habit. The term grafting, in its broad sense, is held to include budding, or the insertion of single buds as defined above, and grafting proper, or the insertion of cions; but it is ordinarily associated with the latter operation alone. A still broader term, to denote the whole process and operations of grafting and budding, and the state and condition incident thereto, has been suggested: the word *graftage*. Grafting or budding is employed for the propagation and perpetuation of nearly all the varieties of tree fruits, and it is used for many ornamental trees and shrubs. It may be used in many herbaceous perennials to advantage, but such plants are more commonly propagated by means of cuttings. The common office of grafting is to perpetuate a variety which will not reproduce itself, or "come true," from seed, but in some species, which present no well-marked varieties, propagation is so slow or difficult from seeds or cuttings that they are grafted upon stocks of related species. Grafting is also employed for the purpose of producing some radical change in the plant, as in the dwarfing of trees by growing them upon slow-growing stocks, and the acceleration of fruit-bearing by setting cions in old plants. Thus pears are dwarfed by grafting them upon the slow-growing quince, and apples by grafting upon the paradise stock. Grafting is employed, therefore, for three purposes: to perpetuate a variety; to increase the ease and speed of multiplication; to produce some radical change in the habit or other character of the cion. The limits within which intergrafting is possible between different species of plants can be determined only by experiment, but it may be said that only the most closely related species can grow upon each other. For a long time it was supposed that promiscuous grafting was possible, but the instances which were cited in proof of the supposition were not well founded. Among common fruits the stone-fruits not only refuse to grow upon the pome-fruits, but many of the species will not intergraft. Thus the peach does not succeed upon the cherry, although it will grow upon the apricot and plum. Among the pome-fruits, apples will not grow upon pears, but pears succeed for a time upon apples; yet pears thrive upon many of the thorns, although these two plants are thought by botanists to be less closely related than are apples and pears.

There are very many methods of grafting, differing in the size of the cion, the method in which it is cut or shaped, and the manner of insertion into the stock. Grafting proper, or cion-grafting, is usually performed in the winter or early spring, and the cut surfaces of both stock and cion are protected by a covering of wax. The cions are cut from dormant trees in winter and are stored until used in a cool cellar, or they are sometimes buried in a well-drained sandy place. Greenhouse plants are often grafted by using short, green cions which contain two or three leaves. The commonest style of grafting is that shown in the first three illustrations, and is known as cleft-grafting, from the split or cleft which is made in the stock for the reception of the cions. The cion, which is shown about natural size, bears two or three buds, and is cut at its lower end into a wedge-shape. The portion of the branch to be grafted is cut off squarely, and is split to a depth of an inch or two. This cleft is held open by means of a wedge, and a cion is inserted upon either side—if the stock is large enough to accommodate two cions—care being taken that the inner barks of the cion and stock meet. The wax is now applied, either cold by the fingers, or warm with a brush. There are various recipes for grafting wax. One of the best is as follows: Resin, 4 parts by weight; beeswax, 2 parts; hard or cake tallow, 1 part. Melt together and pour into a pail or tub of water. When nearly cool work it through the hands until it becomes tough and light colored. Budding or bud-grafting is commonly done in late summer or early fall, upon small stocks or branches, the bud usually being set upon wood that is not more than two years old. The bud shown in Fig. 4 is cut from the side of a recent twig in shield-shape.

FIG. 4.—Shield-bud.

FIG. 5.—Preparing the stock.

FIG. 6.—The bud tied.

The stock is then prepared by making a T-shaped incision (Fig. 5), into which the bud is slipped, and it is held in place by a binding of some soft string. Fig. 6 illustrates the method. Buds inserted in late summer, after the common method of propagating fruit trees, remain dormant until the following spring, but the bandage must be removed in a week or two after the bud is inserted. Any part of the stem or root of a tree may be grafted, and where the bark is not too thick and stiff budding may also be practiced. Grafting in the top of a tree is called top-grafting, in distinction from

* *Cion*, an old form of the word *scion*, is that generally used by nurserymen, though marked obsolete in the dictionaries.

crown-grafting, which is performed at the "crown" or "collar" at the surface of the ground, and from root-grafting which is done upon roots. Many fruit and ornamental plants are propagated by the last method, the cion being inserted into a piece of root. There has been much discussion as to the merits of grafting as a means of multiplying plants, but, while it has disadvantages in many instances and is unsatisfactory when carelessly or improperly performed, it is nevertheless one of the most indispensable practices in horticulture. See Fuller's *Propagation of Plants* and Bailey's *Nursery-book*. L. H. Bailey.

**Grafton**: city; capital of Walsh co., N. D. (for location of county, see map of North Dakota, ref. 1–F): on the Gt. N. and the U. Pac. Railways; 50 miles N. W. of Grand Forks. It is the distributing point for a large wheat-growing region, and has 1 daily, 1 monthly, and 3 weekly periodicals. Pop. (1890) 1,594; (1900) 2,378.

**Grafton**: town; capital of Taylor co., W. Va. (for location of county, see map of West Virginia, ref. 6–I): on the Tygart Valley river and the Balt. and O. Railroad; 100 miles S. E. of Wheeling. It has several churches and public schools, large railway shops, several foundries, and flour, planing, and saw mills, 1 bank, and 2 weekly papers, and is prineipally engaged in lumbering, coal-mining, and manufacturing. Pop. (1880) 3,030; (1890) 3,159; (1900) 5,650.
Editor of "Sentinel."

**Grafton**, Augustus Henry Fitzroy, Duke of: b. Oct. 1, 1735; descended from a natural son of Charles II.; was educated in the University of Cambridge; succeeded his grandfather, the second duke, in 1757; entered upon a political career by opposing Bute in 1763, and under the auspices of William Pitt became Secretary of State in the cabinet of the Marquis of Roekingham 1765. Very soon, however, he fell out with the chief of the cabinet, made common cause with the opposition, and compelled his colleagues to retire. A new cabinet was formed, nominally under his leadership, but in reality under that of Pitt, then Lord Chatham. The latter, however, showed a singular indifference to the course of affairs, and was dismissed in Oet., 1768. Alone, and face to faee with a formidable opposition, Grafton abandoned the principles of the party whieh had brought him to power, and governed by means of the two worst expedients possible—bribery and violence. The indignation which this manner of proceeding caused was extreme, and it found its willing expression in the letters of Junius. At last even Chatham raised his voice against his former pupil, and in Feb., 1770, Grafton retired. He was a member, however, of the cabinet of Lord North as Keeper of the Privy Seal 1771–75, but the public seemed to take little notice of him. He held the same office in 1782–83. During the last years of his life he was much occupied with religious, or rather theological, matters. He gradually separated from the Church of England, and at last openly professed Socinianism or Unitarianism, publishing *Hints submitted to the Serious Attention of the Clergy, Nobility, and Gentry newly associated*, and *Apeleutherus*. He was elected chancellor of the University of Cambridge in 1768, and held the dignity to his death, which occurred at Euston Hall, Suffolk, Mar. 14, 1811.

**Gragnano**, grăn-yaa′nō: town of Italy, near Castellamare di Stabia, in the province of Naples; 20 miles by rail S. E. of the city of Naples (see map of Italy, ref. 7–F); is a bishop's see, has a collegiate church, is celebrated for its superior wines, and has manufactures of cloth and maccaroni. It was anciently surrounded with walls. Pop. 8,611.

**Graham**, Charles Kinnaird: civil engineer and soldier; b. in New York city, June 3, 1824; received a liberal education, and entered the U. S. navy as midshipman. Soon after his enrollment the Mexican war broke out, and the vessel to which he was attached was ordered to the Gulf of Mexico, where he devoted himself to the study of engineering science. At the close of the war he returned to New York, and after continuing his studies for several years began private practice. About 1857 he was appointed constructing engineer of the Brooklyn navy-yard, the dry dock and landing-ways being constructed under his supervision. On the outbreak of the civil war he and upward of 400 men in his employ at the navy-yard enlisted and the Excelsior Guard was organized, of which Graham was elected major subsequently. He served throughout the war, part of the time with the Army of the Potomac; was made brigadier-general; commanded a gunboat flotilla on the James river, and took part in the attack on Fort Fisher; soon after the close of the war returned to New York and resumed the practice of his profession; in Mar., 1865, was breveted major-general of volunteers. In 1873 he was appointed chief engineer of the department of docks, and in 1878 surveyor of the port of New York; was naval officer of it 1883–85. D. at Lakewood, N. J., Apr. 15, 1889.

**Graham**, James Duncan: topographical engineer; b. in Prince William co., Va., Apr. 4, 1799; graduated at the U. S. Military Academy, and entered the U. S. army as third lieutenant of artillery July, 1817; promoted to be second lieutenant Oct., 1817, first lieutenant Sept., 1819; adjutant at the Military Academy till Feb., 1819; accompanied Maj. Long on his Western exploration 1819–21; on topographical duty 1822–29; he was transferred as assistant topographical engineer, and continued on railway and military surveys 1829–38; promoted to be major topographical engineers; from 1838 to 1850 engaged as astronomer to determine the boundary between the U. S. and the republic of Texas; commissioner in survey of the northeastern boundary of the U. S.; head of the scientific corps and principal astronomer to determine the boundary between the U. S. and the British provinces; on survey of "Mason's and Dixon's line," and of the boundary between the U. S. and Mexico. Promoted to be lieutenant-colonel 1861, and colonel of engineers 1863, and engaged in the survey of the lakes, lighthouse duty, and in charge of harbors on the North Atlantic coast. D. in Boston, Mass., Dec. 28, 1865.

**Graham**, John, Viseount Dundee and Lord Graham of Claverhouse: b. near Dundee, Scotland, about 1649; studied at the University of St. Andrews; served in the French and Dutch armies 1670–77; was made captain of dragoons by Charles II., and sent into the Western Lowlands against the Covenanters; was defeated at Drumclog, but was victorious at Bothwell Bridge, and obtained unenviable notoriety by his atrocities. In 1688 he was ennobled by James II., whose cause he supported against William III. At Killiecrankie Pass he defeated William's troops, but fell himself July 27, 1689. See Napier, *Memorials and Letters illustrative of the Life and Times of John Graham of Claverhouse* (3 vols., 1859–62); Morris, *Claverhouse* (1887).

**Graham**, Thomas, D. C. L., F. R. S.: chemist; b. in Glasgow, Scotland, Dec. 21, 1805; educated at Glasgow High School and the Universities of Glasgow and Edinburgh; passed M. A. in 1826; Professor of Chemistry in the Andersonian University 1830–37; announced the discovery of the law of the diffusion of gases 1834; became F. R. S. 1836; Professor of Chemistry in the London University 1837–55; master of the mint 1855; was the first president of the Chemical Society 1840; president of the Cavendish Society 1846. He first fully developed the theory of liquid diffusion; made numerous and important discoveries in theoretical and applied chemistry, and became widely known by his excellent *Elements of Chemistry* (1837). D. in London, Sept. 16, 1869.

**Graham**, William Alexander: U. S. Senator; b. in Lincoln co., N. C., Sept. 5, 1804; graduated at the University of North Carolina in 1824; studied law, and in 1833 entered public life as a member of the lower branch of the State Legislature, of which he was several times chosen Speaker; was a member of the U. S. Senate 1841–43, and Governor of the State 1845–49; was Secretary of the Navy under President Fillmore until 1852; in 1852 candidate for the vice-presidency on the ticket with Gen. Scott; was a member of the Confederate Senate; in 1866 was a delegate to the Union convention at Philadelphia called to sustain the policy of Andrew Johnson. D. at Saratoga, N. Y., Aug. 11, 1875.

**Graham Bread**: See Bread.

**Grahame**, James: poet; b. in Glasgow in 1765, and educated at Glasgow University. He became a lawyer and afterward a minister, and was curate of Shipton, Gloucestershire, and Sedgefield, Durham. He wrote a number of poems, mostly in blank verse, the best known of which are *The Sabbath* (1804) and *Poems on the Abolition of the Slave-trade* (1810). D. Sept. 14, 1811. H. A. B.

**Grahamite**: a fossil form of asphalt occurring in Ritchie co., West Va.; first found in a nearly vertical vein which cut the inclosing sandstones of the Subcarboniferous age nearly at right angles to the plane of their stratification. In appearance it resembles some kinds of highly bituminous coal, having a slightly fibrous structure and resinous

fracture, with a black or brownish-black color. It was formerly used for the manufacture of oils and for an enricher of gas; also for roofing, for pavements, and as an electric insulator. When distilled it yields a distillate rich in oils of the paraffin series and of solid paraffin. It belongs to that class of asphalts occurring in injected veins. Petroleum has largely superseded it. See ASPHALTIC COAL and BITUMEN.

S. F. PECKHAM.

**Grahamstown**: capital of the Albany district, Cape Colony, South Africa; 100 miles N. E. of Port Elizabeth (see map of Africa, ref. 10–F); lies along a series of parallel ridges nearly 2,000 feet above sea-level; has an Anglican cathedral, built from the design of Sir George Gilbert Scott, and a Roman Catholic cathedral. With its broad streets, trim gardens, well-built schools, and public buildings, it resembles an English cathedral town. Pop. 6,903.

**Grail, THE HOLY**: See SANGREAL.

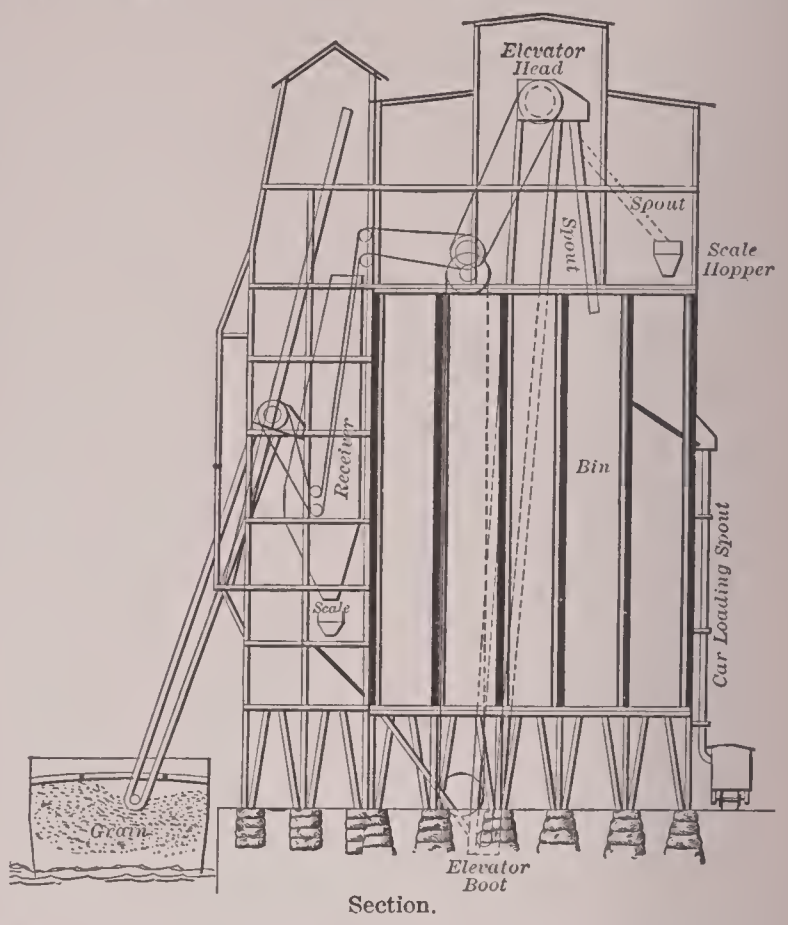
**Grain**: See CEREALIA and FOOD.

**Grain** [special use of *grain*, seed of wheat (the grain being originally determined by the weight of a grain of wheat), from Lat. *granum*, a grain < Indo-Eur. *grnóm* > Eng. *corn*]: the unit of the system of weights prevailing in Great Britain and the U. S. A statute of Henry III. (1266) enacted that 32 grains of wheat from the middle of the ear, well dried, should weigh a pennyweight, of which 20 should go to the ounce; but finally, in the twelfth year of Henry VII., the pennyweight came to be divided into 24 grains. In the U. S. the troy and the apothecaries' pound each contain 5,760 grains, or 12 oz. of 480 grains each; while the avoirdupois pound has 16 oz. of 437½ grains each, or 7,000 grains to the pound. There are 15.43234874 grains in the gramme of the French or metric system of weights, according to Miller's determination made in 1844.

**Grain Coast**: the former name of the coast of what is now Liberia, in Africa, so named from the GRAINS OF PARADISE (*q. v.*), formerly an important article of trade in that region.

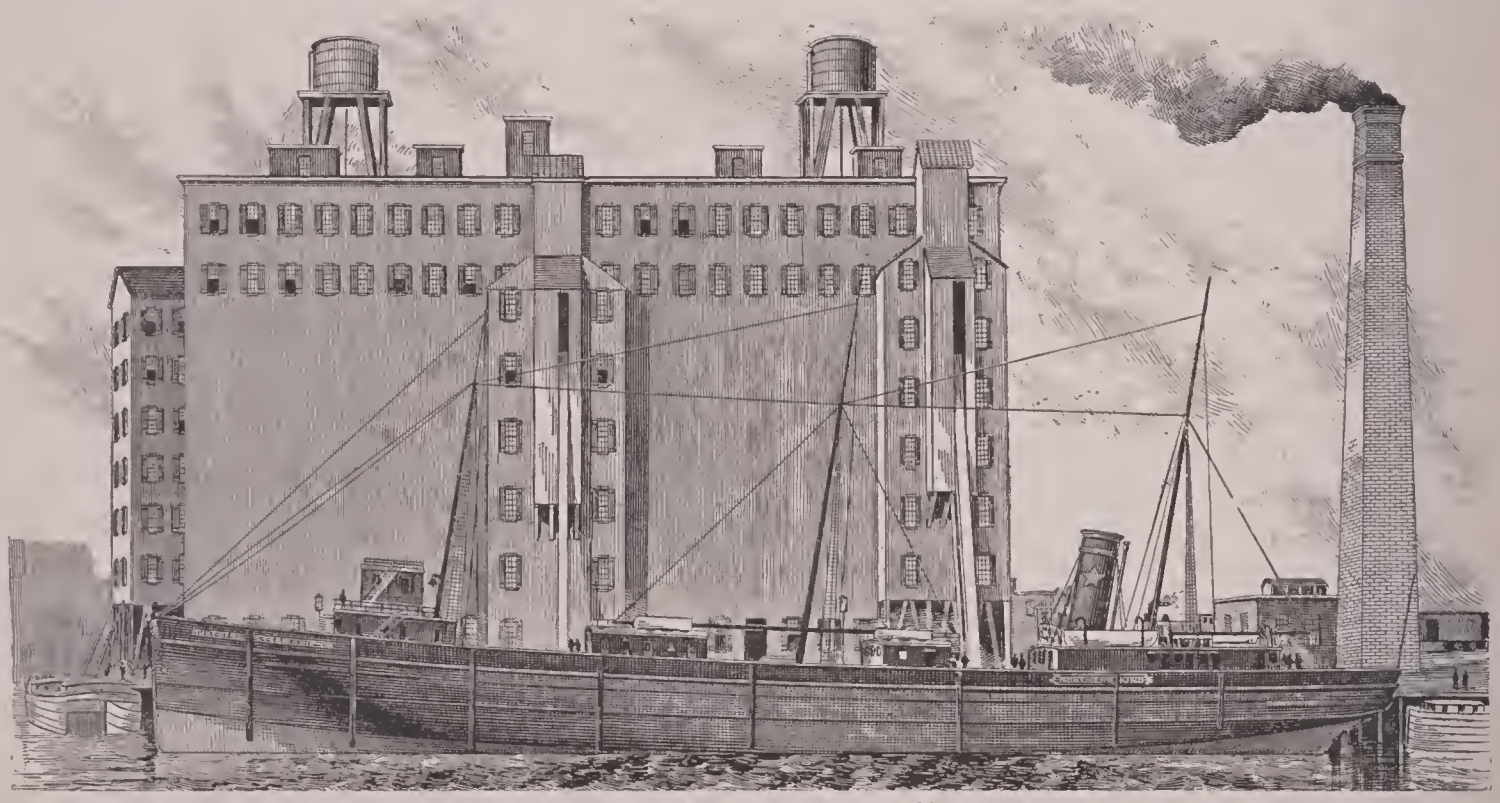
**Grain Elevators**: buildings designed for the storage transfer, and handling of cereals. The old and crude method of handling grain consisted in the employment of men to shovel the grain into bags in the hold of a vessel, carry these out on their backs, then empty them into a storehouse, an operation requiring several days. By the method of elevating grain by machinery, 30,000 bush. of grain can be transferred from a vessel to cars or canal boats in an hour. A modern grain elevator is a large, high structure, with two or three unloading towers on the water-front, one of the towers being stationary. The movable towers are mounted on car-wheels, which run on a double railway track, each tower having its own moving and operating machinery. The stationary tower is built on the middle of the front, with the movable towers on either side.

The main house which holds the grain is built upon a pile and stone foundation. The first story is high, and contains the posts which hold up the superstructure and all the discharge spouts. The bin work rests upon timbers




Section.

which are laid on and fastened to the supporting columns, and the bins vary in height from 60 to 80 feet, and are from 10 to 12 feet square. The floor of the building on top of the bins is called the machinery floor, for in this part of the building are placed the shafting and gearing for driving all of the machinery in the elevator. A wide belt transmits power from the engine below. From this shafting on the machinery floor all of the stationary or inside elevator legs of the storehouse for the distribution of the grain to the different bins are driven. The tops of these distributing legs, with their shafts and driving pulleys, are one story higher. On the front of each unloading tower a projection is built with a slot or opening for operating the marine or outside elevator leg. A marine leg is a large, long double box of sufficient size to admit of cups or buckets, which are fastened to an endless rubber belt. The



Kellogg elevator, Buffalo, N. Y.

bucket in going up maintains an upright position until it reaches the top of the pulley, over which it runs and discharges its contents. It reverses itself in going down until the bottom of the leg is again reached. A barge or vessel in coming to be unloaded moors at the dock with her middle hatch placed opposite the stationary tower, the unloading leg of which is then dropped into the grain in the vessel and elevating begins. The other towers are moved opposite the hatches of the vessel, and their legs also are lowered into the grain which is drawn to the legs by means of steam-shovels. The grain flows through openings in the foot of the leg to the buckets, and is elevated to a large receiver built in the tower into which the grain is admitted. From the receiver the grain is drawn into a hopper, weighed and dropped to the foot of the lofter or distributing legs in the main house, when it is again elevated and spouted into store through spouts arranged at the heads of the inside legs. As the cargo is discharged, the craft, relieved of its burden, rises in the water on an even keel.

GEORGE H. DUNBAR.

**Grains of Paradise**: the seeds of the Malaguetta pepper (*Amomum melegueta*), a scitaminaceous plant of West Africa; cultivated to some extent in Guiana and Trinidad. The name is also given to other similar seeds. They are of a fiery quality, and are used in giving apparent strength to watered spirits, beer, and wine. They are used in farriery, and their alcoholic tincture makes a good stimulant in some cases of neuralgia.

**Grakle**, or **Grackle** [from Lat. *gra'culus*, jackdaw, perhaps named from its cry, *gra, gra*]: any one of several birds of the starling family, such as the paradise grakle (*Acridotheres tristis*) and the MINA BIRD (*q. v.*), or *Eulabes religiosa*, natives of India, and originally in the genus *Gracula*. In the U. S. the name is given to various birds of the family *Icteridæ*, the most familiar being the purple grakle or crow blackbird (*Quiscalus quiscula*) of the Eastern U. S. The boat-tailed grakle (*Quiscalus major*), known locally as the jackdaw, is a larger bird found in the Southern Atlantic and Gulf States. The rusty grakle (*Scolecophagus carolinus*) is a smaller bird with a range from the Eastern U. S. northwesterly to Alaska. The name grakle probably was transferred to the American birds because their general appearance and bronze-black plumage was suggestive of the East Indian forms.

F. A. LUCAS.

**Grallæ** [from Lat. pl. *grallæ*, stilts. See GRALLATORES]: a name applied to various groups of wading birds on account of their long, stilt-like legs. The group is very hard to define, and its members are generally distributed in several groups or orders. In the system of Linnæus the order *Grallæ* included *all* the wading birds, and Dr. Stejneger uses the name for an order containing all the waders save the ibises, storks, and herons. He assigns the following characters to the order: toes partly or at most incompletely webbed, palate schizognathous, the vomer usually pointed, two carotids, and feathers with aftershafts. Ambiens and semitendinosus muscles present, the latter with an accessory slip. See ALECTORIDES, HERODIONES, and LIMICOLÆ.

F. A. LUCAS.

**Grallato'res** [Mod. Lat., lit., plur. of Lat. *gralla'tor*, one who walks on stilts, deriv. of *gralla're*, walk on stilts, deriv. of *gral'læ*, stilts, dimin. of *gra'dus*, step]: a term practically synonymous with GRALLÆ (*q. v.*), but less frequently employed. Dr. Reichenow uses it as the name for a "series" of birds comprising the waders, the *Thinocoridæ*, true quails (*Turnicidæ*), and sand-grouse.

F. A. L.

**Gramin'eæ**: See GRASSES.

**Grammar** [M. Eng. *gramere*, from O. Fr. *gramaire* > Fr. *grammaire* < Low Lat. * *gramma'ria*, by analogy with words ending in *-aria* for Lat. *gramma'tica* = Gr. γραμματική (sc. τέχνη, art), grammar, liter. fem. of γραμματικός, pertaining to letters, deriv. of γράμμα, * γράφμα, deriv. of γράφειν, write, engrave]: the science of the phenomena of language. When the basis of arrangement is the form and relation which these phenomena present in actual use, the science is called *descriptive* grammar. When the basis is their relation to an order of historical development, the science is called *historical* grammar. When the basis is their relation to the general principles which govern the rise and growth of language in general, the science is called *general* or *philosophical* grammar. Most school grammars belong to the descriptive class, though a tendency has shown itself in the latter half of the nineteenth century to seek aid even here from the historical principle so far as it can be done without compromising clearness of statement regarding the existing facts. Thus the purely descriptive grammar formerly explained the case-construction in Lat. *Romæ fuit* as the "genitive of place," but regard for *Athenis, Carthagine, rurī*, etc., has shown it to be more advantageous, even for descriptive purposes, to adopt, partially at least, the historical point of view for the classification of these cases, and to explain them as locatives, as relics of an old case, which, though entirely hidden to the methods of descriptive grammar, can be clearly identified and traced by the use of the comparative method of historical grammar.

Historical grammar deals with the facts as standing in a line of historical development. It gives meaning to the apparently arbitrary systems of descriptive grammar by assigning them to a place in the order of cause and effect. Descriptive grammar, as involving observation and a complete collection and survey of the facts as they occur in use, must, however, always precede even the first applications of the historical method, and, as presenting the materials of a language according to the relations which they hold in the linguistic sense of those who speak it, represents the only *grammatical* method by which a foreign tongue is to be acquired. The application of the modern comparative method to the science of historical grammar has enabled it to extend its arrangement and explanation of facts back beyond the point where the records of the individual language first begin. (See COMPARATIVE PHILOLOGY.) Historical grammar, in which the method by comparison predominates, is therefore often called *comparative grammar*. This is especially the case with those languages in which the scantiness of earlier records compels a more exclusive resort to the indications afforded by comparison. Thus the historical study of Lithuanian, whose earliest records belong to the sixteenth century, can not proceed far without comparison, first with the closely related Lettic and Old Prussian, then with the Slavic languages, finally with the other branches of the Indo-European family; whereas, on the other hand, the study of Modern English, with its rich background of Middle English and Old English, is pre-eminently historical. Comparative grammar is therefore only an auxiliary method of historical grammar. A good example of the best modern type of the descriptive grammar is found in Whitney's *Sanskrit Grammar*. It presents and classifies the facts as they appear in use, without, however, ignoring or doing violence to the historical relations of the facts. A more distinctively historical grammar is Braune's *Althochdeutsche Grammatik*, or Siever's *Angelsächsische Grammatik* (Engl. trans.), while an illustration of the predominance of the comparative point of view will be found in Brugmann's *Griechische Grammatik*.

Philosophical or general grammar deals with the principles that underlie all languages. It considers questions connected with the origin of language, the connection of thought and expression, the action of phonetic law, motives to sound-change, association of forms, formation of the syntactical categories, division into dialects, relation of standard language to dialect, mixture in language, varieties of type or structure, valuation of languages, etc. Under this head are to be classed works like Paul's *Principien der Sprachgeschichte* (Engl. trans.), Whitney's *Life and Growth of Language*, von der Gabelentz's *Die Sprachwissenschaft, ihre Aufgaben, Methoden und bisherige Ergebnisse*, Steinthal's *Ursprung der Sprache* and *Charakteristik der hauptsächlichsten Typen des Sprachbaus*, as well as the earlier works of Wilhelm von Humboldt, the pioneer in this field.

Grammar is not only a science, but an art, inasmuch as it offers a systematic guide to correct usage. It was called an art (τέχνη) by many of the early Greek grammarians. The earliest manual of grammar, that of Dionysios Thrax (second century B. C.) is entitled τέχνη Διονυσίου γραμματικοῦ, and was known at Rome as the *Ars grammatica*. Grammar was called an art (τέχνη) in distinction from ἐπιστήμη, a science, such as astronomy, on the one hand, and from ἐμπειρία, empiricism, on the other. It conformed reasonably to Aristotle's definition of an art as "methodical skill with practical adaptation," τέχνη ἐστὶν ἕξις ὁδοῦ τοῦ συμφέροντος ποιητική. Arising at a time when the purity of Greek speech was seriously threatened by the wide extension of its use, the art of grammar found from the beginning an important practical use in maintaining correct standards of Attic speech. Grammar as taught in the common schools is pre-eminently an art. Its chief aim is by methodical instruction to establish and maintain correct standards of native speech.

The impulse to a grammatical science appears independently among but few of the peoples of early history. The necessity of perpetuating the knowledge of the language and literary monuments of the Sumero-Accadian civilization, which they had inherited, caused the Assyrians to construct vocabularies, syllabaries, translations, and systems of paradigms of this language. The Egyptians invented methods of recording words and then sounds. The Chinese developed in the study of their ancient literature a science of textual criticism and of lexicography, though the impulses to grammatical work in the proper sense unquestionably came first from India, as was also the case in Japan. The only two peoples, however, who independently developed complete grammatical systems were the Hindus and the Greeks, and it is upon the foundations laid by them that the entire structure of modern grammatical science rests. With the Hindus the science of grammar arose in immediate connection with the study and interpretation of their sacred books, and served the main purpose of explaining and of maintaining in purity of form the ancient or classical standard language, the Sanskrit, which had ceased to be the language of the people and was regarded as the peculiar property of the priestly class. The transparency of formation characteristic of this language admitted of its analysis into its constructive elements. With the Hindu grammarian originated the identification and clear definition of root, suffix, tense-sign, mode-sign, inflexional ending, etc. They observed and discussed the exact character of sounds, their changes and combinations, the laws of stem-formation, inflection, and composition with an accuracy, fineness, and completeness that, upon the discovery of the Sanskrit literature, evoked the admiration and amazement of European scholarship. The rise of the science of comparative-historical grammar distinctly dates from this discovery at the end of the eighteenth century. The vast materials of Hindu grammatical science find their completest summary in the marvelous grammar of Pāṇini (probably fourth century B. C.), which is a collection of about four thousand sharply condensed rules. See *Pāṇini's Grammatik herausgegeben übersetzt erläutert und mit verschiedenen Indices versehen*, by Otto Böhtlingk (1887).

The beginnings of Greek grammar are found in the works of the philosophers. Aristotle partly identified and defined the parts of speech, and the Stoics added to his results, but the essential work of constructing a grammatical system lay with the professional grammarians who from the third century B. C. onward are found in connection with the Macedonian courts of Pergamon or Alexandria, or in the schools of Athens or Rhodes. Especially at Alexandria assembled themselves about the great library founded by Ptolemy Philadelphus II. a notable body and succession of grammarians. Among the earliest of these are Zenodotus, Eratosthenes, Aristophanes of Byzantium, and Aristarchus. The influence of Aristarchus (second century B. C.), especially through his pupils and interpreters, who extend in a long line down to Herodianus (second century A. D.), was of the supremest importance not only for the formation of a grammatical system, but for the establishment of standards for textual criticism. Among the grammarians of Aristarchus's school was Dionysios Thrax, whose little handbook of grammar became the basis for all the Greek grammars down almost to modern times, and determined the traditions of school grammar for the entire Occident. In the fifth century A. D. it was translated into Armenian, and in the sixth into Syriac. In the twelfth century it was put into the form of a catechism (*ἐρωτήματα*), and as such formed the basis of the grammars with which such scholars as Chrysoloras, Gaza, Lascaris, and Chalcondyles spread the Greek learning of the Renaissance in Italy. Among the followers of Aristarchus were also Ammonius, Apollodorus, Ptolemæus Ascalonites, Demetrius Ixion, Dionysios of Halicarnassus, Tyrannion, Tryphon, Didymus, Aristonicus, Apollonius Dyscolus, and Herodian. Among the Romans the science of grammar was left largely to Greek scholars, many of whom, like Didymus, Apollonius Dyscolus, and Herodian, found in Rome an appreciative reception. Of the native grammarians M. Terentius Varro, a contemporary of Cicero, occupies the first position by reason of the value of his reports concerning the materials of the older Latin and the Italic dialects. Ælius Stilo and Servius are also to be mentioned, and Priscianus of Constantinople (fifth century A. D.) in his famous *institutiones grammaticæ* pressed into the service of the Latin tongue the best of the doctrines of the Greek grammarians. The grammatical work of the Greeks, in sharp distinction from that of the Hindus, had its rise in philosophical speculation, and later freed itself from the leading-strings of metaphysics only as the accumulation of collected facts compelled it. The first question which engaged its attention was that of the relation between expression and idea. Was the word by nature and right (*φύσει*) or only by convention (*θέσει, νόμῳ*) the expression of the idea? Throughout the whole history of the Greek study of grammar ran also the controversy between anomaly (*ἀνωμαλία*) and analogy (*ἀναλογία*); viz., shall the irregularities or the regularities of language constitute the criterion for judging it? The practical activity of the science addressed itself, however, in foremost regard to the interpretation and establishment of the text of Homer, and herein at least it presents a parallel to the work of the Indian grammarians.

The traditional descriptive grammar generally divides itself under four main heads, orthography, etymology, syntax, and prosody. Orthography deals with sounds and their symbols, letters, and with the grouping of these into syllables and words. In the modern historical grammar this is replaced by phonetics, or the physiology of sounds, phonology, or the history and relation of sounds, and the history of writing with its special disciplines, epigraphy, and palæography. Etymology treats of the parts of speech and their inflections, and in historical grammar is replaced by the historical study of inflections or accidence and of word-formation, including composition and derivation (suffixes and prefixes). The traditional division of accidence into declension and conjugation does not represent any fundamental difference of purpose. Conjugation (Lat. *con* + *jungere*, join) is a translation of Gr. *συζυγία* (*σύν*, with + *ζυγ-*, join), and denoted the grouping of like inflected verbs. It was originally and correctly viewed as a subdivision of *κλίσις* (inflection). Inflection or declension (*κλίσις*) was so named because the various inflections were viewed as deflections from the upright, as represented in the leading form. Thus the nominative was called the "upright" case (*εὐθεῖα, casus rectus*), the others "oblique" (*πλάγιαι*). The cases are so many "fallings" (*πτώσεις, casus*). Aristotle calls the tenses other than the present "oblique" (*πλάγιοι*). Syntax treats of the arrangement of words into sentences according to the functions expressed in their form. The modern historical syntax seeks to show how the functions expressed by form and the types of construction in sentences are historically conditioned and developed. Prosody treats of the laws of versification as related to the quantity and accent of syllables.

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BENJ. IDE WHEELER.

**Grammar Schools**: See the Appendix.

**Grammateus** (in Gr. *Γραμματεύς*): an Athenian secretary or clerk. There were several kinds of clerks in Athens: the humblest were professional clerks, paid by the state, and belonged to the lowest classes, or else they were slaves owned by the state. Clerks of this kind were attached to a host of petty offices, such as the office of magistrate. But there were also several kinds of clerks of higher rank, such as the clerk of the senate, who was a senator elected by his colleagues. Of high rank was the clerk of the PRYTANY (*q. v.*) in office; he was elected by lot and his duty was to preserve the enactments of the Prytany, and his name was placed in the enactment as a guarantee of accuracy and to date the document. The clerk of the city was elected by the people, and it was his duty to act as the clerk of the public assemblies, keep the records, etc. To the clerks of high rank belonged the antigrapheus (the auditor or check-clerk) of the senate, who was responsible to the people for the accounts and enactments of the senate. The antigrapheus of the treasury was elected by the people, to whom he was responsible for the accuracy of the accounts of all the officials of the treasury. See Böckh, *Staatshanshalt der Athener*, i., 252 ff.; Hille, *De scribis Atheniensium publicis* (Leipzig, 1878); Kornitzer, *De scribis publicis Atheniensium* (Vienna-Hernals, 1883); Schaefer, *De scribis senatus populique Atheniensium* (Greifswald, 1878); Heydemann, *De senatu Athe-*

*niensium quæstiones epigraphicæ* (Strassburg, 1880); Hartel, *Studien über Attisches Staatsrecht und Urkundenwesen* (Vienna, 1878). J. R. S. STERRETT.

**Gramme**, or **Gram** [= Fr. *gramme* < Lat. *gram'ma* = Gr. γράμμα, a small weight, liter., a letter, deriv. of γράφειν, write]: the unit of weight in the metric system of weights and measures. Theoretically it is the weight in vacuo of a cubic centimeter of distilled water at the temperature of maximum density, assumed to be 4° C. or 39·1° F. Practically it is the one-thousandth part of the weight of the kilogramme in platinum, deposited on June 22, 1799, in the Palace of the Archives in Paris, by the international commission appointed to fix the standards, who on that day completed their work. (See METRIC SYSTEM.) The original determination of this standard was made in 1795 with great care, by Mr. Lefèvre Gineau, a member of the commission. It was adopted as representing exactly the weight in vacuo of 1 cubic decimeter of water under the conditions above named. Its weight in British grains has since been carefully ascertained on three occasions, viz.: by Hassler, chief of the U. S. Coast Survey, in 1832; by Kupffer, of St. Petersburg, in 1841; and by Miller, of London, in 1844. These determinations are severally as follows: Hassler, 15,433·1669; Kupffer, 15,432·36186; Miller, 15,432·34847. Miller's determination has been officially adopted by the British Standards Bureau, and is hence generally accepted. But as the officially adopted length of the meter in England is 39·37079 inches, and the officially adopted weight of the cubic inch of distilled water in vacuo, at 62° F. (252·724 grains) reduced by Miller's coefficient to 39·1° F. is 253·00452 grains, it results from the combination of these numbers that the standard kilogramme of the Archives is 7·77118 grains too light. Kupffer, on the other hand, found the weight of the cubic inch of water in vacuo at 13⅛° R. = 16.67° C. = 62° F., to be only 252·598 grains; and taking this with his determination of the weight of the standard kilogramme (which exceeds that of Miller only by the minute fraction 0·01312 gr.), a cubic centimeter of water at maximum density weighs in vacuo 1,000·0115 grammes, or only about one-sixth part of a grain more than the standard kilogramme. On this Mr. Chisholm, Warden of the Standards to the British Government, remarks (*Second Report of the British Standards Commission*, 1869) that "if Capt. Clarke's more recent valuation of the meter = 39·370432 English inches, be taken as the base, a cubic decimeter of water at its maximum density weighs 0·015 gramme or 0·23145 grain *less* than a kilogramme," and that "if the mean of these two computations be taken, the weight of a cubic decimeter of water at its maximum density will be only 0·00175 gramme, or 0·027 grain less than a kilogramme."

It is still unsettled what is the true weight in British grains of a cubic inch or of any other given volume of water; and hence it is equally uncertain what is the amount of discrepancy, if any, between the actual or legal and the theoretic weight of the standard kilogramme. A summary of the results of investigation up to 1832 on the weight of the cubic inch of water may be found in Hassler's first and large *Report on Weights and Measures* made in that year to the Secretary of the Treasury of the U. S. The substance of Kupffer's results is given in the Sixth Appendix to the *Second Report of the British Standards Commission*, made in 1869 and published as a blue book. A discussion of the whole subject may be found in F. A. P. Barnard's essay, *The Metric System* (1872).

The gramme = 15·43 grains, though the unit base of the system of metric weights, is the practical unit only where small quantities are concerned, as in medicine, chemistry, coinage, etc. The usual commercial unit is the kilogramme = 2·20462 lb. avoirdupois. It should be observed that this equivalent of the kilogramme, which is commonly received, is a weight in vacuo, and involves consequently for ordinary uses a trivial error.

**Grammont**, grăă'mōn': town of Belgium, in the province of East Flanders; on the Dender; 14 miles by rail S. by E. of Ghent (see map of Holland and Belgium, ref. 9–C). It has an episcopal seminary and manufactures of damasks, linen, cotton, and black laces. Pop. 9,746.

**Grammont, Order of**, called also **Grandmontains**: an order of monastics established at Muret, near Limoges, in France, in 1073, by Stephen of Thiers, who wore a shirt of steel rings and slept in a coffin. He took the title of corrector. Gregory VII. imposed the rule of St. Benedict. In 1124, after Stephen's death, the order was removed to Grandmont, whence it took its name. It had a verbal or traditional rule, derived from its founder and afterward reduced to writing. The Grandmontains were afterward very numerous and much respected. They were at first allowed to hold no lands or churches. This was one of the orders whose members were known as Bons Hommes. The order perished at the time of the French Revolution, having degenerated.

**Gramont**, grăă'mōn', PHILIBERT, Count de: courtier; b. in France in 1621; served in the French armies in Germany, Burgundy, and Spain; chiefly famous for his scandalous intrigues at the French and English courts. Having seduced Eliza Hamilton, a Scottish lady, he was compelled by her brother, afterward Count Anthony Hamilton, to marry her (1664). He re-entered the French service in the Low Countries, and died Jan. 10, 1707. Count Anthony Hamilton published in French his *Mémoires* (1713), a brilliant narrative of Gramont's exploits in love and at the gaming-table, well known in the English translation. Among English editions is that by Bohn (1846).

**Gram'pians**: a range of mountains in the western part of Victoria, Australia, stretching from N. to S. in a curve around the basin of Glenelg and its affluents. The highest peak is 5,600 feet above the sea.

**Grampians**: a range, or rather system, of mountains which traverse Scotland from N. E. to S. W., from the Atlantic to the North Sea, and form the highlands of Aberdeenshire, Kincardineshire, Forfarshire, and Perthshire. The highest point is Ben Nevis, 4,406 feet; the general height is from 2,000 to 3,000 feet. Toward the N. the Grampians send forth ranges of wild mountains, forming extensive highlands; towards the S. they slope more gently.

**Grampus** [from Ital. *gran pesce*, or Span. *grandpez* < Lat. *grandis piscis*, great fish]: popular name for almost any good-sized cetacean; applied not only to such forms as the blackfish (*Globiocephalus*) and killer (*Orca*), but to some of the *Delphinidæ*, and smaller finback whales. Strictly speaking, it belongs to the members of the genus *Grampus*, a division of the blackfish family, distinguished, aside from more technical characters, by having no teeth in the upper jaw, and but few (four to fourteen) in the front portion of the lower jaw. The best-known species, the gray grampus (*Grampus griseus*), is slaty gray, mottled and streaked, is about 8 or 10 feet long, and is found in the North Pacific, North Atlantic, and the Mediterranean. F. A. LUCAS.

**Gran**, graan: town of Hungary; on the right bank of the Danube; 25 miles N. W. of Budapest (see map of Austria-Hungary, ref. 5–G). It is one of the oldest towns of Hungary, being the birthplace and residence of St. Stephen, the first king, and it is still a handsome and lively place. It is the see of the Primate of all Hungary, an archbishop of the Latin rite, and has a most beautiful though yet unfinished cathedral. Its trade in wine is considerable. Pop. 8,932.

**Granacci**, grăă-năăt'chĕe, FRANCESCO: a Florentine painter; b. in 1477. Lorenzo de' Medici protected him, and he studied in his garden, where he became an expert draughtsman, following the lead of Michelangelo, whose friend he was. He studied also with Domenico Ghirlandajo. His work is chiefly to be found in Florence, and is of a decorative character. D. at Florence in 1554. W. J. S.

**Granada**, grăă-naa'da [Span., liter., pomegranate]: one of the largest and richest kingdoms which the Moors established in Spain. It comprised the three modern provinces of Malaga, Granada, and Almeria, and had an area of 11,063 sq. miles of the most diversified and fertile land, bordering S. on the Mediterranean, and traversed by the Sierra Nevada, from whose lofty snow-clad peaks the ground gradually sinks, through beautiful terraces, into the low and hot plain of Andalusia. In the time of the Romans this territory belonged to the province of Bætica. After the invasion of the Moors in the eighth century it formed part of the kingdom of Cordova until 1235, when it rose into an independent kingdom, with Granada as its capital. Here the genius of the Moorish people had its finest and happiest inspirations. The land was densely peopled, the soil excellently cultivated, and the kingdom covered with works of wonderful architecture and engineering. The most delicate products of art and industry passed from here to all the markets of the world, and a considerable influence was exercised on the civilization of Europe—on its science, its morals,

and its customs. But in 1492 the kingdom of Granada was conquered by Ferdinand and Isabella, and in 1510 the Moors were expelled from Spain. The works of irrigation stopped operation, the plantations withered away, the gloom of the Inquisition fell like a frost on the sciences and arts, and the splendor of Granada was gone. The present province of Granada has an area of 4,937 sq. miles. Pop. (1887) 484,341.

**Granada**: city of Spain; the capital of the province of Granada (see map of Spain, ref. 19–F). It is built on two spurs of the northern range of the Sierra Nevada, at an elevation of 2,445 feet above the level of the sea, and has a most delightful climate, the atmosphere being refreshed by the breezes from the snowy peaks behind the city. Below it stretches the Vega, the plain of Granada, watered by the Jenil and the Darro, and once remarkable for its high state of cultivation. Granada is the see of an archbishop, and has a university founded in 1531, and yearly attended by several hundred students, and a large cathedral, most gorgeously decorated with variegated marble and containing the monuments of Ferdinand and Isabella. But its chief interest it derives from its historical remains. It was founded by the Moors in the eighth century, and became in 1248 the capital of the kingdom of Granada. As such it was one of the most splendid cities the world ever saw. It had 400,000 inhabitants, and was surrounded by a strong wall crowned by 1,030 towers; and in spite of centuries of decay, not only the ALHAMBRA (*q. v.*) but many other buildings attract the traveler. Pop. (1887) 73,006.

**Granada**: a city of Nicaragua; on the northwest shore of Lake Nicaragua, near the foot of the Mombacho Volcano (see map of Central America, ref. 6–H). It is in the midst of a fertile district noted for its fine cacao plantations. The lake, E. of the city, is dotted with numerous islets, formed by a lava-flow from Mombacho, but now covered with vegetation and very picturesque. Owing to its situation, Granada is a commercial point of great importance, all the trade between the Pacific and the lakes passing through it. A railroad connects it with Managua, Leon, and the port of Corinto on the Pacific, and the projected Nicaragua Canal will greatly increase its commerce. It was founded by Hernandez de Cordoba in 1524; in the sixteenth and seventeenth centuries it was one of the most important places in the Spanish colonies, the transit trade across Nicaragua passing through it; its fairs attracted hundreds of traders. Its university, once famous, has now fallen into decay. Granada has been four times destroyed by fire; the last time during the filibusters' war of 1856, when it was temporarily the capital of the republic. Pop. (1893) about 12,000.

HERBERT H. SMITH.

**Granadil'la** [Span., dimin. of *granada*, pomegranate]: the fruit of several tropical species of passion-flower. The great granadilla is the fragrant, gratefully sub-acid fruit of *Passiflora quadrangularis*, whose root is emetic and narcotic. *P. laurifolia* (watermelon), *P. maliformis* (sweet calabash), *filamentosa*, *edulis*, and many other species bear edible fruits. They are all natives of America. See PASSION-FLOWER.

**Granbery**, JOHN COWPER, A. M., D. D.: b. at Norfolk, Va., Dec. 5, 1829; educated at Randolph-Macon College, Virginia; became a member of the Methodist Episcopal Church South in 1844; was a chaplain in the Confederate army 1861–65; Professor of Moral Philosophy and Practical Theology in Vanderbilt University, Nashville, Tenn., 1875–82; elected a bishop in 1882; and published a *Bible Dictionary* in the same year. J. F. H.

**Granbury**: town; capital of Hood co., Tex. (for location of county, see map of Texas, ref. 3–H); on the Brazos river and the Ft. W. and Rio G. Railway; 40 miles S. W. of Fort Worth. It is in an agricultural and cattle-raising region, and has two weekly newspapers. Pop. (1880) 524; (1890) 1,164; (1900) 1,410.

**Granby**: a town of Shefford County, Quebec, Canada; on the northern division of the Central Vermont Railway; 29 miles E. of St. Johns (see map of Quebec, ref. 6–C). It has a good water-power and several mills and factories. Pop. 1,040.

**Granby**, JOHN MANNERS, Marquis of: soldier; b. in England, Jan. 2, 1721; eldest son of the Duke of Rutland; was educated at Eton and Cambridge; raised a foot regiment in 1745; was chosen to Parliament 1754, 1761, and 1768; became colonel of the Horse Guards in 1758; lieutenant-general in 1759, and distinguished himself at the battle of Minden; commanded the British troops in the Seven Years' war 1760–63; was distinguished at Warburg 1760, at Kirchdenken 1761, at Gräbenstein and Homburg 1762; became master-general of ordnance 1763; had chief command of the British army 1766–70. D. at Scarborough, Oct. 19, 1770.

**Gran Chaco** [from the Quichua *chacu*, the animals driven together by a round-up hunt, in allusion to the numerous Indian tribes inhabiting it]: a region in South America embracing all the land W. of the Paraguay and N. of the Salado to the highlands of Northwestern Argentina and Bolivia, and northward to about lat. 17° 30′ S.; it thus includes the northeastern part of Argentina, the southeastern part of Bolivia, Western Paraguay, and a very small strip of Brazil, the total area being not less than 325,000 sq. miles. Formerly the name was extended to Northeastern Bolivia as far as the Guapré and Beni, which would add nearly 200,000 sq. miles to the estimate. Excluding this northern region, the Chaco is a vast plain, in parts perfectly flat, elsewhere slightly rolling, the whole with a very gentle slope to the southeast; in the northern part there are some isolated hills, and westward the plain is broken by spurs from the highlands; but the general surface is nowhere more than a few hundred feet above sea-level. The great rivers Pilcomayo, Bermejo, and Salado cross it in a southeasterly direction; they have very tortuous courses, and break up into a network of channels before reaching the Paraguay. All these rivers, as well as the Paraguay itself, are subject to yearly freshets, when the waters rise over the low banks and inundate vast areas of the flat lands; it is said that the whole region between the Bermejo and the Pilcomayo is thus flooded, only small portions being left as flat islands. As the waters subside the soil bakes hard, leaving an arid waste, with stagnant lakes, pools, and swamps here and there. Where the pools are lacking, travelers crossing the plain may die for want of water on the very ground that was flooded 10 feet deep a few months before. Large areas of these floodlands are covered with a thin growth of Carandá palms (*Copernicia cerifera*), presenting a very peculiar appearance. Higher portions of the Chaco are covered with grass, but the pasturage is nowhere equal to that of the pampas. The soil is generally sandy, and, judging by what is known, little of it is adapted to agriculture. True forest is generally confined to the river-banks and to small clumps on the plains, but there are vast and almost impenetrable thickets of low trees, vines, and bushes. In the southern part there are extensive salines. The climate is everywhere hot except at times in the winter months (June to October). Rains are not abundant, and only fall from October or November to May. Malarial fevers are prevalent in many localities. During historical times the Chaco has been inhabited by many savage Indian tribes—the Tobas, Mocobis, Vilelas, and others—nearly all of wandering habits, and often at war with each other. Many of them have cattle and horses, descended from Spanish stock. All efforts of the early missionaries to Christianize these tribes proved unavailing. Owing to their hostility, and the obstacles presented by swamps, floodlands, matted thickets, and deserts, exploration in the Chaco region is peculiarly difficult, and large areas are still unknown. One of the latest explorers, Crevaux, was killed with his companions in 1882. The Bolivian Government has long been seeking for a practicable route across the Chaco to the Paraguay, and military expeditions from Argentina have penetrated it with the view of preparing a way for settlement. Civilization is slowly extending northward across the Salado. On the western side some of the Argentina and Bolivian herdsmen have utilized pastures near the highlands; and on the east a few settlements have been formed near the Paraguay. But the whole civilized population of the Chaco does not exceed 5,000 souls. The rivers Pilcomayo and Bermejo are both obstructed by bars and floating vegetation, but it is hoped that the latter may eventually be utilized for navigation. See Thouar, *Voyage dans le Chaco boréal*; the reports of Arenales, Seelstrang, Cominges, etc.

HERBERT H. SMITH.

**Grand Army of the Republic**: a fraternal, charitable, and patriotic association composed exclusively of soldiers and sailors of the U. S. army, navy, and marine-corps who served during the civil war of 1861–65, and were honorably discharged. No person is eligible to membership who has at any time borne arms against the U. S. B. F. Stephenson, M. D., who served as surgeon of the Fourteenth

BADGES OF THE GRAND ARMY OF THE REPUBLIC
AND LOYAL LEGION AND U. S. MEDAL OF HONOR

Illinois Infantry, was the founder of the order. The first "general orders" were issued Apr. 1, 1866, and the first charter for a post was granted Apr. 6, 1866. Of the twelve charter members all but one served in Illinois regiments. Dr. Stephenson had in mind a grand organization of veterans, so cohesive, so incisive, so potential as a factor and teacher of patriotism, as to make the Government evermore secure from attacks of treason. At the celebration of its twenty-fifth anniversary his dream had been realized.

The Grand Army is an organization of 7,500 posts, located in every State and Territory, and 450,000 comrades. The constituted bodies of the association consist of (1) precinct organizations known as Post No. —, to which may be prefixed the name of a battle or locality, a deceased soldier or sailor, or of some other deceased loyal person; (2) State organizations known as Departments; (3) a national organization known as the National Encampment of the Grand Army of the Republic.

The supreme power is lodged in the national encampment, and all rules and regulations for the government of the order emanate from it. The constitution forbids every comrade to use the organization for partisan purposes; it prohibits the discussion of partisan questions at any of its meetings. Each post is required to establish a relief fund for the assistance of needy soldiers, sailors, and marines, and their widows and orphans; any donations to this fund are to be held sacred for such purpose. May 30 in each year, Memorial Day, is observed by the posts visiting the cemeteries wherein lie their dead comrades in arms, and laying on each grave an offering of flowers. On the Sunday next preceding Memorial Day the posts attend some church in their locality, and if any members have died during the year a memorial service is held.

The motto of the order, "Fraternity, Charity, and Loyalty," symbolizes its objects, which are: (1) to preserve and to strengthen the kind and fraternal feelings which bind together the soldiers, sailors, and marines who united to maintain the Union; (2) to assist such comrades as need help and protection, and to extend needful aid to their widows and orphans; (3) to maintain true allegiance to the U. S. of America, based upon the paramount respect for and fidelity to the national Constitution and laws; to discountenance whatever tends to weaken loyalty, incites to insurrection, treason, or rebellion, or in any way impairs the efficiency and permanence of free institutions; to encourage the spread of universal liberty, equal rights, and justice to all men, and to perpetuate the memory of its dead. JOHN PALMER.

**Grand Bank**: the subaqueous plateau in the Northern Atlantic which extends eastward from Newfoundland toward Europe. It is triangular in form, with the base on Newfoundland and the apex 450 miles S. E., in about lat. 44° N. The width of the triangle is slightly less than the height. Its existence, it is believed, is largely due to the melting of icebergs by the warm waters of the Gulf Stream. The icebergs bring much gravel, earth, and stone from the glaciers of Greenland, and as they melt this matter is deposited on the sea-bottom. The Grand Bank is the most extensive and important known resort of the codfish, and is visited by many fishing-vessels from France and Great Britain and their colonies and from the U. S.

**Grand Bank**: port of entry and fishing-town on the south side of Fortune Bay, Burin district, Newfoundland. It has a good trade with St. Pierre. Pop. 1,000.

**Grand Bay**, or **Ha-Ha Bay**: a beautiful inlet from the river Saguenay, in Chicoutimi County, Quebec, Canada, averaging a mile in breadth, with water 600 feet deep. At its head the largest ships load with lumber.

**Grand Canal**: (1) the principal waterway of Venice. (2) An important waterway of China commonly believed to have been constructed by Kublai Khan, the first emperor of the Yuen or Mongol dynasty, which ruled in China from 1280 to 1368 A. D. It extends from the city of Hangchow in the province of Cheh-kiang northward to Peking, the capital, a distance of over 650 miles, and is called by the Chinese Yun-ho, Transport river, or Yun-liang-Ho, Grain-transport river, from the fact of its having been constructed for the purpose of connecting the great rice-producing provinces of the south with the capital. It crosses the Yang-tse, the Hwang-ho, and other rivers, and until recent years formed part of an inland system of water communication by which almost any part of the country could be reached from the capital. The part of the canal which lies between the Yellow river and the Yang-tse is said to have been constructed more than 500 years before our era (see Father Hyacinth's *Statistical Description of China*), and the part between the Yang-tse and Hangchow about the beginning of the seventh century A. D., while Bretschneider has shown in his *Archæological and Historical Researches on Peking and its Environs* that during the twelfth century, when the Kin Tartars ruled over North China, a canal called the Yun-liang-Ho extended as far south as Hopei, the province lying to the north of the Ho, or Yellow river. Kublai united these, connecting "river with river and lake with lake," as Marco Polo says. In parts it follows the natural courses of rivers, e. g. the Peiho, the Wei, and the Hwun.

Since the Yellow river changed its course in 1853 the canal has become silted up in many places between Tsin-kiang-pu in Kiangsu and Tsi-ning-chow in Shantung, thus destroying the continuity of the canal, and the rice tribute now finds its way to Peking by sea. R. LILLEY.

**Grand Coutumier** [Fr., great statute-book; *grand*, great + *coutumier*, statute-book, book of customs, deriv. of *coutume*, custom]: either of two collections of ancient French laws. One, known also as the *Coutumier de France*, is a collection of the customs, usages, and forms of practice which had been in use from time immemorial in the kingdom of France. The work was first planned by Charles VII. in 1453, but was not finished until 1609. The other collection, which is more specifically designated as the *Coutumier de Normandie*, embodies the laws and customs of Normandy, and is much more ancient, having been made about the year 1229, in the reign of Henry III. of England. The great similarity between this latter collection and the ancient laws of England has been regarded as indicating that the Norman laws were in great measure derived from the English. Revised by T. W. DWIGHT.

**Grand Days**: the days of social festivity appointed by the English Benchers for the entertainment of judges, barristers, and students of the Inns. These were formerly great occasions, and were celebrated four times a year with much revelry.

**Grand Falls**, or **Colebrooke**: a post-village and port of entry of Victoria County, New Brunswick; near the Great Falls of the river St. John, which are 180 feet high and very imposing (see map of Quebec, etc., ref. 3–G). Steamers ply between Grand Falls and St. John (202 miles) during high water. There is a fine suspension bridge over the falls. Pop. (1881) 1,534.

**Grand Forks**: city; capital of Grand Forks co., N. Dak. (for location of county, see map of North Dakota, ref. 2–F); on the Red River of the North, at the head of navigation, and on the Great Northern Railway and the N. Pacific Railroad; 25 miles N. W. of Crookston. It is an agricultural and lumber region, and is principally engaged in lumber-manufactures. It is the seat of the State university, of St. Bernard's Ursuline Academy, and of a Lutheran college, and has 3 public-school buildings, 5 banks, and 3 daily and 6 weekly newspapers. Pop. (1880) 1,705; (1890) 4,979; (1900) 7,652. EDITOR OF "PLAINDEALER."

**Grand Haven**: city; port of entry; capital of Ottawa co., Mich. (for location of county, see map of Michigan, ref. 7–H); on Lake Michigan, at the mouth of Grand river, and on the Chi. and W. Mich. and the Detroit, G. H. and Mil. Railways; by water 86 miles E. of Milwaukee and 112 miles N. E. of Chicago; by rail 31 miles W. by N. of Grand Rapids. It has the broadest and deepest harbor on the chain of the Great Lakes, with two lighthouses, and has regular steamboat communication with Milwaukee, Chicago, and the principal lake ports. There are 13 churches, public, high, and grammar schools, public library, gas and electric-light plants, 1 bank, and 2 daily and 3 weekly newspapers. The city also has magnetic mineral springs, which, with its delightful location, have made it popular as a summer resort, ship-yards, glass-factory, the largest refrigerator works in the State, and other industries. Pop. (1880) 4,862; (1890) 5,023; (1900) 4,743.
EDITOR OF "EVENING EXPRESS."

**Grand Island**: city; capital of Hall co., Neb. (for location of county, see map of Nebraska, ref. 7–J); on the Burlington and Mo. River, the St. Jos. and G. I., and the Union Pac. Railroads; 1½ miles N. of Platte river, 154 miles W. by S. of Omaha. It is in an agricultural region, and is principally engaged in handling grain. It has the car and machine shops of the Union Pacific Railway, flour-

mill, beet-sugar factory, creamery, and canning-factory. There are several churches, 7 public-school buildings, Baptist college, business college, opera-house, water, sewerage, gas, and electric-light plants, 5 banks, and 1 daily, 1 semi-weekly, and 4 weekly newspapers. Pop. (1880) 2,963; (1890) 7,536; (1900) 7,554. EDITOR OF "INDEPENDENT."

**Grand Junction**: city; capital of Mesa co., Col. (for location of county, see map of Colorado, ref. 3–A); at the confluence of the Grande and Gunnison rivers, and on the Rio Grande Railroad and the Col., Mid. and the Rio G. West. Railways. It is in an agricultural, horticultural, stock-raising, and coal-mining region, and has 8 churches, 6 school buildings (including a high-school building that cost $20,000), opera-house that cost $35,000, 2 banks, and 1 daily and 2 weekly newspapers. Pop. (1880) 859; (1890) 2,030; (1900) 3,503. EDITOR OF "STAR."

**Grand Jury** [from O. Fr. *grande juree*, great court or jury]: a jury whose province it is to determine whether indictments shall be brought against alleged criminal offenders; so called from its size, as distinguished from a petit jury. (See JURY, TRIAL BY.) The custom of making the trial of any person for a crime depend entirely upon the decision of his fellow citizens is very ancient in English history; and its importance as a safeguard of civil liberty has caused its scrupulous maintenance to the present day. In the U. S. provisions have been inserted in the national Constitution, and, for the most part, in the State constitutions as well, prohibiting criminal prosecutions for all but an inferior class of offenses, or such as occur among the military or naval forces, except upon the presentment or indictment of a grand jury.

At the common law a grand jury consists of not more than twenty-three members nor less than twelve, and the concurrence of at least twelve is required that a bill of indictment may be found. In a few of the United States the number of members composing a grand jury has been altered by statute. The proper number of jurors, selected by lot, is returned by the sheriff or marshal at every session of a court for the trial of criminal causes, in pursuance of a writ termed a "venire," which directs him to summon a jury to be present at the appointed time. After their appearance they are impaneled—that is, a foreman is appointed, and they are severally sworn to perform their duties faithfully and impartially. They sit in absolute secrecy, and may either consider and pass upon bills of indictment presented by the attorney-general or other officer representing the government, or they may of their own motion make presentments—that is, accusations upon their own observation and knowledge or upon evidence laid before them, and without any introduction of a bill at the instance of the governmental officer. Ordinarily, however, the business transacted is brought forward by the prosecuting attorney, and in any case the proper officer must frame an indictment upon which the party accused may be brought to trial. The proceedings are entirely *ex parte*. Only witnesses in support of the prosecution are examined, and no evidence is admitted in favor of the accused. The decision of the jury does not determine the guilt of the alleged offender, but merely indicates that in their opinion the evidence against him is or is not of sufficient weight to justify his being brought to trial. The jurors are not ordinarily permitted to disclose in a court of justice what occurs in the jury-room, in order that the consultation may be free and unbiased, that no fear of animosity or hostile acts on the part of those against whom accusations are brought may deter the jurors from agreeing upon an indictment if they deem it proper and requisite, and that those indicted may not receive intelligence of the fact, and be thus enabled to make their escape. But in some instances a grand juror may by statute be compelled to serve as a witness upon the actual trial of the cause, as to prove that the evidence of a witness upon the trial was directly contrary to that given before the grand jury. If the requisite number of jurors are satisfied, from the evidence presented to them, of the truth of the accusation, they write upon the back of the indictment the words, "A true bill"; but if they are convinced that the charge is groundless, the indorsement is "Not a true bill" or "Not found." Formerly they used in this latter case the word *Ignoramus*, "we are ignorant"; whence the expression, "the bill of indictment has been *ignored*." After all the accusations have been considered, and indictments found or denied, their labors are ended, and the causes are ready for trial before a petit jury. Revised by F. STURGES ALLEN.

**Grand Lake**, La.: See CHETIMACHES LAKE.

**Grand Ledge**: city; Eaton co., Mich. (for location of county, see map of Michigan, ref. 7–I): on the Grand river and the Detroit, Lans. and North. Railroad; 12 miles W. of Lansing. It is in an agricultural region, obtains excellent water-power from the river, and has 2 flour-mills and manufactures of chairs, tile, sewer-pipe, and other articles. There are 4 churches, 2 school districts, 2 banks, and 2 weekly newspapers. It is the leading summer resort of Central Michigan. Pop. (1880) 1,387; (1890) 1,606; (1900) 2,161. EDITOR OF "INDEPENDENT."

**Grand Mal**: See EPILEPSY.

**Grand Manan'** [from Fr. *grand*, great + Passamaquoddy *manan*, island]: an island in the Bay of Fundy, belonging to Charlotte County, New Brunswick. Lat. of northeast head, 44° 45′ N., lon. 66° 45′ W.; lat. of southwest head, 44° 34′ N., lon. 66° 53′ W. It is 22 miles long, and from 3 to 6 miles in breadth. It is fertile and well timbered, and its coast abounds in good harbors. Its shores are bold and high, but the general surface is not greatly elevated. The herring, haddock, and cod-fisheries are important. Grand Harbor is the principal settlement. The island is a favorite summer resort. Pop. 3,000, partly Indians.

**Grand Monad'nock**, or **Monadnock**: an isolated mountain-peak in Jaffrey township, Cheshire co., N. H. It is 3,718 feet high, and is visible for many miles in every direction. The view from its top is very fine. It is regarded as an outlying member of the White Mountain group.

**Grand Pensionary**, or **State Pensionary**: the state secretary for the province of Holland during the republic of the United Netherlands. He was originally also advocate-general for the same province. In later times he was, by virtue of his position, an official of the States-General, a kind of premier in that body. His term of office was five years. The syndic, or paid counselor, of any important Dutch town was called a pensionary.

**Grand Pré**, grăăn′prā′ [Fr., great meadow]: a beautiful village on the Basin of Minas, Horton township, Kings County, Nova Scotia; on the Windsor and Annapolis Railway; 15 miles from Windsor (see map of Quebec, etc., ref. 2–B); the scene of Longfellow's *Evangeline*. It was settled by the French under De Monts in 1604, but passed with the rest of the province of Nova Scotia into the hands of the British in 1713. The expulsion of the Acadian colonists, however, did not occur till the year 1755. The Pré is a fertile tract of diked land; area, 10 sq. miles. Pop. about 2,000.

**Grand Rapids**: city; capital of Kent co., Mich. (for location of county, see map of Michigan, ref. 7–H); on Grand river, at the head of navigation; on twelve railway lines, prominent among which are the Pere Marquette, the Gr. Tk., the Gr. Rap. and Ind. of the Pennsylvania system, the Mich. Cent., and the Lake Shore and Mich. South.; besides several interurban lines and a line of steamboats on Grand river and Lake Michigan, making direct connections with Chicago and Milwaukee. The city is fifty years old, well governed, and enjoys an extended reputation for its healthful climate and up-to-date methods. The civic flag of the place bears the legend "Furniture City." It is not only a furniture-manufacturing community, but it is also a sales-center of furniture, glass, bric-a-brac, lamps, china, stoves, carpets, brass bedsteads, etc. There are 38 factories, with an invested capital of $2,967,000, and 7,774 employees. The output in 1900 was valued at $7,234,000. Everything coming under the general term furniture is manufactured here, including all kinds of cabinet hardware, glass plates, mirrors, etc. The co-operation of the most perfect mechanical devices, intelligent labor, skilled carvers and wood workers, and artists has so developed this industry that its recurring semi-annual display is the event of the year in the furniture trade. Other prominent manufactures are carpet-sweepers, wood-working machinery, wagons, malleable iron, stucco, flour, fly-paper, felt boots, wood veneers, gasoline engines. Of the principal manufacturing industries, 487 have an invested capital of $18,176,000, and 16,473 employees, with a pay roll of $26,709.50 per day. The 117 houses in the jobbing trade have an invested capital of $6,203,000, employing 1,123 persons, and do business which amounted to $16,969,000 in 1900. The fruit-market statistics for 1900 show $613,000. Number of telephones in use, 6,769. Number of residences, 18,369. Freight tonnage for 1900, 3,473,000 tons. Grain receipts, 3,662,550 bushels. Bank clear-

ings, $62,616,687.87. Aggregate banking capital, $2,850,000,000; number of savings-bank depositors, 18,086: school savings for 1900, $21,011.07. Grand Rapids has 53 miles of electric railway, and a well-equipped street-railway mail service. There are 3 daily, 2 semi-weekly, 21 weekly, 3 semi-monthly, and 17 monthly publications; 94 churches, in 28 of which the preaching is in the Dutch language; 36 public and 27 private and denominational schools, 1 kindergarten training school, 1 manual training school, 4 business colleges, and 1 each of theological, veterinary, and medical schools. The public library contains 56,402 volumes, and the law library has 8,400 volumes. The city has 160 miles of paved streets. Its bonded indebtedness is $2,057,000; assessed valuation of real estate, $27,788,950; average rate of taxation, 1½ per cent. Pop. (1880) 32,016; (1890) 60,278; (1900) 87,565. SECRETARY BOARD OF TRADE.

**Grand Rapids**: city; capital of Wood co., Wis. (for location of county, see map of Wisconsin, ref. 5–D); on the Wisconsin river, and the Chi., Mil. and St. P., and the Green Bay and Weston, and Marshfield and S. E. railways; 66 miles N. by W. of Portage City, 200 miles N. W. of Milwaukee. The river here falls 30 feet a mile, affording water-power for several lumber-mills, 3 wood-pulp and paper mills, 2 flour mills, 2 furniture-factories, hub and spoke factory, and other manufactories. Large beds of pure kaolin are found near the city. Principal business, lumbering, manufacturing, and agriculture. Pop. (1880) 1,350; (1890) 1,702; (1900) 4,493. EDITOR OF "WOOD COUNTY REPORTER."

**Grand River**: a tributary of Lake Michigan; formed by the union of various streams in the southern peninsula of Michigan. At its mouth is Grand Haven. The river is navigable 40 miles to Grand Rapids, and boats ply upon it 50 miles above that point.

**Grand River**: an affluent of the Missouri river. Its head-streams rise in Iowa. With its numerous forks it drains a large part of Northern Missouri. Its mouth is at Brunswick in Chariton County.—Another GRAND RIVER is a northwestern fork of the Osage.

**Grand Tactics**: See TACTICS.

**Grand Traverse Bay**: in Michigan: a southern extension of Lake Michigan. Its southern part is divided by Preogenise Point into the east and west arms. Leelenaw County lies on the W., Antrim County on the E., and Grand Traverse County on the S.

**Grange** [M. Eng. *grange*, from O. Fr. *grange* > Fr. *grange* < Low Lat. *gra'nea*, barn, deriv. of *gra'num*, grain, corn]: primarily a granary; then the outhouses of a farm, its stables, etc.; also an isolated farmhouse of the better class, a sort of semi-castle, as The Grange, Suffolk Grange, La Grange. In 1867 the term was selected by the order of Patrons of Husbandry as the designation of its national, State, and subordinate organizations. See PATRONS OF HUSBANDRY.

**Granger**, GORDON: soldier; b. in New York, 1821; graduated at the U. S. Military Academy; brevet second lieutenant infantry July 1, 1845; transferred to Mounted Rifles July, 1846; captain May, 1861; engaged in the Mexican war, served on the frontier 1848–61; was assigned to duty on the staff of Gen. McClellan, and subsequently of Gen. Sturgis at the breaking out of the civil war. In September he was appointed colonel Second Michigan Cavalry, and in Mar., 1862, brigadier-general U. S. volunteers; in command of cavalry in the advance on Corinth and subsequent pursuit of Beauregard's army. Promoted to be major-general of volunteers Sept., 1862, he commanded various districts in Kentucky and Tennessee, and at the defense of Franklin, Mar.–June, 1863, successfully repulsed the attack of Gen. Van Dorn; at the battle of Chickamauga he arrived in time to drive back the columns of Longstreet. At the battle of Missionary Ridge he commanded the Fourth Army-corps; in the Southwest the Thirteenth Corps, being engaged in the siege of Fort Morgan and Spanish Fort, the storming and capture of Blakely, and final occupation of Mobile; subsequently commanded the district of Texas and department of Kentucky. For gallant conduct in the Mexican war he was breveted first lieutenant and captain, and for similar services in the civil war he received the successive brevets from major to that of major-general U. S. army. In July, 1866, he was appointed colonel Twenty-fifth Infantry; transferred to Fifteenth Infantry in 1870. D. at Santa Fé, New Mexico, Jan. 10, 1876.



**Grani'cus** (in Gr. Γράνικος): the ancient name of the Khodja Su, a small river in Mysia which rises on Cotylos, a peak of Mt. Ida, and empties into the Sea of Marmora, near Priapus. Here Alexander the Great won his first victory over the Persians in 334 B. C., and here too Lucullus was victorious over Mithridates. J. R. S. S.

**Granier de Cassagnac**, grăă'ni-ā' de-kăă'săăn'yăăk', ADOLPHE: journalist; b. at Bergelles, Gers, France, Aug. 12, 1806. He went to Paris in 1832, and became one of the editors of the *Journal des Débats* and the *Revue de Paris*. After a voyage to the French West Indies, where he was married, he advocated the maintenance of slavery in the French colonies, and started many papers in Paris. In 1852 he was elected deputy to the Corps Législatif, of which he remained a member until the fall of the empire. He was chief editor of *Le Pays*, an imperialist paper. He wrote a *History of the Laboring and Bourgeois Classes* (1837); *History of the Causes of the Revolution* (1850); *History of the Origin of the French Language* (1872); two romances, and many other works. Died at his castle in the department of Gers, Jan. 31, 1880.

**Granier de Cassagnac**, PAUL: See DE CASSAGNAC.

**Granite** [Fr. *granit*, from Ital. *granito*, granite, liter., *grained*, perf. partic. of *granire*, run to seed, deriv. of *gra'no*, a grain, seed]: a massive granular rock composed essentially of the minerals quartz and feldspar, but almost always containing other components, such as mica (biotite or muscovite), hornblende, tourmaline or pyroxene in varying proportion. The feldspar is both orthoclase and plagioclase. The former feldspar and the quartz are called essential ingredients, because their presence is necessary to form a granite. If the quartz is absent the rock becomes a *syenite*; if the orthoclase is absent it becomes a *diorite*. The other constituents merely determine the variety of granite. Thus there is a muscovite-granite, a biotite-granite, a hornblende-granite, a tourmaline-granite, etc. A variety common in the Alps, which contains talc or chlorite, is called *protogene*. In its chemical composition granite is an acid rock, having a silica range of from 62 to 74 per cent. Aside from its composition, an essential feature of granite is an evenly granular structure, at least coarse enough to be distinctly visible to the unaided eye. In some cases the constituent grains become very large, giving to the rock a very coarse texture. Such varieties are called *pegmatite*, or, when their quartz and feldspar are regularly intergrown, *graphic granite*. The typical granitic structure is not inconsistent with the development of large porphyritic crystals of feldspar, and in such cases the rock is called *granite-porphyry*. A genuine granite must, however, be without a pronounced banding or parallel arrangement of its mineral constituents, for the rock is in that case more properly termed a GNEISS (*q. v.*).

*Name.*—The name granite alludes to its granular structure, and was introduced by the early Italian antiquaries in the sixteenth century. It was, however, loosely used for any granular rock, until Werner gave it its present meaning. The term granite is still employed in ordinary usage for any granular feldspathic rock, independent of its precise mineralogical composition.

*Mode of Occurrence and Distribution.*—Granite and the granitoid gneisses, which are genetically identical with it, are the oldest and the most widely distributed of all rocks. They apparently underlie all other formations, and it is possible that the original cooling crust of the earth may have had this character. Granite, or granitoid gneiss, is usually exposed in the axes of mountain-chains, or where such areas of great displacement and dynamic action have been deeply eroded. In Canada and Scandinavia, however, enormous areas of granitic gneiss lie quite flat, as though the earth's crust had there never been disturbed, nor yet covered with later sedimentary deposits. All granites do not by any means belong to the oldest geological horizons. It is true that they are most abundant in the Archæan and older Palæozoic formations, but this is due to the circumstances necessary to their formation rather than to their being formed in less amount in more recent times. The production of the granitic structure requires solidification at considerable depth, so that the chances are against the most recent granites being exposed by the removal of the vast thickness of other rocks which covers them. Granites are known which have broken through and altered sediments of every Palæozoic age. The granites of the Sierra Nevada are considered to be Jurassic, while Australia, South Amer-

ica, and some parts of the Western U. S. exhibit granites of Tertiary age. To outline the geographical distribution of granitic rocks would be to far exceed the limits of this article. They are found in all great mountain regions, like the Urals, Alps, Rockies, and Andes, or in the eroded roots of former mountain ranges, like the Auvergne, Bohemia, or New England. They are enormously developed in Northern Russia, Finland, Scandinavia, and Canada.

*Origin.*—The origin of granite has been one of the most disputed problems of geology. This rock has been regarded as produced only by the original cooling of the globe; it has been explained as a normal igneous or eruptive rock; it has been accounted for as the result of extreme metamorphism of sedimentary deposits; and it has been attributed to aqueous agency, either as so-called aquo-igneous fusion or as simple chemical precipitation. The prolonged discussion has been due both to the vagueness with which the different theories have been formulated and to the manifest difficulty in explaining the origin of all rocks having the composition and structure of granite by a *single* hypothesis. There is doubtless an element of truth in many, if not in all, of these theories. Some granites may indeed, for all we know to the contrary, represent the earth's original cooling crust; some granites have been proved beyond doubt to be igneous rocks of the ordinary type; some granites may also be extremely metamorphosed sediments, although the argument commonly used in favor of this—their association with gneiss—can not now be regarded as valid. See GNEISS.

*Economic Uses and Supply.*—The wide distribution, compact structure, homogeneous appearance, range of color, susceptibility to polish, and durability of granite—all fit this rock for an extensive application to architectural and decorative uses. The more or less developed jointing or "rift" which always traverses granite enables it to be readily quarried in blocks of any desired size.

One of the most famous granites of the world is the rather coarse, red hornblende-granite of Syene, in Upper Egypt (formerly called syenite). Of this the ancient Egyptians constructed many of their imperishable monuments. The durability of this stone is, however, largely dependent on the dryness and warmth of the climate. An obelisk which has remained unaltered in Egypt for 4,000 years when exposed to northern frost and moisture readily scales and crumbles. Among famous granites of Europe are those of Elba, Baveno in Northern Italy, Finland (the so-called "Rappikiwi"), and Scotland (Peterhead, red, and Aberdeen, gray). A beautiful granite porphyry, much used for monuments, comes from Shap, in the English lake district. In the U. S. the granite industry is large and constantly increasing. The value of the product in 1899 was $11.618,339. Twenty-nine States participated in this production, of which the five most important were Massachusetts, Maine, Vermont, Delaware, and New Jersey. Minnesota and Wisconsin have a fine granite which has begun to be developed. A fine-grained gray granite, much used as a building-stone, is found in Maryland and Virginia. At St. George, New Brunswick, a red granite is found, rivaling in color and quality the famous rock from Peterhead, Scotland. The Rocky Mountains and Sierras contain vast supplies of granite, which has not as yet been economically developed. See BUILDING-STONE; see also *Building-stones* and *Statistics of Quarrying Industries* in vol. x. of the Tenth U. S. Census Reports; also *Stones for Building and Decoration*, by George P. Merrill (New York, 1891).

*Disintegration.*—Granitic rocks are subject to disintegration through a peculiar alteration of their feldspar. This mineral, under atmospheric influences, loses a part of its silica, and by the gain of a little water becomes the soft substance known as *kaolin*. Many valuable kaolin deposits used for porcelain manufacture have originated in this way from very coarse granites. The widespread action of this process causes granite to disintegrate into sand, or to weather into rounded blocks or dome-shaped hills. Granite mountains therefore usually present softly rounded outlines, although they sometimes exhibit sharp peaks like the Swiss *aiguilles*. The vast accumulations of granitic blocks caused by the weathering of this rock are called *tors* in England and *Felsenmeer* in Germany. GEORGE H. WILLIAMS.

**Granius Licinianus**: See LICINIANUS.

**Grant** [from O. Fr. *grant, greant*, deriv. of *granter, greanter, creanter* (the last form original, the forms with *g* perhaps by analogy of *garantir*, warrant), from Low. Lat. **credenta're*, grant, credit, deriv. of *cre'dens*, pres. partic. of *cre'dere*, believe]: in the most comprehensive sense of the term, a transfer of any kind of property from one person to another, or the bestowal upon or concession to an individual of any right or privilege by the public. The term *grant*, however, acquired at common law a specific technical signification, being confined in its application to a conveyance of such intangible interests in real property as reversions, rents, franchises, and other kinds of incorporeal hereditaments, of which livery of seizin could not be made, and was distinguished from feoffment, which was employed in the transfer of freehold estates of a tangible nature, of which an actual delivery of possession, termed in law "livery of seizin," could be made. (See FEOFFMENT.) Therefore, corporeal hereditaments were said to "lie in livery"—those incorporeal to "lie in grant." The grant was evidenced by a deed containing appropriate words of transfer, as *dedi et concessi* (I have given and granted), and corresponding terms have been retained in conveyances by deed. But the old system of feoffment has gone out of use, and it has been declared by statute in England that the distinction between corporeal and incorporeal forms of real property shall be abolished, and that transfer by grant shall be sufficient for both these classes of estates. In the U. S. also the ancient and distinctive meaning of the word has received important modifications. Still, in a majority of the States it would be generally employed, if used at all, with particular reference to the conveyance of incorporeal interests, as formerly. But in New York, by a special statutory provision, every mode of transfer of a freehold has been declared a grant, so that though deeds of bargain and sale and of lease and release may continue to be used, they are to be deemed grants. In Maine, New Hampshire, and Massachusetts nearly every form of conveyance is in actual practice denominated a grant, so that the old peculiar meaning of the word seems effectually abolished.

Besides "private grant," which is a transfer by a private person, there is a mode of conveyance known in law as "office grant," which consists in a transfer of land made by some officer of the law where the owner is either unwilling or unable to execute the necessary deeds to pass the title. An example would be the conveyance of lands sold by a government official for the payment of taxes, or by an administrator under license of the court for the payment of the debts of the deceased. The phrase "public grant" is employed to designate the mode of creating a title in an individual to lands which had previously belonged to the government. Conveyances of this kind are also termed "letters patent." Revised by F. STURGES ALLEN.

**Grant**, Sir ALEXANDER, LL. D., D. C. L.: teacher; b. in New York, Sept. 13, 1826; educated at Harrow and Oxford; went to Madras 1859, where he became Professor of History and Political Economy; in 1863 vice-chancellor of the University of Bombay; appointed director of public instruction for the Presidency of Bombay, and in that office showed the highest ability, his administration marking an epoch in the history of education in India. In 1868 he was elected principal of the University of Edinburgh, a position which he held till his sudden death, Nov. 30, 1884. He was a prolific and versatile author. Among his most valuable works are *A History of the University of Edinburgh*, *Lives* of Aristotle and Xenophon, and a translation of the *Ethics* of Aristotle (his masterpiece). ALFRED GUDEMAN.

**Grant**, ANNE: author; b. in Glasgow, Scotland, Feb. 21, 1755; the daughter of a British army officer named MacVicar, whose estate in Vermont (where she for some years lived) was confiscated during the American Revolution. She married in 1779 the Rev. Mr. Grant, of Laggan, and became the mother of a large family. He died in 1801, and the stress of poverty forced her into literary work. *The Highlanders*, a successful volume of verses (1803); *Letters from the Mountains* (1806–07); *Memoirs of an American Lady* (Mrs. Schuyler, of Albany, 1808); *On the Superstitions of the Highlanders* (1811); *Eighteen Hundred and Thirteen* (a poem, 1814), are her principal works. D. in Edinburgh, Nov. 7, 1836. Her *Life*, by John Peter Grant (the last of her thirteen children), but partly autobiographical, was published in 1844 (rev. ed. 1845 and 1853).

**Grant**, Sir FRANCIS: portrait-painter; b. at Kilgraston, Perthshire, Scotland, in 1804. He was educated for the bar and practiced his profession for a time, but relinquished it for painting about 1828. He began without a master and was first known as a painter of hunting scenes; began to paint portraits about 1840, and exhibited an equestrian por-

trait of the Queen in 1841; Royal Academician 1851 and president 1866, when he was knighted. He was the fashionable portrait-painter of his time, and his work is notable for elegant style and simple method. D. Oct. 5, 1878.

**Grant**, Frederick Dent: See the Appendix.

**Grant**, George Monro, D. D., LL. D.: teacher; b. at Albion Mines, East River of Pictou, Nova Scotia, Dec. 22, 1835, and graduated with honors at Glasgow University (M. A. 1857). He was ordained a Presbyterian minister, settled as pastor at Georgetown, Prince Edward Island, in 1861, removed to Halifax, Nova Seotia (1863), and was pastor of St. Matthew's church there till 1877, when appointed principal of Queen's University, Kingston. Since he assumed this office, new university buildings have been erected, a large endowment fund has been created (largely by his efforts), and the efficiency and the importance of the institution greatly increased. In addition to the principalship of the university, he is also Primarius Professor of Theology, and has some distinction as a lecturer. He wrote *Ocean to Ocean through Canada* (1872) and *Picturesque Canada* (1881), and has contributed extensively to the magazines.
Neil Macdonald.

**Grant**, James: military novelist; b. in Edinburgh, Scotland, Aug. 1, 1822; at the age of ten he accompanied his father, who was a British officer, to Newfoundland, and his education was principally acquired in barracks in British North America. In 1839 he returned to England, and was appointed ensign in the Sixty-second Regiment; retiring from the army, however, the following year, he turned his attention to literature, and his first work, *The Romance of War, or Highlanders in Spain*, appeared in 1846. After that he published many romances, principally of a military character, all of which have been well received, and many of them republished in the U. S. and translated into French and German. D. in London, May 5, 1887.

**Grant**, Sir James Alexander, M. R. C. S.: physician; b. at Inverness, Scotland, Aug. 11, 1830; graduated M. D. at McGill College, Montreal, in 1854. He began practice at Ottawa; soon attained great distinction in his profession, and has been physician to each successive Governor-General of Canada since 1867. He represented the county of Russel for eight years in the Dominion Parliament; introduced the original Pacific Railway Bill in that body, and was one of the first to advocate the admission of the Northwest Territories into the Dominion of Canada. He has been president of the College of Surgeons of Ontario; prominently connected with learned societies both in Europe and America, and has contributed extensively to medical literature. In 1887 he was created a Knight Commander of the Order of St. Michael and St. George, in recognition of his distinguished rank as a physician. Sir James is a grandson of James Grant (1743–1835), last Chief of Corrimony, author of *Essays on the Origin of Society* (1785) and *Thoughts on the Origin and Descent of the Gael* (1814). Neil Macdonald.

**Grant**, Lieut.-Col. James Augustus, C. B., C. S. I., F. R. S., F. L. S., LL. D.: soldier and explorer; b. at Nairn, Scotland, in 1827; educated at the grammar school and at the Marischal College, Aberdeen. In 1845 he was appointed to the Indian army, and served at both sieges of Multan; was present at the battle of Gujerat, for which he received a medal, and did duty with the Seventy-eighth Highlanders at the relief of Lucknow, where he was wounded. In 1863 he accompanied Capt. Speke on his exploration of the source of the Nile, a joint account of which was published in 1864, and was made a C. B. in 1866; accompanied the Abyssinian expedition under Lord Napier in 1868, and for his services was nominated a Companion of the Order of the Star of India, and afterward went upon the retired list. D. Feb. 11, 1892.

**Grant**, Gen. Sir James Hope, G. C. B.: soldier: b. at Kilgraston, Scotland, July 22, 1808; entered the army in 1826 as cornet in the Ninth Lancers; served with distinction in China as brigade major; served with his regiment at Sobraon, commanding it in the battles of Chillianwallah and Gujerat. In 1854 he became brevet colonel, and in 1858 was made a major-general and nominated a K. C. B. for his eminent services in command of the cavalry division at the siege of Delhi, at the relief of Lucknow, and in subsequent operations at Cawnpore. In the campaign in China terminating with the capture of Pekin he commanded the British forces throughout, for which he received the thanks of Parliament and was nominated a G. C. B.; was commander-in-chief at Madras 1861–65 with the rank of lieutenant-general; in 1872 was made general. He wrote *Incidents of the Sepoy War* (1874); *Incidents in the China War of 1860* (1875). D. in London, Mar. 7, 1875.

**Grant**, Field-Marshal Sir Patrick, G. C. B., G. C. M. G.: b. at Auchterblair, Strathspey, Scotland, in 1804; entered the military service of the East India Company at the age of sixteen. Three years of jungle fighting made him a lieutenant, and nine years more a captain. In 1854, having previously reached the grade of colonel, Grant was made a major-general, and two years later was promoted to the command of the army of Madras. After half a century of hard fighting in India he was in 1867 appointed governor of Malta; in 1870, general and colonel of the Seventy-eighth Highlanders; in 1872, field-marshal and governor of Chelsea Hospital, where he died Mar. 28, 1895. Many honors were conferred upon him, including the colonelcy of the Royal Horse Guards (the Blues). Jas. Grant Wilson.

**Grant**, Robert: author; b. in Boston, Mass., Jan. 24, 1852; graduated at Harvard in 1879, and began the practice of law at Boston. His writings, which are mostly light social satires, include *Little Tin Gods on Wheels* (Cambridge, 1879); *The Confessions of a Frivolous Girl* (Boston, 1880); *An Average Man* (New York, 1883); *The Knave of Hearts* (Boston, 1885); *Face to Face* (New York, 1886); *The Reflections of a Married Man* (1892); and *The Opinions of a Philosopher* (1893). H. A. B.

**Grant**, Ulysses Simpson: eighteenth President of the U. S.; b. at Point Pleasant, Clermont co., O., Apr. 27, 1822. His father, Jesse R. Grant, a dealer in leather, was a descendant of Matthew Grant, a Scotchman, who emigrated to New England in 1630, and settled at Dorchester, Mass., soon removing to Windsor, Conn. At the age of seventeen Ulysses Grant entered the Military Academy at West Point, where he graduated twenty-first in a class of thirty-nine, receiving the commission of brevet second lieutenant. He was assigned to the Fourth Infantry, and remained in the army eleven years; was engaged in every battle of the Mexican war except that of Buena Vista, and received two brevets for gallantry. In 1848 he married Julia, daughter of Frederick Dent, a merchant of St. Louis, and in 1854, having reached the grade of captain, he resigned his commission in the army. For several years he was engaged in farming near St. Louis, but met with small success, and in 1860 he entered the leather-trade with his father at Galena, Ill.

When the civil war began in 1861 Grant was thirty-nine years of age, but entirely unknown to public men, and without any personal acquaintance with great affairs. President Lincoln's first call for troops was made on Apr. 15, and on the 19th Grant was drilling a company of volunteers at Galena. He also offered his services to the adjutant-general of the army, but received no reply. The Governor of Illinois, however, employed him in the organization of volunteer troops, and at the end of five weeks he was appointed colonel of the Twenty-first Illinois Infantry. He took command of his regiment in June, and reported first to Gen. Pope in Missouri. On Aug. 7 he was commissioned a brigadier-general of volunteers, the appointment having been made without his knowledge. He had been unanimously recommended by the Congressmen from Illinois, not one of whom had been his personal acquaintance. For a few weeks he was occupied in watching the movements of partisan forces in Missouri.

On Sept. 1 he was placed in command of the district of Southeast Missouri, with headquarters at Cairo, and on the 6th, without orders, he seized Paducah, at the mouth of the Tennessee river, and commanding the navigation both of that stream and of the Ohio. This stroke secured Kentucky to the Union, for the State Legislature, which had until then affected to be neutral, at once declared in favor of the Government. Early in November he was ordered to make a demonstration in the direction of Belmont, a point on the west bank of the Mississippi about 18 miles below Cairo; it was not only in possession of the Confederates, but commanded by the guns of Columbus on the opposite shore. The object of the demonstration was to prevent the crossing of hostile troops into Missouri. Grant got his orders on the 5th, and moved on the 6th, with 3,100 men on transports. On the 7th he landed at Belmont, broke up and destroyed the camp under a heavy fire from Columbus, and was returning to his transports when large re-enforcements arrived from the eastern bank to intercept him. His troops were raw, and even the officers were greatly disturbed at the idea

of being surrounded. But Grant soon rallied the force, and charging the enemy, cut his way out, reached the steamers, and returned to Cairo, having fully obeyed his orders and accomplished the object of the expedition. If any re-enforcements had been intended for Missouri, they were by this operation detained. In the affair of Belmont the Confederates had 7,000 men engaged against Grant's 3,000. Their loss was 642, and his 485. Grant carried off two pieces of artillery and 200 prisoners.

Early in Feb., 1862, after repeated applications to Gen. Halleck, his immediate superior, he finally was allowed to move up the Tennessee river against Fort Henry, in conjunction with a naval force. The gunboats silenced the fort, which surrendered on the 4th, before the troops arrived. Grant immediately made preparations to attack Fort Donelson, about 12 miles off, on the Cumberland river. Without waiting for orders, he moved his troops to the latter point, and on the 12th with 15,000 men began the siege. This position was extremely strong, and the garrison numbered 21,000. There was hard fighting on three successive days, and on the 15th Grant carried by assault the works which were the key to the place. On the 16th the Confederates surrendered unconditionally 65 cannon, 17,600 small-arms, and 14,623 soldiers. About 4,000 more had escaped in the night, and 2,500 were killed or wounded. Grant's entire loss was less than 2,000. On the last day of fighting his numbers amounted to 21,000. This was the first important success won by the national troops during the war. Its strategic results were marked; the entire States of Kentucky and Tennessee at once fell into the national hands, and the navigation of the Mississippi, the Tennessee, and the Cumberland rivers was opened for hundreds of miles. Grant was made a major-general of volunteers, and placed in command of the district of West Tennessee. In March he was ordered to move up the Tennessee river toward Corinth, where the Confederates were concentrating a large army; he was directed, however, not to attack. Accordingly his forces, numbering 38,000, were encamped near Shiloh, or Pittsburg Landing, on the west bank of the Tennessee, waiting the arrival of Gen. Buell with 40,000 more; but on Apr. 6 the Confederates came out from Corinth, 50,000 strong, and attacked Grant violently, hoping to overwhelm him before Buell could arrive; 5,000 of his troops were beyond supporting distance, so that he was largely outnumbered. Both sides fought fiercely, but the national forces were pushed back to the river. There, however, Grant held out till dark, when the head of Buell's column came upon the field. There was no more heavy fighting that night, but on the 7th the combined national armies attacked and drove the hostile force, who retreated as far as Corinth, 19 miles. Grant was senior in rank to Buell, and commanded on both days. His entire loss was 13,047, that of the Confederates was greater, with the loss of their commander, Gen. A. S. Johnston, who was killed on the first day of the battle, Apr. 6. The ground remained in the hands of Grant, and the object of the attack was unattained. Two days afterward Halleck arrived at the front and assumed command of the army, Grant remaining at the head of the right wing and the reserve. On May 30 Corinth was evacuated by the Confederates, although no fighting had occurred since Shiloh. In July Halleck was made general-in-chief, and Grant succeeded him in command of the department of the Tennessee. On Sept. 19 he fought the battle of Iuka, where, owing to the failure of Gen. Rosecrans to carry out his orders, only an incomplete victory was obtained. The national loss was 736, that of the Confederates 1,438. The strategy of this battle was Grant's, the tactics were those of Rosecrans and Ord. Subsequently Grant fortified Corinth, and directed the operations which resulted in the repulse of the Confederates from that place on Oct. 3 and 4, and in the battle of the Hatchie on the 5th, the commanders under him being again Rosecrans and Ord. At the battle of Corinth the entire national loss was 2,359, that of the Confederates more than twice as large.

Immediately after the victory of Corinth Grant proposed to the general-in-chief the capture of Vicksburg, and, receiving no answer, on Nov. 2 he began a movement into the interior of Mississippi. While he threatened Vicksburg from the rear with 30,000 men, Sherman was sent by way of the Mississippi river with 40,000, to attack it in front. Grant advanced without opposition as far as Oxford, 50 miles, when Holly Springs, his principal base of supplies, was surrendered by Col. Murphy, who was dismissed from the army in consequence. This compelled the abandonment of the campaign, and Grant returned to the neighborhood of Corinth. Sherman's assault on Vicksburg failed at about the same time. In Jan., 1863, Grant took command in person of all the troops in the Mississippi valley, and moved by the river to a point opposite Vicksburg. There he spent several months in fruitless efforts to turn the place; one plan was to build a canal in sight of Vicksburg, but out of reach of its guns, through which the army could pass to a point below; another, to divert the Mississippi river from its course; a third, to find or make a circuitous passage to the rear of the town through the tortuous streams on the N. and E. But all these failed, and in April Grant marched his army through the swamps on the western bank to a place below Vicksburg, while the gunboats and the transport fleet ran the batteries under a terrific fire. On Apr. 30 he crossed the river, and landed at Bruinsburg, 30 miles S. of Vicksburg. Two armies were now opposed to him. Pemberton, with 52,000 men, defended Vicksburg, and J. E. Johnston, with a smaller but rapidly increasing force, was at Jackson, 50 miles farther E. Grant's column was 43,000 strong. He at once abandoned all communication with the river, and pushed into the interior between the two hostile armies. On May 1 he met and defeated a portion of Pemberton's command at Port Gibson; then advancing eastward, on the 12th he fell upon and destroyed a force coming out from Jackson to resist him; and on the 14th he captured Jackson and scattered Johnston's army. Turning the same day to the Mississippi, on the 16th he utterly routed Pemberton's entire force at Champion's Hill; on the 17th, pursuing hotly, he came up with the enemy and beat him again at Black River Bridge; and on the 18th drove him into Vicksburg, encamping in its rear, with his own base once more on the Mississippi. On the 19th and 22d he made unsuccessful assaults, and on the 23d began a regular siege. On July 4 the place surrendered with 31,600 men and 172 cannon, at that time the largest capture of men and material ever made in war. During the entire campaign the Confederates had lost 40,000 prisoners, besides 12,000 in killed and wounded, and about 8,000 by disease and straggling; altogether an army of 60,000 men. Grant's entire loss was 8,873. The great river was thus opened to the sea, and no more important fighting occurred in the Mississippi valley. Grant was made a major-general in the regular army. On Oct. 16 he was placed in command of the military division of the Mississippi, which included the armies of the Ohio and the Cumberland, as well as that of the Tennessee, with which he had been so long associated. Chattanooga was at this time beleaguered and almost surrounded by hostile forces, and the army of the Cumberland, which defended it, was in imminent danger of starvation or capture. On Oct. 23 Grant reached this place, and on the 27th the battle of Lookout valley, fought under his direction, relieved the army of the Cumberland. On Nov. 23, 24, and 25 he fought the battle of Chattanooga, utterly defeating Bragg, driving him from positions that seemed impregnable, and capturing in the open field over 5,000 prisoners and 40 pieces of artillery. His own losses were 6,616; the Confederates reported 2,500 killed and wounded, besides prisoners. Grant's force in this battle was 60,000; that of Bragg, 45,000; but the enemy enjoyed advantages of position which more than counterbalanced the disparity. The victory of Chattanooga overthrew the last important hostile force W. of the Alleghanies, and opened the way for the national armies into Georgia.

The remarkable series of successes which Grant had now achieved pointed him out as the appropriate leader of the national armies. In Feb., 1864, the rank of lieutenant-general was created for him by Congress, and on Mar. 17 he assumed command of the armies of the U. S. Having beaten all the other important hostile commanders, and broken in pieces every other great opposing force, he now prepared to encounter in person the army of Northern Virginia, under Lee, and at the same time, by his subordinates, to occupy all the remaining forces of the enemy, so that no Confederate army could in any emergency or by any possibility support another. Accordingly, while he sent Sherman into Georgia, and directed Sigel to penetrate the valley of Virginia, and Butler to capture Richmond, he fought his own way from the Rapidan to the James. On May 4 he could put into battle 110,000 soldiers; Lee confronted him with 75,000; while 30,000 under Butler were opposed by the same number at Richmond, and Sigel with 7,000 fought Breckenridge with 5,000 or 6,000. Before Grant reached the James he had lost 6,000 men killed, 26,000 wounded, and nearly 7,000 missing. The losses of Lee's troops can never be known, as their

records were destroyed by their own hands; but Grant captured in this period 10,000 men (4,000 more than Lee), and it is probable that the entire loss of the enemy was little if any less than his, although Lee fought constantly on the defensive, and therefore with immense advantage and security. The battles of the Wilderness, Spottsylvania, North Anna, and Cold Harbor were the hardest Grant ever fought, but after each he advanced and Lee withdrew. They cost the national commander dear, but they inflicted losses on Lee from which he never recovered, and thus accomplished the object at which Grant was aiming. He was more anxious to annihilate Lee's army than to effect any purely strategic result, or even to capture Richmond, for he believed that only by the annihilation of Lee could the Confederacy be overthrown. With this view and for this purpose the campaign of the Wilderness was planned and fought. When Grant arrived in front of Richmond he crossed the James, in pursuance of the design formed months before. Butler had failed to take the city, and his army was now joined to that which had fought its way from the Rapidan; and in June the siege of Richmond was begun. Sherman, meanwhile, was marching and fighting daily in Georgia, and steadily advancing toward Atlanta; but Sigel had been defeated in the valley of Virginia, and was superseded by Hunter, who made his way as far as Lynchburg, and was then in his turn repelled. Hunter's retreat left open a road to Washington, and Lee sent Early to threaten the national capital; whereupon Grant gathered up a force which he placed under Sheridan, and that commander rapidly drove Early, in a succession of battles, through the valley of Virginia, and destroyed his army as an organized force. But the siege of Richmond still went on. The Confederates were gallant and stubborn, and though Grant made numerous attacks he was only partially successful. His army reached out on both sides of the James, but for many months he was unable to get possession of the railroads by which Richmond was supplied. The Government advised him to abandon the attempt, and the country was sometimes impatient and distrustful, but Grant never wavered.

By September Sherman had made his way to Atlanta, and Grant then sent him on his famous march to the sea. He made Sherman's success possible, not only by holding Lee in front of Richmond, but by sending re-enforcements to Thomas, who then drew off and defeated the only army which could have confronted Sherman. Sherman by this strategy was left unopposed. Thus Thomas, Sheridan, and Sherman were all used in furtherance of Grant's plans, each executing his part in the great design, and contributing his share to the result at which Grant was aiming. Sherman finally reached Savannah, Schofield beat the enemy at Franklin, Thomas at Nashville, and Sheridan wherever he met him; and all the while Lee was held near Richmond, unable to send to any part of the theater of war to re-enforce any army, no matter how threatened or assailed. Schofield was now brought from the West, and Fort Fisher and Wilmington on the seacoast were captured, so as to afford him a foothold; from here he was sent into the interior of North Carolina, and Sherman was ordered to move northward to join him. When all this was effected, and Sheridan could find no one else to fight in the valley, Grant brought the great cavalry leader to the army in front of Richmond, and, making a last effort, drove Lee from his intrenchments and captured Richmond.

When the final campaign began Lee had collected 73,000 fighting men in the lines at Richmond, besides the local militia and the gunboat crews, amounting to 5,000 more. Including Sheridan's force, Grant had 110,000 men in the works before Petersburg and Richmond. Petersburg fell on Apr. 2, and Richmond on the 3d, and Lee fled in the direction of Lynchburg. Grant pursued with remorseless energy. Lee was completely surrounded, and on Apr. 9, 1865, at Appomattox Court-house, he surrendered in the open field 27,000 men, all that remained of his army. In ten days Grant had captured Petersburg and Richmond, fought, by his subordinates, the battles of Five Forks and Sailor's Creek, besides numerous smaller ones, captured 20,000 men in actual battle, received the surrender of 27,000 more at Appomattox, absolutely annihilating an army of 70,000 soldiers. During the year Grant's entire loss among the troops immediately under his command, including those in Butler's army, amounted to 12,663 killed, 49,559 wounded, and 20,498 missing; total, 82,720. He captured in the same time 66,512 soldiers; of the Confederate killed and wounded no return was ever made. He had destroyed every army opposed to him—those of Lee, Early, and Beauregard, besides the re-enforcements sent to Lee from all quarters of the South, leaving at the last not a living man of all those armies who was not a prisoner. His forces had never been more than one-third greater than those of his antagonist, and he had constantly fought on the offensive. The terms granted to Lee at Appomattox were so magnanimous that the whole population of the South at once sought to share their benefits. The other Confederate armies offered to surrender, and the greatest civil war in history was at an end.

Grant returned at once to Washington to superintend the disbandment of his armies. This work was scarcely begun when President Lincoln was assassinated. It had doubtless been intended to inflict the same fate on Grant, but he, fortunately, on account of leaving Washington early in the evening, declined an invitation to accompany the President to the theater where the murder was committed. This event made Andrew Johnson President, but left Grant by far the most conspicuous figure in the public life of the country. He became the object of an enthusiasm greater than had ever been known in the U. S. Every possible honor was heaped upon him; the grade of general was created for him by Congress; houses were presented to him by citizens; towns were illuminated because he entered them. President Johnson soon took such a position in politics as threw most of those who had supported the war into open hostility to him. At first he had been so bitter toward the defeated South that Gen. Lee asked Grant's interposition in his behalf, and it was given. Grant saved Lee from prosecution for treason when Andrew Johnson was eager for it. But Mr. Johnson soon became the ardent friend of the former Confederates, and was believed by many to be plotting their return to power. In this conjunction all parties turned to Grant. Congress passed laws to restrain the President and giving Grant an amount of power unknown before to any subordinate. His position was extremely delicate. He was a soldier and it was his duty to be subordinate to the President. Yet the President was in direct opposition to Congress, the law-making power. Grant, however, for a long time was able to comply with the directions of Congress without offending the President. Johnson, indeed, sought to obtain the sanction of Grant's name for his policy. He suspended the Secretary of War and placed Grant in his stead, and the soldier for some months was a member of Mr. Johnson's cabinet. Finally, however, it became necessary for him either to break with the President, or by compliance, as he thought, to disobey the law; and he refused to do the latter. From this time President Johnson was his political and personal enemy. Grant's popularity, however, remained unshaken with those who had supported the war, and in 1868 he was elected President by large majorities. He was inaugurated on Mar. 4, 1869. His first administration was distinguished by a cessation of the strifes which sprang from the war, by a large reduction of the national debt, and by a settlement of the difficulties with Great Britain, which had grown out of the depredations committed by privateers fitted out there during the war. These difficulties threatened at one time to embroil the two nations, but they were referred to arbitration, and the result was an award of $15,000,000 damages, which were paid by Great Britain to the U. S., on account of the injuries she had occasioned or allowed. During the latter half of his administration a violent opposition arose to Grant, led by men in his own party, who were dissatisfied with his course. He was, however, re-elected to the presidency in 1872 by a larger vote and a larger majority than any presidential candidate had ever received. Soon after he left the presidential chair he set out on a tour around the world, returning by way of California, and became actively engaged in railroad and other enterprises. He was appointed in 1882 one of the commissioners to negotiate a commercial treaty with Mexico, and was placed on the retired list of the army Mar. 4, 1885, with rank and full pay of general. He wrote for *The Century* a series of papers on different battles and campaigns of the civil war. These were subsequently amplified and embodied in two remarkable volumes, known as *Personal Memoirs* (New York, 1885), from which his widow has received more than $400,000 copyright. D. at Mt. McGregor, 11 miles N. of Saratoga, N. Y., July 23, 1885, and was buried in Riverside Park, New York city, Aug. 8, 1885. The civic and military procession at the funeral was never equaled in the U. S. in extent and in the number of distinguished men attending it. A tomb has been erected

in New York at a cost of $500,000, chiefly contributed by citizens. Revised by JAMES GRANT WILSON.

**Granta**: a river of England. See CAM.

**Grantham**: town of England; in the county of Lincoln, on the left bank of the Witham, and on the Great Northern Railway, 25 miles S. S. W. of Lincoln (see map of England, ref. 8–I). Its church is an interesting building of the thirteenth century, with a fine spire 278 feet high. In its grammar school, founded in 1528, Newton received his first education. There are manufactures of agricultural implements and brick. Pop. 17,500.

**Grant's Pass**: town (incorporated 1884); capital of Josephine co., Ore. (for location of county, see map of Oregon, ref. 7–B); on the Rogue river and the S. Pacific Railway; equidistant between Portland and San Francisco. It is in an agricultural, mining, fruit-raising, and lumber region; is the distributing-point for the trade of a large area; and contains 4 churches, large union school, gas, water, and electric-light plants, railway-car and machine shops, opera-house that cost $19,000, a national bank, 2 weekly newspapers, and manufactures of brick, carriages, brooms, matches, and lumber. Pop. (1890) 1,432; (1900) 2,290.

**Granular Lids** (synonyms: *granular ophthalmia*, *granular conjunctivitis*, *trachoma*, *Egyptian ophthalmia*, *military ophthalmia*): an inflammation of the conjunctiva, in which the membrane loses its smooth surface owing to the formation of "granulations," or yellowish-red, rounded bodies, which after absorption leave cicatricial changes. It is usually described under two forms, *acute* granulations and *chronic* granulations. Chronic granulations may result from the imperfect disappearance of acute granulations, but more frequently appear as a primary disorder. Certain individuals are predisposed to the disease, and, although its subjects are often pale and anæmic, there is no known constitutional disorder which causes it. The predisposition also includes races, the Jews, the Irish, and the inhabitants of the East, as well as the Indians in the U. S., being especially liable to the affection, while the Negroes are almost exempt. Dwellers in certain regions of the earth where the climate is damp are readily affected, while an altitude of 1,000 feet confers comparative immunity. A large amount of evidence has accumulated indicating the dependence of granular lids upon the presence of a special form of micro-organism, which is known as the *trachoma-coccus*. The contagious nature of the affection is undoubted. The essential elements of this disease are the "granulations," and this word refers to the characteristic feature of granular lids, and must not be confused with the granulation tissue or proud flesh which is seen in wounds. One form of the disease, called *follicular conjunctivitis*, is due to enlargement of the natural follicles of the conjunctiva, but in true granular lids bodies of special structure, called *trachoma nodules* or *granules*, develop under the circumstances which have been described. In the acute variety the symptoms are like those of a violent ophthalmia, added to which is the formation of roundish granulations. In the chronic variety, often without any preceding inflammation, the yellowish-red semi-transparent bodies develop, especially on the folds of the conjunctiva which join the lids and the eyeball together. Gradually these increase, the lids become thickened, the granulations soften, break down, and form scar tissue. New ones take their places, and so the process is repeated again and again. With the softening there is often much discharge, which is markedly contagious. The roughened lids rub over the cornea and irritate it, producing an inflammation of this membrane in which a great many new blood-vessels form in its layers, called *pannus*, which when inveterate has been treated by producing a violent inflammation with an infusion of the seeds of the *Abrus precatorius* (paternoster bean). When the acute stage disappears the pannus may also subside. It is a dangerous method. The lids become distorted by the contraction of the scar tissue, and the eyelashes are misplaced and rub against the eyeball. In neglected cases these serious changes may cause destruction of sight. It is an exceedingly tedious disease, and months and even years elapse before its cure is brought about. The treatment of granular lids consists in the application of such remedies as will cause absorption of the "granulations" with the least possible scar tissue. For this purpose many caustics are used, among which the most noted are nitrate of silver, strong solutions of corrosive sublimate, sulphate of copper or bluestone, and boro-glyceride, which is a mixture of borax and glycerin. A host of other remedies have been recommended in addition to these, comprising all the best known antiseptics and astringents. In many cases it becomes necessary to operate. The best operations are those by which, with certain specially devised instruments, the contents of the granulations are evacuated, either by a squeezing process (expression) or by rubbing (*grattage*). Under certain circumstances electricity is applied.

The disease was probably known to the ancient Egyptians 1500 B. C. It has been the means of seriously interfering with the operations of armies in the East, and, as general attention was first called to the disease by Larrey's description of the state of the eyes of the French army in Egypt in 1798, it is often called *Egyptian ophthalmia*, although no doubt this disease includes many other forms of conjunctival affections besides true granular lids. The soldiers who returned from the Egyptian campaigns are supposed by some authorities to have been the means of disseminating this disorder on the continent of Europe.

G. E. DE SCHWEINITZ.

**Granvelle** (Fr. pron. grăăn'vel'). or **Granvella**, ANTOINE DE PERRENOT, Cardinal: b. at Ornans, Burgundy, Aug. 20, 1517; the son of the Sieur de Granvelle, Prime Minister to Charles V.; studied law at Padua and theology at Louvain; became Bishop of Arras 1540; attended the Diets of Worms and Ratisbon 1540, and in 1545 was sent to the Council of Trent, where his great diplomatic talent first found an opportunity to show itself; became a prominent state councilor under Charles V., and in 1550 took the chancellorship of the empire after his father's death; negotiated the treaty of Passau 1552; arranged the marriage between Philip II. and Mary of England 1553, which, however, led to a result quite opposite to that which was expected, as the marriage was without issue, and England, after the death of Mary, immediately placed herself among the bitterest enemies of Spain; concluded the treaty of Cateau-Cambrésis 1559; was minister to the Duchess of Parma in the Low Countries 1559–64; became Archbishop of Mechlin 1560, cardinal 1561, and in 1564 retired to Besançon, compelled to leave his office by the clamors of nobles and people, led by Horn, Egmont, and the Prince of Orange. Granvelle's tyranny was, indeed, of the most odious kind. He introduced swarms of Spanish troops into the Netherlands, supported, and even encouraged, the Inquisition, and destroyed the flourishing commerce and industry of the country. Never has a minister been more bitterly hated than he was. His house was plundered, burned, and razed to the ground, and caricatures of him were publicly sold in the streets. Afterward he became Spanish envoy to Rome 1570; Viceroy of Naples 1570–75; became president of the supreme council of Italy and Castile 1575; was translated to the archbishopric of Besançon 1584. D. in Madrid, Sept. 21, 1586. He was a man of learning and ability.

**Granville**, grăăn'veel' [Fr., great city]: a fortified town of France; in the department of La Manche, on the English Channel (see map of France, ref. 3–C). It has a hydrographic college and manufactures of brandy, chemicals, and ironware. Ship-building, tanning, and fishing (oysters and cod) are important industries. Pop. (1896) 12,005.

**Granville**: village; on the Rutland and Washington Branch of Delaware and Hudson Railroad system; Washington co., N. Y. (for location of county, see map of New York, ref. 4–K); 65 miles N. of Albany. Within the limits of Granville township are five other villages and several cheese-factories. The principal business of the town is agriculture and the quarrying and manufacturing of roofing slate, mantels, and all articles of marbleized slate. Pop. of township (1880) 4,149; (1890) 4,716; (1900) 5,217; village (1900) 2,700.

**Granville**: village; Licking co., O. (for location of county, see map of Ohio, ref. 5–F); on Raccoon creek and the Toledo and Ohio Central Railway; 28 miles E. N. E. of Columbus. It is the seat of DENISON UNIVERSITY (*q. v.*), the Shepardson College for Women, and the Granville Female College (Presbyterian, opened 1827). It has a bank, and 3 weekly and 2 quarterly periodicals. Pop. (1880) 1,127; (1890) 1,366; (1900) 1,425.

**Granville**, GEORGE: Viscount Lansdowne, Baron of Bideford; b. in 1667; was educated at Trinity College, Cambridge; kept aloof from politics during the reign of William and Mary on account of his sympathy for the Stuarts; wrote *Heroic Love*, *British Enchanters*, and other dramas, besides poems; became the head of the family by

the death of his brother; entered Parliament in 1710, and was in the same year appointed Secretary of War. His connections with the Pretender, however, were so well known that after the death of Anne he was for two years confined in the Tower, 1714–15, and in 1722 he saw fit to retire for some time to France, where he lived for ten years. His works (poetry and prose) were published in 1732, in a collected edition of two volumes quarto, and dedicated to Queen Caroline. He was a friend of Pope, who dedicated his *Windsor* to him. D. Jan. 30, 1735.

**Granville,** Granville George Leveson-Gower, K. G., P. C., D. C. L., F. R. S., Earl: the second earl of the present line; b. in London, May 11, 1815; was educated at Eton and Christ Church, Oxford; entered Parliament 1836; was Under-Secretary for Foreign Affairs 1840–41; master of the buckhounds 1846–48; vice-president of the Board of Trade 1848–51; Foreign Secretary 1851–52; chancellor of the duchy of Lancaster 1855; ambassador extraordinary to St. Petersburg 1856; lord president to the council 1855–58 and 1859–66; Colonial Secretary 1868–70; Secretary for Foreign Affairs 1870–74; also chancellor of London University, constable of Dover Castle, and lord warden of the Cinque Ports; was an able and distinguished Liberal politician; succeeded to the peerage in 1846, and in the same year became a privy councilor. He was Secretary of State for Foreign Affairs 1880–85; became Secretary of State for the Colonies 1886. D. in London, Mar. 31, 1891.

**Granville,** John Carteret, Earl: statesman; son of Baron Carteret of Hawnes, Bedfordshire, England; b. Apr. 22, 1690; educated at Westminster School and Christ Church College, Oxford; entered the House of Lords in 1711 as second Baron Carteret; supported Stanhope and the Whigs, and on the accession of George I. became a lord of the bedchamber. As ambassador extraordinary to Sweden, and later as Foreign Secretary, he proved himself a skilled diplomatist, and in 1724 was appointed Lord-Lieutenant of Ireland. On his return he led the party that overthrew Sir Robert Walpole, and as Secretary of the State for the Northern Department was the real head of the administration till its overthrow by the Pelhams in 1744. In the same year he became Earl Granville on the death of his mother, Countess Granville. Henry Pelham made him lord president of the council in 1751, but he was never again a party leader. D. in London Jan. 2, 1763.

**Granville College**: See Denison University.

**Grape** [from O. Fr. *grape*, *crape*, grape, orig. hook, claw, from O. H. Germ. *chrapfo* > Mod. Germ. *Krapfen*, hook]: any species of the genus *Vitis*. The wine grape (*Vitis vinifera*) has been grown from the earliest times, and it was among the first fruits introduced into North America from Europe. All the early attempts to cultivate the foreign grape in the U. S. resulted in failure, save in the missions upon the Pacific slope, and perhaps on isolated plantations along the southern borders of the country. In some instances companies were organized in Europe for the purpose of growing grapes and making wine in the U. S., and experienced *vignerons* were sent to care for the vines, but all failed after a few years. The cause of the greater part of this failure was, as not then known, the downy mildew and the root-louse or phylloxera, enemies which are native to America, but which work much greater injury upon the European grape than upon native species. The failure of the foreign or wine grape in the U. S. naturally drew the attention of grape-lovers to the wild varieties. These wild grapes were known to the earliest settlers to be variable, and the New England colonists have left descriptions of them. As early as 1629 a vineyard of wild vines was set in the Massachusetts colony. But the cultivation and amelioration of the native vines was not begun seriously until about the end of the eighteenth century, when a European grape colony on the Ohio river was threatened with disaster in the failure of the imported species. A native grape was introduced into the plantations, the *vignerons* having been told that it had been procured at the Cape of Good Hope, and it was therefore called the Cape grape. It had been known previous to this time as the Alexander, however, and under this name it is still described in some grape manuals. This grape is a chance variety of the Fox grape, or *Vitis labrusca* of New England and the Eastern Allegheny region, and this species is the parent, in whole or in part, of nearly all the popular grapes grown in the U. S. Catawba, Isabella, and Diana were early varieties of promise, and the first is still extensively grown. The introduction of the Catawba by Major Adlum, not far from 1820, really marked the second era in viticulture in the U. S., for this variety was not only a better table grape than any which had preceded it, adding such desirable qualities as vigor, productiveness, and good size, but it is still the leading native wine grape. The parentage of the Catawba is still in doubt, but some of the leading viticulturists suppose that it contains some *vinifera* or foreign blood; its chief characteristics are clearly of the *labrusca* type. The third epoch came with the introduction of the Concord in 1853, but there is indication that some of the new varieties of the Southwest, containing blood of the Post Oak grape (*Vitis lincecumii*), may prove more valuable. The profitable or commercial cultivation of grapes may be said to have begun with the Concord, which is still the most popular variety, although its place is contested by Worden, Niagara, and a few others of *labrusca* parentage. Two other native species, *Vitis riparia* and *V. æstivalis*, are the parents of cultivated varieties, but their contributions to viticulture are small. *V. riparia* is the commonest grape of the Northern Middle U. S., is also largely used in France and other European countries as a stock upon which to graft the wine grape, or *Vitis vinifera*, to enable it to resist the attacks of the phylloxera, which has been introduced into Europe. The root of *V. riparia* resists almost completely the attacks of the louse. Numerous attempts have also been made to hybridize the Fox grape and the European species, and many fine table grapes have resulted, but none of the hybrids have adapted themselves to commercial cultivation over any considerable area. Among the best known of these hybrids are those produced by E. S. Rogers, of Massachusetts, of which the leading ones are Agawam, Barry, Salem, Wilder, Lindley, Gaertner, and Goethe. The Scuppernong grape of the Southern States (*Vitis rotundifolia*) has also given rise to cultivated varieties. T. V. Munson and other experimenters of the Southwestern U. S. have made very promising attempts to hybridize and ameliorate the grapes of that region. North America has at least twenty-five species, nearly all of which are likely to prove valuable in one way or another. The eleventh census bulletin gives the following figures for the Eastern U. S.:

| | Acres. |
|---|---|
| Eastern or New York region | 51,000 |
| Middle or Ohio-Illinois region | 42,633 |
| Western or Kansas-Missouri region | 17,306 |
| Southern or Virginia-Georgia region | 17,092 |
| Miscellaneous | 60,000 |
| Total | 188,031 |

In the production of table grapes New York leads with 60,687 tons in 1890, and is followed by Ohio with 38,947 tons. The wine production was 2,528,250 gal. and 1,934,833 gal. respectively. The grape interest in Ontario is also large. It must not be thought, however, that the native grapes alone succeed in the U. S. The vast Pacific vine area is planted with the true wine grape of the Old World. The census gives the total acreage in the Pacific region, including California and parts of Arizona and New Mexico, as 213,230 acres. In the census year this region produced 14,626,000 gal. of wine, and the raisin crop was also large. The phylloxera is now invading this region, and it is probable that greater difficulty will be experienced in the future in the cultivation of the wine grape; but the undoubted adaptability of the Pacific and extreme southwestern areas to the wine and raisin industries, coupled with the aid which experiments are continually bringing to problems of viticulture, must maintain the advantage which that territory now enjoys. The European grapes, as the Black Hamburg and Chasselas, are also popular varieties for growing under glass in the Northern States.

*Pruning and Training.*—As the native grapevines of the U. S. differ widely in habit from those of the Old World, it follows that they must receive different care and be subjected to different methods of training. It was not until the vineyardists of the Central and Eastern States perceived this fact that grape culture in the U. S. entered upon an epoch of prosperity. This is especially true as regards training, methods of dealing with mildew, and varieties. In training, the ultimate object is the same in all species—to curtail the growth so that the vine will not become too large and unmanageable, to thin the fruit by the removal of superfluous branches, to increase productiveness, and to allow the sun to reach the berries. Most grapevines will endure

very severe pruning, but the wine grape or *Vitis vinifera* can be more severely pruned than other species. Grape pruning and training are greatly simplified if one comes thoroughly to understand that the fruit is borne upon wood of the current year's growth. That is, the shoots bloom as they grow, early in the season—the grape does not develop fruit-buds in the fall. The number of buds which is left on a vine, therefore, does not directly determine how many clusters of grapes the vine will bear, for each bud is to make a branch, which in turn will bear grapes. This explains the very close pruning of grapevines. The canes or ripened shoots of any season are cut back to two to four or five buds, and some of the canes may be removed entirely if they are numerous. Ordinarily three or four canes will be enough to leave, each being cut back, so that a very large vine, after pruning in the winter, may bear only eight to forty buds. The nature of the pruning depends greatly upon the character of the variety or the species. Some strong varieties of native grapes, as Concord and Niagara, can well carry twice as much wood as weaker varieties, like the Delaware. It follows that if each successive year's growth is cut back to a few buds, the bearing wood must be constantly removing itself from the root or crown of the plant. In order to prevent this, or to keep the wood near the stock, a new cane is often trained up from the root, which shall ultimately take the place of the old stock or plant; but by judicious pruning the grower can prevent the accumulation of too many "spurs," as the remnants of the pruned canes are called, and can keep the bearing wood near the crown.

There are very many ways of training the grape, but it is well to bear in mind at the outset that the American varieties can not be cut back so closely as the European. The European vine can be made to stand entirely alone without any support whatever, and this is the common system in California. The "stump" or trunk of these vines varies in height, according to the fancy of the operator. Sometimes the branches start at the surface of the ground, and sometimes the trunk is 2 or 3 feet high. Tying to a single stake is also often practiced with the wine grape. The American species, however, are commonly trained upon a trellis. The high renewal system demands three wires. The "arms," or the permanent portion of the vine, reach the bottom wire and are tied to it. The canes are cut back to within a few buds of these arms every winter. These pruned canes are tied horizontally on the lower wire, and the shoots, as they grow, are tied perpendicularly to the wires above. This is a favorite system for Catawba, Delaware, and all varieties of medium or weak growth. It is also well adapted to the stronger sorts, but in them too much summer tying of shoots is required, and such vines usually overgrow the trellis. This system, while it secures fruit of the finest quality, demands much hand labor during summer, and a cheaper system must eventually supersede it for the common varieties. Its strongest competitor is the Kniffin system. Here only two wires are required, and the top one stands from 5 to 6 feet above the ground. Two canes are trained out in each direction on each wire, and the bearing shoots, instead of being tied up, are allowed to hang, thus doing away with all tying, except that required to keep the main canes on the wires. The Kniffin system is especially adapted to all strong growing varieties, and it is now the favorite one in the grape districts of New York.

*Culture and Propagation.*—Grapes demand a well-drained, warm, and gravelly soil, and a location free from late spring and early fall frosts. The American varieties are usually most reliable near bodies of water, which modify the temperatures at both ends of the growing season. Vine-yards are ordinarily given clean culture throughout the season, or until the fruit is ready to pick. The vines are set from 6 to 8 feet apart each way, the distance depending upon the strength and habit of the variety. Grapes are usually propagated by means of cuttings of hardwood taken in the fall and stored until spring in a cool cellar or buried in a gravelly place. New or rare varieties are sometimes started under glass from cuttings of single "eyes" or buds. Greenwood cuttings and layers are occasionally used. The vine can be grafted with ease, but the scion should be inserted below the surface of the ground, else it will be broken out by the wind.

*Diseases, etc.*—The grape is subject to many diseases and insects, of which the worst probably is the PHYLLOXERA (*q. v.*). The downy mildew (*Peronospora viticola*) is a fungous disease affecting the leaves and the fruit, causing the latter to rot. Upon the leaves it appears as slight frost-like patches upon the under surface, causing discolored spots above, and finally resulting in the premature death or great injury of the entire leaf. The mildew of Europe (*oïdium*) is a different disease from this, and is kept in check by dusting sulphur upon the vines, and before the nature of the downy mildew was known this remedy was urged upon growers in the U. S. But dry sulphur has little influence upon the downy mildew, and its use has been given up. The American or downy mildew is common in Europe, however, and the French have found a remedy for it in the Bordeaux mixture, and a new remedy has been added in the U. S. in the ammoniacal carbonate of copper. (See FUNGICIDE.) Either of these compounds is a specific for mildew if applied from four to six or eight times at intervals, beginning just before the blossoms open and continuing, if necessary, until a short time before the grapes begin to color. The black-rot (*Læstadia bidwellii*), also an American disease, causes a serious shriveling and decay of the fruit, but it can be kept in check by the same means as recommended for the downy mildew. Of the numerous insects peculiar to the grape and allied plants, the so-called thrip, or leaf-hopper, is almost as serious as the phylloxera. This is a minute insect feeding on the leaves. In grape-houses the thrip is kept at bay by fumigating with tobacco or pyrethrum. In the field kerosene emulsion (see INSECTICIDE) applied as a spray is recommended. Some growers catch the insects on sheets of sticky fly-paper carried on poles, the insects being scared up by a person who precedes the operator. The rose-chafer is also a serious pest, especially on light soils, but no good remedy beyond hand-picking is known.

*Varieties.*—Over 500 varieties of grapes indigenous to the U. S. are described. The most popular kinds are Concord, Worden, Niagara, Catawba, Delaware, Champion, Brighton, Moore's Early, Pocklington, Lady, Cynthiana, Norton's Virginia, Herbemont, Ives, Lady Washington, Martha, the Rogers hybrids already mentioned, and others for special localities. For graperies under glass the following are popular: Black Hamburg, White Frontignan, Muscat of Alexandria, Chasselas, St. Peter's, Black Prince. For varieties suited to California, and other information concerning grape-culture there, consult the articles RAISIN and WINE.

There is a large grape literature in the U. S.; the most recent information is to be found in the *Bushberg Catalogue*, Husmann's *American Grape-growing and Wine-making*, Barry's *Fruit Garden*, Mitzsky's *Grape Culture*, Thomas's *American Fruit Culturist*, Bailey's *American Grape Training*, Charlton's *Grape-growers' Guide* (for glass graperies), Wickson's *California Fruits*, and Eisen's *Raisin Industry*.

L. H. BAILEY.

**Grape-cure**: a systematic administration of grapes, or of certain parts of them, in large quantities, for the relief of disease. This mode of treating various ailments is most extensively carried out in Germany, while there are places in which it is practiced in Austria, Hungary, and Switzerland. In France, however, where vineyards are very numerous, there seems to be no place where the grape-cure is regularly used. In using grapes for the grape-cure it is customary to reject both the skins and the seeds, and to swallow only the pulp and the juice which surrounds it. These contain in 1,000 parts (about)—

| | |
|---|---|
| Water | 865·0 |
| Grape-sugar | 120·0 |
| Free acid | 4·0 |
| Albumin | 5·6 |
| Pectin, etc | 2·9 |
| Salts | 2·5 |
| Total | 1,000·0 |

Tannin is found in the juice only when derived from broken seeds or bruised skins or stems. In the grape-cure it is usual to begin with a pound or two, and gradually to increase the quantity to 6 or 12 lb. a day. This quantity is divided in three portions. The first, consisting of half the daily quantity, is taken in the morning before eating anything else, though patients who find this not to agree with them are permitted to take the grapes after a breakfast, or even to eat some bread crusts with the grapes. If the grapes are eaten before breakfast, the meal follows in an hour, and consists of bread, tea, coffee, thin chocolate, or a light soup. The second portion of the grapes (a quarter of the daily quantity) is taken an hour before the midday meal. The third portion (again a quarter of the whole

daily quantity) is taken an hour before the evening meal. The best grapes are those which are of good size, with thin skins, small seeds, rather thick juice, and a sweet and aromatic taste. The effect of the cure is cooling, it quiets thirst, and stimulates the kidneys and bowels, and increases the appetite. If simultaneously the amount of other food is diminished, the patient usually loses weight; but if suitable and nourishing food is taken in proper quantities the weight increases. Experiments made in Germany showed that with small quantities of grapes and large quantities of meat-food weight was lost, while with large quantities of grapes and smaller quantities of meat the weight increased. Bichof and Voigt found that 500 grammes of meat and 100 grammes of grape-sugar produced a loss of weight of 230 grammes; 500 grammes of meat and 200 grammes of grape-sugar a loss of 23 grammes; and a gain of 92 grammes followed 400 grammes of meat and 300 grammes of grape-sugar. From these results it is inferred that in wasting diseases the grape-cure should be conducted with moderate quantities (about 4 lb. daily) of grapes rich in grape-sugar, combined with nourishing meat-food. This is the treatment best suited to scrofulous or anæmic persons, or convalescents from fevers. Overfed, plethoric, constipated, or congested patients should use larger quantities of grapes and small quantities of meat, and no fats. The effect of increasing or diminishing the proportions of grapes and other articles of food each must be carefully studied before it can be learned just how much of each is suited to individual cases. When this is done admirable results have been obtained, especially when the grape-cure has followed suitable (principally evacuant) treatment of the bowels. In Germany the location in wholesome localities of the various grape-cures probably contributes something to the results of the treatment; but the usefulness of the special diet is beyond question.

CHARLES W. DULLES.

**Grape Family**: See VINE FAMILY.

**Grapeshot** (Fr. *mitraille*): a name applied to several kinds of artillery missiles, but especially to a cluster of iron balls grouped together about a spindle, and held in place by iron disks, through which the spindle passes. Grapeshot is very effective against infantry in masses at short range.

**Grape-sugar**: See GLUCOSE.

**Grapevine**: See GRAPE.

**Graphic Statics**: that branch of mechanics in which statical problems are solved by means of simple geometric constructions. The forces are represented by lines drawn to scale, and by operating upon them the draughtsman deduces other lines which furnish the solution of the particular problem before him.

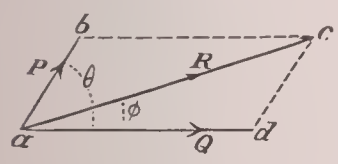


FIG. 1.

The principle of the parallelogram of forces forms the starting-point of the science. The resultant R of the forces P and Q being represented in direction and intensity by the diagonal *a c* of the parallelogram *a b c d*, the directions and intensities of the three forces are shown by the sides of the triangle *a b c*, and passing around that triangle in the direction from *a* to *b*, *b* to *c*, and *c* to *a*, the direction of each force thus obtained is that necessary for equilibrium. Hence arises the principle of the triangle of forces, which is extended to include any number under the name of the polygon of forces, and which may be thus stated: If any number of forces are in equilibrium, a closed polygon may be formed whose sides are parallel and equal to the several forces; and, starting with any given force and following around this polygon, the direction thus obtained for each of the others will be the direction required for equilibrium. By this principle the graphical resolution and composition of forces may be made, and many problems of statics be readily solved.

The most useful application is to the determination of the stresses caused in the members of a roof-truss by loads applied on the rafters. For example, in Fig. 2 the upper diagram represents a roof-truss, held at rest by five external forces—viz., three equal weights acting downward at the points *q*, *r*, and *s*, and two equal reactions acting upward at the supports *m* and *n*. These forces, being in equilibrium, can preserve that equilibrium only by means of other forces or stresses generated in the various pieces of the truss. It is required to determine these stresses. The weight acting at *q* is designated by B C, that at *r* by C D, the reaction at *m* by A B, and so on, each force receiving a name corresponding to the two letters placed on opposite sides of it; in the same way the pieces of the truss are named, B F being that joining the points *m* and *q*, F G that from *q* to *p*, and so on. The force polygon for the weights and reactions is first formed by drawing *b a* equal and parallel to B A, *a e* to A E, *e d* to E D, *d c* to D C, and *c b* to C B, thus obtain-

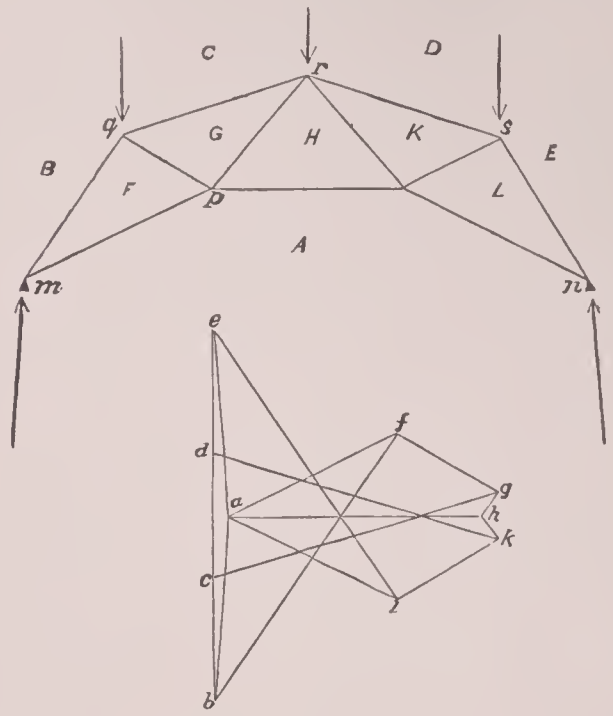


FIG. 2.

ing the closed figure *a e d c b a* to represent the equilibrium of the given exterior forces. The process for finding the stresses is then as follows: Beginning at the point *m*, there are three forces in equilibrium, the reaction *a b* and the unknown stresses in A F and B F, whose directions, however, are given; and these, being in equilibrium, will be represented by the sides of a triangle formed by drawing *a f* parallel to A F and *b f* parallel to B F, which with *a b* constitute the force triangle *a b f*. Measuring, then, *a f* and *b f* by the same scale with which *a b* was laid off, the intensities of the two forces in A F and B F are found; and following around the triangle in the direction indicated by the given reaction the first is determined to be tension and the second compression. Passing next to the point *q*, there are acting four forces, of which B F and B C are known and represented in the strain diagram by *b f* and *b c*; hence drawing from *c* and *f* lines parallel to C G and F G, the force polygon *c b f g c* is formed for the forces meeting at *q*, which determines the strains *c g* and *f g*. Again, passing to *p*, in like manner the force polygon *a f g h a* for that point is made, and thus continuing a stress diagram results in which every line is parallel to its corresponding one in the truss. The two figures are, as will be noticed, reciprocal ones, the stresses represented by the lines meeting at any point, as *k*, being those which exist in the pieces surrounding the space K. The relations of the various forces are thus clearly shown to the eye, the stresses are readily found by measurement, their character determined by following around the polygons, while the symmetry of the figure furnishes checks upon the accuracy of the work. Another principle of great importance is that of the equilibrium polygon, which is the polygon that a cord will assume when solicited by forces acting at various angles. The properties of this polygon furnish numerous elegant graphical methods for the determination of centers of gravity and moments of inertia of bodies, as also the discussion of the stability of arches, beams, and bridges. See ARCH, MOMENT, STATICS, and STRESSES.

Graphic statics, as a special instrument for investigations in engineering, may be said to date from 1866, the year of publication of Culmann's *Graphische Statik*, although a few special applications had been made by Poncelet and Cousinery as early as 1840. Among U. S. works the following may be noted: Du Bois, *Elements of Graphical Statics* (New York, 1875); Eddy, *New Constructions in Graphical Statics* (New York, 1877); Greene, *Graphics for Engineers* (New York, 1879); Ricker, *Trussed Roofs* (New York, 1885).

Merriman and Jacoby, *Graphic Statics* (New York, 1890); and Hoskins, *Elements of Graphic Statics* (New York, 1893). Many of the books mentioned under BRIDGES also contain chapters on applications of graphic statics in the determination of stresses. MANSFIELD MERRIMAN.

**Graphite** [deriv. of Gr. *γράφειν*, write]: a form of carbon (often called *plumbago* and *black lead*), usually classed as a mineral, but supposed to be of organic origin and the ultimate product of the destructive distillation of vegetable or animal tissue. When pure it crystallizes in flat hexagonal tables. Its specific gravity is 1·81, and its hardness from 0·5 to 2. As it occurs in nature, graphite is usually mixed with more or less foreign matter, consisting of silica, alumina, lime, magnesia, etc. The purest known variety of natural graphite, found at Ticonderoga, N. Y., consists of 99·9 carbon. The best Ceylon graphite contains 99 per cent., and that from the famous Borrowdale mine in Cumberland, England, 87 per cent. of carbon. The inferior varieties of graphite frequently contain 50 to 60 per cent. of foreign matter. Graphite usually occurs in metamorphic rocks, such as gneiss, granite, slate, crystalline limestone, etc., but it also is sometimes found in trap. It is often produced in iron furnaces, crystallizing in flat, specular flakes in cavities in the cast iron. In many instances it is seen to be the direct product of metamorphism on coal, as at Craigman, Ayrshire, Scotland, where coal is altered by trap, and at Newport, R. I., where the coal, highly metamorphosed in mass, varies from anthracite to graphite, and may be classed as graphitic anthracite. Still more direct evidence of the conversion of vegetable tissue into graphite is seen in the coating of graphite which sometimes covers the impressions of fossil plants in metamorphosed carboniferous strata. Here it is plain that the graphite is the residual product of the distillation to which the vegetable tissue has been subjected. Graphite occurs most abundantly in somewhat irregular sheets or in detached masses, occupying nearly the same plane in gneiss, slate, and other metamorphic rocks. In these instances it apparently represents collections of vegetable matter, like those which in more recent deposits form beds of coal. Graphite also occurs as a more or less abundant constituent of graphitic schist, which is probably but the metamorphic condition of bituminous shale. Usually these stratified deposits of graphite contain much earthy matter. Graphite also frequently occurs in detached grains, crystals, lumps, or masses, sometimes of remarkable purity. In this category should be included the specks and grains found in crystalline limestone at Amity, Orange co., N. Y., the flattened crystals of Ticonderoga, N. Y., the larger masses found in trap at the Borrowdale mine, England, and perhaps those of the no less famous Alibert mine, Siberia. In some of these cases the graphite is almost chemically pure, and it seems to have crystallized out of its associations, as it does in cast iron. The detached masses or particles of graphite which occur in limestone probably represent the carbon of the soft parts of the animals of which the shells and bones have supplied the calcareous matter. Many unchanged limestones contain asphalt and petroleum, and these, in the process of metamorphism, may, by the loss of their hydrogen, be left as masses or specks of nearly pure carbon. The graphite which is sometimes found filling fissures in crystalline rocks is perhaps the product of the metamorphism of asphaltic veins or asphaltic coals like albertite, grahamite, chapapote, etc.

The uses of graphite in the arts are very varied. It is a good conductor of electricity, and is frequently employed for coating molds in electrotyping. It is largely used for foundry facings and in the manufacture of stove polish. It is also an excellent lubricant, and is frequently added to the compositions applied to the bearings of machinery to reduce friction. The great consumption of graphite, however, is for the manufacture of crucibles and pencils. Although in certain circumstances graphite will burn, producing carbonic acid, yet it is practically infusible. When mixed with clay and molded into crucibles, it forms one of the most refractory substances known, and supplies the material from which the best crucibles used in chemistry and metallurgy are made. For the manufacture of pencils only the finer varieties of graphite are used. Where it occurs in blocks of considerable size and great purity, it is sawed in sheets, and these are again cut into rods which are inserted in wooden holders. The graphite obtained from the Borrowdale mine was largely used in this way, and the pencils made from it were in such repute that the material was sometimes sold at $40 per pound. The Siberian graphite from the Alibert mine is also used in the same way for the manufacture of pencils, the monopoly of which has been enjoyed by A. W. Faber, of Stein, Germany. Although pencils made from the purest natural graphite are most highly esteemed, nearly all those used are manufactured from graphite washed free from its impurities, ground to an impalpable powder, and then consolidated by pressure, with or without cement. For the harder pencils a considerable quantity of fine clay is mixed with the powdered graphite.

The great source of supply of graphite or plumbago to commerce and the arts is Ceylon. The imports into the U. S. in the fiscal year ending June 30, 1900, amounted to 20,597 gross tons. Most of the product of this island is sent to the United Kingdom for distribution or manufacture. It varies much in purity, some being almost entirely free from foreign matter—being second only to the Ticonderoga graphite in purity—while other varieties contain large quantities of earthy matter. These different grades are applied to different uses, the finer qualities serving for the manufacture of pencils, the coarser for crucibles, etc. Graphite is also produced in considerable abundance at Harnon, Sweden; at Passau, Bavaria; Schwarzbach, Bohemia; Stiermark, etc. It has also been discovered in the province of Nelson, New Zealand. In the U. S. graphite occurs at innumerable localities, but is mined in a pure state only at Ticonderoga, N. Y. Impure grades are mined at Raleigh, N. C., Cumberland Hill and Cranston, R. I., and near Asheville, N. C. Important deposits of graphite exist in Canada, the most considerable of which is perhaps that of Buckingham on the Ottawa river, 16 miles above Ottawa city. This, like most of the New England and New York graphite, occurs in gneiss and crystalline limestone, and is mixed with much foreign matter, from which it needs to be freed by crushing and washing. The impurities contained in or associated with graphite are of two kinds—(1) the foreign matter of the rock which contains it, and (2) earthy material intimately blended with it. From the former it may often be easily separated by washing. The latter is an inherent impurity, like the ash in coal, and its character and quantity determine the value and uses of the material. Sometimes it exists as a mere trace, as in the Ticonderoga graphite, or it may amount to more than 50 per cent. of the mass. The market value of graphite is, however, not directly proportioned to the earthy matter or ash it contains, as even when this is in large amount, if very fine and equally diffused, it may not forbid the employment of the material for the manufacture of pencils and other uses for which a kind is demanded that commands a high price. For the manufacture of crucibles, graphite may contain much ash, provided the quantity of lime, magnesia, etc., is small. Much of the alkalies or alkaline earths renders the substance fusible. The market price of graphite is variable, but the average commercial quality applicable chiefly to the manufacture of crucibles is worth, at wholesale, from $150 to $800 per ton, the latter for the best grades of lump.

Revised by CHARLES KIRCHHOFF.

**Graphotype** [from Gr. *γραφή*, writing + Eng. *-type*, from Gr. *τύπος*, impression, deriv. of *τύπτειν*, strike]: a process by which prints are made without engraving. A tablet of prepared and compressed chalk is used, and upon it the draughtsman makes his drawing with a peculiar ink. The tablet is gone over with a brush in such a way as to leave the inked parts in relief. The chalk is then hardened by an appropriate process, and from it electrotypes may be taken. Well-made graphotype plates sometimes afford prints of much merit.

**Grap'tolites** [from Mod. Lat. *graptolites*; Gr. *γραπτός*, written, deriv. of *γράφειν*, write + *λίθος*, stone]: fossil *Hydrozoa* of the genus *Monograptus* and its allied genera; named ("written stone") from the slender black tracings left by the fossils upon the slates in which they occur. They first appear in very early Lower Silurian rocks, and have been recognized as high up as the Hercynian rocks of Germany, which have been placed in the Lower Devonian by Keyser. They were somewhat closely allied to the living sertularians, and constitute a sub-order, *Graptolithidæ*, of the order *Hydroida* of the classification of Zittel.

Revised by H. S. WILLIAMS.

**Graslitz**, graas'lits: a town of Bohemia; near the frontier of Saxony; about 90 miles W. N. W. of Prague by rail (see map of Austria-Hungary, ref. 3–D). It has manufactures of musical and mathematical instruments and of look-

ing-glasses, and an active trade in agricultural produce. Pop. (1890) 9,929.

**Grass-cloth**: a popular name for fabrics made of the fiber of the ramie (the *Bœhmeria nivea*), manufactured chiefly in Asia, but also to some extent in Europe. The grass-cloths are extremely durable, and often very beautiful. See RAMIE.

**Grasse**, graăs: town of France; in the department of Alpes-Maritimes; 12 miles by rail N. of Cannes (see map of France, ref. 8–I). There are manufactures of silks and olive oil, but the main industry is the manufacture of essences and perfumes from odoriferous flowers, for which Grasse is very celebrated. Pop. (1896) 15,020.

**Grässe**, gres'se, JOHANN GEORG THEODOR: author; b. at Grimma, Germany, Jan. 13, 1814; studied philology and literary history at Leipzig and Halle; became assistant in the Kreuzschule at Dresden, and in 1843 private librarian to the King of Saxony; in 1848 inspector of the cabinet of coins and medals, in 1852 director of the collection of porcelain, in 1853 Hofrath, and in 1864 director of the Green Vaults at Dresden. Author of *Lehrbuch der allgemeinen Literaturgeschichte* (4 vols., 1851–59); a *Handbuch* of the same (4 vols., 1844–50); *Die Sage vom Ewigen Juden* (1844); *Bibliotheca Psychologica* (1845); *Die Sage vom Ritter Tannhäuser* (1846); *Beiträge zur Literatur und Sage des Mittelalters* (1850); *Handbuch der alten Numismatik* (1852); *Beiträge zur Geschichte der Gefässbildnerei* (1853); *Orbis Pictus* (1861); a translation of *Gesta Romanorum* (1842); *Sagenbuch des preussischen Staates* (1866–71); *Trésor de livres rares et précieux* (7 vols., 1858–67; with supplement 1869); *Guide de l'amateur de porcelaines et de poteries* (1864; 7th ed. 1885); *Guide de l'amateur d'objets d'art et de curiosité* (1871; 2d ed. 1876); *Die Quelle des Freischütz* (1875), etc. D. Aug. 27, 1885.

Revised by H. H. BOYESEN.

**Grasse**, graăs, FRANÇOIS JOSEPH PAUL, Count de, and Marquis de Grasse-Tilly: soldier; b. at Valettes, Provence, in 1723; entered a galley of the Knights of Malta in 1734, and served against the Moors and Turks; was transferred in 1749 to the French navy; became a lieutenant in 1754, captain in 1762, rear-admiral in 1778, *chef d'escadre* in 1779. Having long been one of the most renowned of French captains, and having especially distinguished himself by his successes against the British fleet in the spring of 1780, he sailed for America in 1781; contributed essentially to the reduction of Yorktown by cutting off the retreat of Cornwallis and preventing aid from reaching him through the British fleet, and afterward served with great distinction in the West Indies; but was surprised by the superior force of the British admiral Rodney, utterly defeated Apr. 12, 1782, and taken prisoner. In England he was treated with high honor, but his undignified bearing during the period of his captivity, together with a suspicion of treachery, or at least gross negligence in the recent naval action, made his name odious in France. An official investigation of his conduct, however, resulted in his honorable acquittal. D. in Paris, Jan. 11, 1788, while holding the rank of lieutenant-general of the naval forces.

**Grasses** [O. Eng. *græs*: Germ. *Gras*]: a family (*Gramineæ*) of flowering plants numbering at least 3,500 species, which are found in all parts of the globe. They are characterized by chaffy inflorescence, free one-celled ovary, versatile anthers, jointed and mostly hollow stems, and two-ranked leaves. The stem (often called the culm) is usually cylindrical or nearly so, differing in this from the stems of sedges, which are more or less triangular in cross-section. It consists of nodes and internodes, the former appearing as slight, short enlargements or swellings (Fig. 1, A), while the latter are the long, straight portions between them. From the upper edge of every node a leaf develops. Internally the node is solid, while immediately above and below it the internodes are more commonly hollow. In the growth of the stem the elongation is nearly confined to the internodes, which grow at their bases. The lowest part of each internode is therefore the youngest. The leaves are always alternate upon the stem in two ranks. They usually sheathe the stem for a distance and then turn outward at a marked angle, this upper part constituting the proper blade of the leaf. At the angle between the sheath and blade there is frequently a tongue-like structure, known as the ligule (Fig. 1, D). The blade is mostly long and narrow, the veins (fibro-vascular bundles) running nearly parallel from base to apex. It is a curious fact that many grass leaves are always twisted so as to present the under

FIG. 1.—A, node of wheat; B, the same split open; C, Indian corn, showing two-ranked leaves; D, part of a sheath of orchard-grass showing the ligule.

surface, instead of the upper, to the sunlight. In these cases the minute anatomy of the leaf shows a reversal of the normal structure, the stomata being most abundant upon the structurally upper side. A good example of this torsion is afforded by the porcupine-grasses (species of *Stipa*) of the great plains of the Western U. S., where in addition the (structurally) upper surface is longitudinally furrowed by many deep channels, thus allowing the leaf to roll its edges together (Fig. 2).

FIG. 2.—Cross-section of a rolled leaf of a porcupine-grass, *Stipa viridula*.

The roots of grasses are usually slender and fibrous. They appear freely upon the lowest nodes of the stem, and in many cases upon those of the upper portion also, when the conditions are favorable. Many grasses have an abundance of creeping underground stems, which are popularly supposed to be roots. The quack-grass (*Agropyrum repens*) furnishes a familiar example of such creeping stems.

The flowers of grasses are thought to be reduced and simplified from the lily-like forms. The ovary is probably to be regarded as composed of two carpels (possibly three in *Bambusa*), never producing more than one ovule, however. The ovule usually soon becomes grown to the ovary-walls, the whole at maturity forming the grain (*caryopsis*). The stamens are frequently three, but may be reduced to one or increased to six (or, in a few genera, to 20–30 or even 40). They are usually borne in the same flower with the pistil, but in some genera they are in separate flowers (monœcious or diœcious). Below the pistil and stamens there may be a couple of minute scales, the lodicules, which are probably the remnants of the perianth (Fig. 3). These simple flowers are normally arranged alternately in the axils of reduced leaves (floral leaves or bracts) technically known as the glumes of the inflorescence (Fig. 3). Usually the lowermost glumes have no flowers in their axils, and frequently the small upper glumes bear rudimentary flowers only. Below each flower on its axis and above and opposite to its glume there is a bract, called a *palet*, which in conjunction with the glume incloses a flower. The inflorescences consisting of the axis with its empty and flowering glumes, the palets, and the inclosed flowers constitute the *spikelet*. The arrangement of spikelets in larger clusters shows many variations. In some cases the spikelets are separate at the ends of a greatly branched stem (e. g. redtop, Kentucky blue-grass, tickle-grass, etc.), or they are on short lateral branches on both sides of the stem (e. g. wheat, barley, timothy, etc.), or on one side only (e. g. gama, cord-grass, crab-grass, etc.).

FIG. 3.—Ideal plan of grass spikelet. The axis and glumes are black, the flowers and their palets unshaded.

The most generally accepted classification of the grasses is that by Hackel, an outline of which is here given, though not a strictly natural one. He divides the family into thirteen tribes as follows:

Series A. *Spikelets, one- or two-flowered, the lower when present imperfect; falling from the pedicel entire, or together with certain joints of the axis at maturity.*

Tribe I. *Maydeæ.*—Staminate spikelets occupying the upper portion of the inflorescence, or of its divisions, the pistillate below; stem tall with pith; leaves broad and flat; starch grains of endosperm simple (Fig. 4, A). Represented by Indian corn (*Zea mays*), teosinte (*Enchlæna luxurians*), etc.

Tribe II. *Andropogoneæ.*—Spikelets in spike-like racemes, two (rarely one) at each joint of its mostly articulate axis, one sessile and one pedicellate. Spikelets generally one-flowered, with three empty glumes; stamens three, rarely two or one; starch grains simple (Fig. 4, B). The blue-stems of the plains of North America, and the sugar-cane (*Saccharum officinarum*) and sorghum (*Andropogon sorghum*, vars. *saccharatus*, *vulgaris*, and *niger* of the warmer parts of the Old World) are well-known members of this tribe.

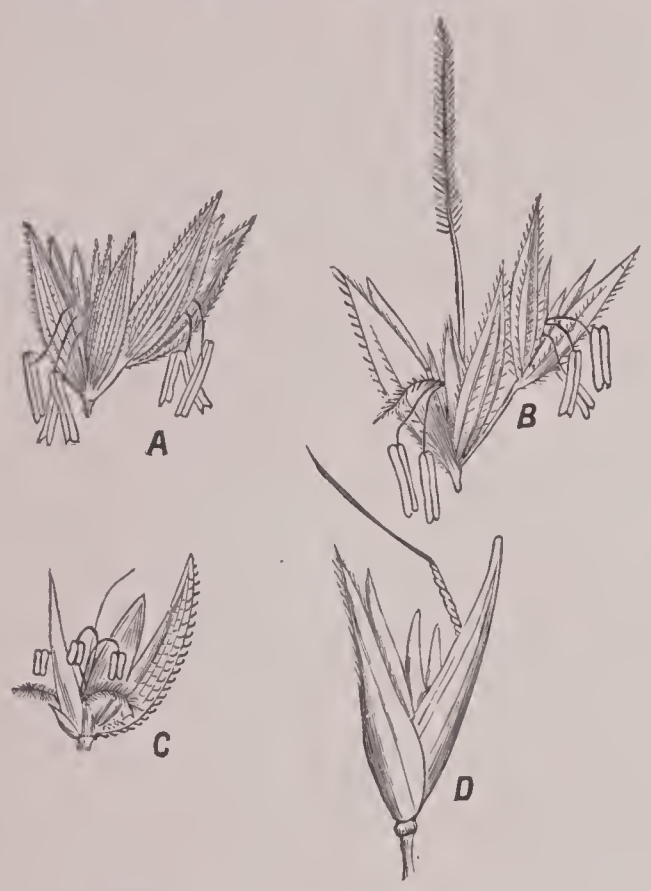



Fig. 4.—A, tribe *Maydeæ*; two staminate spikelets of Zea. B, tribe *Andropogoneæ*; two spikelets of Andropogon. C, tribe *Zoysieæ*; spikelet of Tragus. D, tribe *Tristegineæ*; spikelet of Arundinella.

Tribe III. *Zoysieæ.*—Spikelets solitary or in groups, usually one-flowered, the flowering glume always awnless, membranaceous; the empty glumes of firmer texture and frequently awned, axis continuous. Starch grains simple (Fig. 4, C). Mostly natives of hot climates. Four species of *Hilaria* and two of *Ægopogon* occur in the Southwest U. S. A species of *Tragus* is an introduced weedy grass in the Southeastern U. S.

Tribe IV. *Tristegineæ.*—Spikelets all with stamens and pistils, one- to two-flowered, in panicled racemes, whose axis is continuous. Empty glumes three, the third sometimes having the function of a flowering glume of a staminate flower (Fig. 4, C). All tropical.

Tribe V. *Paniceæ.*—Spikelets one- (or occasionally two-) flowered, the second flower staminate (very rarely perfect) in the axil of the third glume; arranged in spikes, racemes, or panicles; axis usually continuous. Flowering glume and palet of the perfect flower firmer in texture than the empty glumes, and unawned; empty glumes rarely awned; starch grains simple (Fig. 5, A). *Paspalum* (160 species, mostly tropical), *Panicum* (300 species, mostly of warm climates), *Setaria* (10 species), and *Pennisetum* (40 species, mostly of hot climates) are important as furnishing flour-producing grains in many warm countries. They also yield valuable forage for domestic animals. A few are pernicious weeds, e. g. species of *Panicum*, *Setaria*, *Cenchrus*, etc.

Tribe VI. *Oryzeæ.*—Spikelets one-flowered, perfect, or unisexual; flowers apparently terminal, and inclosed by a flowering glume and a palet. Empty glumes two or none (rarely numerous). Stamens frequently six; starch grains

Fig. 5.—A, tribe *Paniceæ*; spikelet of Panicum. B, tribe *Oryzeæ*; spikelet of Oryza.

compound (Fig. 5, B). Wild rice (*Zizania aquatica*) of the ponds of North America and Northeastern Asia, and rice (*Oryza sativa*), a native of India and now cultivated in all warm countries, are the best-known representatives.

Series B. *Spikelets one- to many-flowered, its axis generally articulated above the empty glumes, and in the one-flowered forms frequently produced beyond the flowers; the spikelets in falling away leave the empty glumes.*

Tribe VII. *Phalarideæ.*—Spikelets all fertile, one-flowered, or with one or two staminate flowers below the upper perfect one; empty glumes four (or the two inner ones acting as flowering glumes for the staminate flowers), unequal, or one rudimentary; flowering glume and palet laterally compressed, one-nerved or nerveless, awnless; stareh grains compound (Fig. 6, A). Canary grass and ribbon grass (spe-

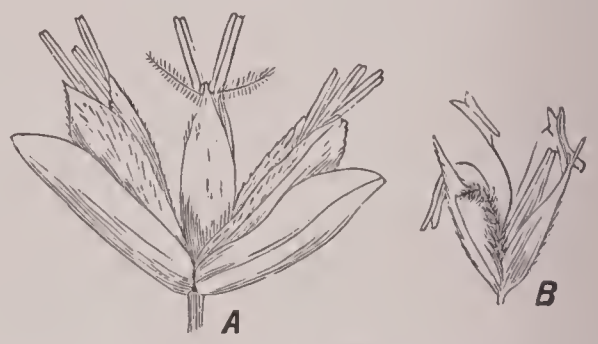



Fig. 6.—A, tribe *Phalarideæ*; three-flowered spikelet of Hierochloë. B, tribe *Agrostideæ*; spikelet of Agrostis.

cies of *Phalaris*) and vanilla-grass (*Hierochloë*) are common representatives of the tribe.

Tribe VIII. *Agrostideæ.*—Spikelets one-flowered, usually all perfect, its axis sometimes prolonged beyond the palet; empty glumes often unequal, usually as long as or longer than the flowering glume (rarely uone); palet usually two-nerved; starch grains compound (Fig. 6, B). This includes several of the most important forage grasses of the U. S., e. g. timothy (*Phleum pratense*), redtop (*Agrostis vulgaris*), meadow-foxtail (*Alopecurus pratensis*), besides many wild species of *Muhlenbergia*, *Sporobolus*, *Calamagrostis*, etc. Species of *Aristida* and *Stipa* are dangerous to sheep, the sharp-pointed fruiting glumes easily penetrating the skin.

Tribe IX. *Aveneæ.*—Spikelets two- to many-flowered, mostly arranged in panicles (rarely in spikes), the flowers all perfect, or one staminate; empty glumes usually longer than the flowering glumes, which are generally awned on the back; palet two-keeled; starch grains compound (Fig. 7, A). The cultivated oat (*Avena satira*) and the tall oat-grass (*Arrhenatherum avenaceum*), both from the Old World, belong here.

Tribe X. *Chlorideæ.*—Spikelets one- to many-flowered (arranged in two rows upon one side of the axis of a spike or raceme); palet two-nerved; starch grains compound (rarely simple) (Fig. 7, B). Among the members of this tribe are cord-grass (*Spartina*), gama (*Bouteloua*), several species of the great plains, and the famous buffalo-grass (*Bulbilis dactyloides*), onee abundant upon the great plains but now fast disappearing. Species of *Eleusine* are grown in India and Africa for their floury grains, from which bread and beer are made.

Tribe XI. *Festuceæ.*—Spikelets two- to many-flowered, rarely one-flowered, usually all perfect (arranged in panicles,

racemes, or spikes); empty glumes usually shorter than the nearest flowering glume; palet two-keeled; starch grains usually compound (Fig. 7, C). Here are many of our common wild and cultivated grasses, e. g. the ornamental pampas-grass of South America (*Gynerium argenteum*), reed-grass (*Phragmites vulgaris*), orchard-grass (*Dactylis glomerata*), Kentucky blue-grass (*Poa pratensis*), besides several other species of *Poa*, fescue-grasses (*Festuca* of several species), brome-grasses (*Bromus* of several species). In the last-named genus is chess or cheat (*B. secalinus*), a weed in wheat-fields.

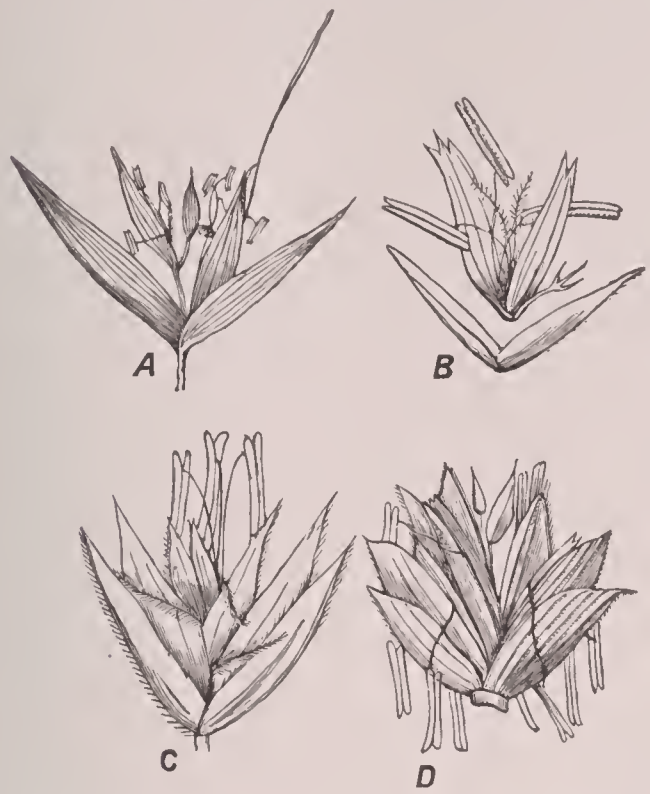



FIG. 7.—A, tribe *Aveneæ*; spikelet of Avena. B, tribe *Chlorideæ*; spikelet of Bouteloua slightly separated. C, tribe *Festuceæ*; spikelet of Dactylis. D, tribe *Hordeæ*; spikelet of Triticum.

Tribe XII. *Hordeæ*.—Spikelets one- to many-flowered (if many, the uppermost imperfect), sessile on teeth or notches of the axis of the spike (Fig. 7, D). Here are ray-grasses (species of *Lolium*), wheat-grasses (species of *Agropyrum*, including *A. repens*, the troublesome quack or couch grass), rye (*Secale cereale*), wheat (*Triticum sativum*), barley (*Hordeum sativum*), wild rye (*Elymus canadensis*), etc.

Tribe XIII. *Bambuseæ*.—Spikelets two- to eight-flowered (rarely one-flowered), mostly arranged in panicles; empty glumes two to several, increasing in size upward, shorter than the succeeding flowering glumes, which are many nerved, and usually awnless; palet. two to many nerved; stamens three to six to many (Fig. 8). Large grasses with woody stems, and leaves jointed at the summit of the sheath. The principal genus of this tribe is *Bambusa*, which includes the species of bamboo of tropical countries, some of which attain a height of 100 to 120 feet, with a diameter of 12 inches or more.

FIG. 8.—Tribe *Bambuseæ*; spikelet of Bambusa.

LITERATURE.—See Bentham, *Notes on the Gramineæ*, in the *Journal of the Linnean Society*, vol. xix. (1882); Hackel, *True Grasses* (English edition, 1890), and *Andropogoneæ* in De Candolle's *Monographiæ Phanerogamarum*, vol. vi. (1889); Kunth, *Agrostographia* (2 vols., 1833–35); Steudel, *Synopsis Plantarum Gramineārum* (1855); Trinius, *Species Graminum* (3 vols., 1828–36); Vasey's *Monograph of the Grasses of the United States and British America* (1892, unfinished); Baillon's *Monographie des Graminées*, in *Histoire des Plantes* (1893). CHARLES E. BESSEY.

**Grasshopper**: a term popularly and very loosely applied in the U. S. to all sorts of saltatorial *Orthoptera*. It is particularly used to designate the Rocky Mountain locust (*Caloptenus spretus*), which in certain years proves such a scourge in much of the country lying W. of the Mississippi. (See LOCUST.) In order properly to restrict the term "grasshopper" as it is restricted entomologically, it will be best to follow Harris, the father of popular entomology in the U. S., and briefly characterize the three principal divisions of the saltatorial *Orthoptera*, as follows: CRICKETS (*Achetidæ* of Westwood) are distinguishable from the others by invariably having the wing-covers placed horizontally on the back. They have, with few exceptions, but three joints to the tarsi or feet, and as they usually live in holes away from the light, their organs of hearing and feeling, the antennæ, are very long, while those of sight are generally small. GRASSHOPPERS (*Gryllidæ* of Westwood) may be distinguished by having four joints to the feet. The wing-covers are roofed, and slope downward at the sides of the body; they are long and wide, and those of the male are furnished at the base with a talc-like plate, which produces the usual chirrup as the wings are rubbed sharply over one another. The female is distinguished by having an exserted or saber-shaped ovipositor. Most grasshoppers are green, and their legs, though longer, are not so muscular as those of locusts. They are mostly nocturnal insects, and their antennæ are consequently long and tapering. They are also more solitary, never migrating in multitudes, like locusts. A few of the larger, tree-inhabiting species are called katydids, well-known insects peculiar to America. LOCUSTS (*Locustidæ* of Westwood) are distinguished from the above insects by having much shorter, thread-shaped antennæ, which terminate abruptly, or are sometimes even club-shaped. The feet appear on the under side five-jointed, but are in reality only three-jointed, the basal joint being long, with two impressions underneath. They nearly all agree in having straight, narrow wing-covers, lapping over and forming a ridge on the back. The female has, instead of the projecting piercer of the grasshopper, four short horny, cuneiform projections, placed in pairs, and opening and shutting opposite to each other. Their stridulation is produced by rubbing the posterior femora or thighs against the prominent nerves of the wings while resting on the fore legs. They are more robust, more muscular than grasshoppers, are essentially social and diurnal insects, and their wing-covers, being so much narrower, do not impede their passage through the air in the same degree as is the case with the grasshoppers. C. V. RILEY.

**Grassmann**, grăs'măn, HERMANN GÜNTHER: mathematician; b. at Stettin, Prussia, Apr. 15, 1809; was an instructor in Stettin 1834–52; became Professor of Mathematics in the gymnasium of Stettin 1852, succeeding his father, Justus Günther Grassmann. He published philological works of importance, but was chiefly noted for his profound treatises upon the theory of mathematics. D. at Stettin, Sept. 26, 1877.

**Grassmann's Law**: a name frequently given in treatises on comparative grammar to the phonetic law, whereby in Sanskrit and in Greek an aspirate loses by dissimilation its after-breath, when an aspirate stands at the beginning of the next syllable. It was discovered by Hermann Grassmann, and published in *Kuhn's Zeitschrift*, xii., 110–138 (1862). Examples: Germ. *bieten* : Eng. *bid* : Goth. *anabiudan*, must represent an Indo-Europ. root, *bheudh-*; this appears in Skr. as *bōdhati*, in Greek as *πεύθομαι*; Germ. *binden* : Eng. *bind* : Goth. *bindan*, represent an I.-E. *bhendh-*, which appears in Skr. *bandh*, Gr. *πενθερός*. The dissimilation took place evidently in Greek after the original voiced aspirates had become voiceless; thus **dhidhēmi* becomes first **thithēmi*, and then by dissimilation *tithēmi* (*τίθημι*); similarly **thrikhós* > *trikhos* (*τριχός*), but nomin. *thriks* (*θρίξ*) retains the initial aspirate; of the same nature is **hékhō* > *ékhō* (*ἔχω*) vs. fut. heksō (*ἕξω*). BENJ. IDE WHEELER.

**Grass-moths**: lepidopterous insects of the genus *Crambus* and family *Pyralidæ*. They are extremely abundant in the U. S. in the summer in pastures and hay-fields. *C. mutabilis* is a common species.

**Grass of Parnas'sus**: popular title of the genus *Parnassia* of smooth herbs, of the family *Saxifragaceæ*, growing mostly in cold regions of both continents. The U. S. has six species, one of which, *P. palustris*, is rare, although in Europe it is the common grass of Parnassus.

**Grass-oil**: a volatile oil extensively distilled in the East Indies from *Andropogon schœnanthus*, *A. muricatus*, *A. nardus*, *A. warancusa*, and other grasses. It is used in scenting honey soap and in adulterating oils of geranium and roses; in perfumery it is called oil of citronella and lemon-grass oil. Ceylon exports tons of this oil annually.

**Grass-trees** [so called from the long grass-like leaves], or **Black-boys**: popular name of long-lived, tree-like, liliaceous plants, somewhat resembling the yucca in habit; belonging to the genus *Xanthorrhœa*. They grow in Tasmania and Australia. There are several species, of which *X. hastilis* and *humilis* are best known. Their leaves are not stiff and sharp like the leaves of yucca, but are gathered as food for cattle. The tender base of the leaves is edible and agreeable. The tree abounds in a balsamic gum which has been used in medicine. The "grass-tree or black-boy gum" is obtainable in inexhaustible quantities, and has been recommended as a source of illuminating gas and of pieric acid.

**Grass Valley**: township in Nevada co., Cal.; on the Nevada County Narrow-gauge Railroad (for location of county, see map of California, ref. 5–D); the center of the chief gold quartz-mining district of the State, from which source it derives the principal part of its business. It has two orphan asylums, high, intermediate, and preparatory public schools, foundries, quartz-mills, etc. Grass Valley is the seat of a Roman Catholic bishop. Pop. of township (1880) 6,688; (1890) 6,798; (1900) 7,043; city (1900) 4,719.

**Grass-wrack**, called **Eel-grass** in the U. S.: the *Zostera marina*, a salt-water plant of the family *Naiadaceæ*, growing in coves and sea-ditches, always under water. It grows in both the Old World and the New, and is used to weave into the coverings of flasks, as a material for stuffing mattresses and cushions, and as packing for glass and queensware. In the U. S. it is gathered like seaweed, chiefly as a manure.

**Gra'tian**, or **Gratia'nus**, Franciscus: founder of the science of canon law; b. at Chiusi, Italy, in the eleventh century; entered the convent of Classe, near Ravenna, whence he removed to that of St. Felix de Bologna. Here he wrote his *Decretum*, and sent it to the pope, Alexander III., who in reward appointed him Bishop of Chiusi. The *Decretum* is a complete and systematized collection of all the canons issued by the popes and councils. It is divided into three parts: (1) *De Ministeriis*, subdivided into 101 *distinctiones*; (2) *De Negotiis*, subdivided into 36 *causæ*; (3) *De Sacramentis*, subdivided into 5 *distinctiones*. There existed earlier collections of this kind, but they were vastly inferior to that made by Gratian, and the science of canon law was not taught in the theological schools until after the publication of the *Decretum*. As Gratian never doubted the authority of the False Decretals, and as his collection was used and referred to for more than three centuries without comment or reservation, it contributed very much to the establishment of the doctrine of the pope's authority as above the canon law, absolute and unrestrained; of the exemption of the clergy from the secular jurisdiction, etc. In 1580, under Pope Gregory XIII., a critically revised and corrected edition of the *Decretum* was published in Rome, forming the first part of the whole *Corpus Juris Canonici*.

**Gratian**, Gratianus Augustus: Roman emperor; son of Valentinian I.; b. 359 A. D.; succeeded his father in 375 as Emperor of the West, his uncle Valens reigning in the East until 378; succeeded Valens in that year, but gave the dominion of the East to Theodosius I. He was a zealous supporter of the Church, and persecuted with equal zeal pagans and heretics of the Christian confession. His wars against the barbarians were measurably successful. He was murdered in 383 A. D. by Andragathius, a follower of Maximus, who succeeded him as emperor.

**Gratio'la** [Mod. Lat., deriv. of Lat. *gra'tia*, grace, in reference to its supposed healing properties]: a genus of herbs of the order *Scrophulariaceæ*. The U. S. have numerous species, none of them important. The hedge-hyssop (*G. officinalis*) of Europe and some South American species have been used in medicine.

**Gratiot**, Charles: soldier; b. in Missouri in 1788; graduated at the U. S. Military Academy in 1806, and entered the army as second lieutenant of engineers; promoted to be captain in 1808, major 1815, lieutenant-colonel 1819, and colonel and chief engineer U. S. army (brevet brigadier-general) 1828. During the war with Great Britain (1812–15) he served with distinction as chief engineer of the army in the Northwest; subsequently in the construction of fortifications to 1838, when placed in command of the corps of engineers, which position he held till Dec., 1838, when he was dismissed by the President for having failed to pay into the treasury certain balances of money placed in his hands for public purposes. In 1852 he appealed to the U. S. Senate for an expression of opinion as to the legality of his dismissal, and the committee on the judiciary, although deeming such expression inconsistent with their duty, reported that his pleas deserved attention. The case of Gen. Gratiot was never reopened, and after holding a clerkship in the land office at Washington from 1840 to 1855, he went to St. Louis, Mo., where he died in destitute circumstances May 18, 1855.

**Gratry**, grăă'trĕĕ', Auguste Joseph Alphonse: author; b. at Lille, France, Mar. 30, 1805; studied at the École Polytechnique; became in 1841 director of the Collège Sainte-Barbe, Paris; almoner of the higher normal school 1846–51; was one of the reorganizers of the Oratory of the Immaculate Conception, and became an instructor of youth; vicar-general of the diocese of Orleans 1861; Professor of Moral Theology in the Sorbonne 1863; was chosen to the French Academy 1867; left the Oratory 1869. Author of *La Connaissance de Dieu*, opposing Positivism (1855, and often reprinted); *Logique* (1856); *Paix: méditations historiques et religieuses* (1862); *Les Sources, conseils pour la conduite de l'esprit* (1861–62); *Philosophie du Credo* (1861); *Commentaries* on St. Matthew (1863); *Jésus Christ* (addressed to Renan, 1864); *Les sophistes et la critique* (1864); *La morale et la loi de l'histoire* (setting forth his social views, 1868); and other works. Shortly before his death he accepted the definitions of the Vatican Council, which he had hitherto opposed. D. at Montreux, Switzerland, Feb. 6, 1872.

**Grattan**, Henry: patriot and orator; b. in Dublin, Ireland, July 3, 1746; son of the recorder of the city, a Protestant, and grandson of Thomas Marlay, chief justice of Ireland; graduated at Trinity College in 1767; studied at the Middle Temple, London, and was admitted to the Irish bar in 1772; was a member of the Irish Parliament in 1775 from Charlton, and almost from the first was the leader of the opposition; brought forward in 1780 resolutions to the effect that "the king, with the consent of the Parliament of Ireland, was alone competent to enact laws to bind Ireland"; and in 1782 moved a declaration of rights, asserting Ireland's right to self-government in a memorable speech, the effect of which was to secure the unanimous passage of resolutions pledging the British Parliament to a redress of grievances. For his services as a patriot he was presented with a valuable estate by the Irish Parliament. He was returned in 1790 from Dublin; opposed alike the rebellious schemes of the United Irishmen and the union with Great Britain; entered the imperial Parliament in 1805; advocated Catholic emancipation with great zeal, and wore himself out with labors in behalf of Ireland. D. in London, June 14, 1820. Personally, Grattan was small and of unprepossessing appearance; his character was pure and noble. See his *Speeches* and *Miscellaneous Works*, both edited by his son (1824); the *Life* by his son (5 vols., 1839–46); and *Henry Grattan* in Statesman Series (1889).

**Grattan**, Thomas Colley: novelist and historian; b. in Dublin, Ireland, in 1796. He spent much time on the Continent, and from 1839 to 1853 was British consul at Boston, Mass. Among his novels, which are mainly historical, are *Philibert* (1819) and *The Heiress of Bruges* (1830). He wrote also a *History of the Netherlands*, a pamphlet on the northeast boundary question (1842), and *England and the Disrupted States of America* (1861). D. in 1864. H. A. B.

**Grat'ius Falis'cus**: a Roman poet of whom nothing is known but the three following circumstances: he was a contemporary of Vergil (see Ovid, *Epistles from Pontus IV.*, 16, 33); he wrote a poem upon the chase entitled *Cynegetica*, probably in several books; and this poem was so entirely forgotten at the time of Numerianus (283 A. D.) that Nemesianus, writing on the same subject, could assert that he entered on a hitherto untrodden path. Of the poem 540 hexameters have come down through one single MS., discovered in France in the beginning of the sixteenth century, printed in Venice in 1534, translated into English verse by Christopher Wase in 1654, and into German verse by Perlet in 1826. See Baehren's *Poetæ Latini Minores*, vol. i., pp. 31–53 (Leipzig, 1879). Revised by M. Warren.

**Gratz**, grăătz (Servian *Gratsa*, a little castle; the word is often written Grätz, but in 1843 the form Gratz was officially determined on as the nearer representative of local pronunciation): city of Austria, and capital of Styria; situated on both sides of the Mur at an elevation of 1,047 feet above the level of the sea, and forming the principal station on the route from Vienna to Trieste (see map of Austria-Hungary, ref. 6–E). It is an old town, with narrow and

crooked streets, but its surroundings are very picturesque, and it contains many interesting buildings. The Cathedral of St. Agidi was built in 1462; the Church of St. Leonhard in 1283; the mausoleum of Ferdinand II. in 1615. The old ducal palace is a structure of great interest. Gratz has a university and many other good educational institutions. Its manufactures of steel and iron wares and saltpeter are large, and its trade very extensive. Pop. (1890) 113,540.

**Grau**, grow, MAURICE: See the Appendix.

**Grau**, RUDOLF FRIEDRICH, D. D.: theologian; b. at Heringen-on-the-Werra, Hesse, Apr. 20, 1835; studied at Leipzig, Erlangen, and Marburg; became professor extraordinary at Königsberg 1865; and ordinary professor there 1866; one of the editors of the apologetical journal *Beweis des Glaubens*; has published much on apologetical themes, and contributed the treatise on New Testament theology to Zöckler's *Handbook of the Theological Sciences* (Nördlingen, 1883). His *Ursprünge und Ziele unserer Kulturentwickelung* (Gütersloh, 1875) was translated under the title *Goal of the Human Race* (London, 1892). D. Aug. 7, 1893.

**Graubünden**: a Swiss canton. See GRISONS.

**Graudenz**, grow'dens: town of Prussia; in the province of West Prussia; on the right bank of the Vistula; 37 miles N. of Thorn (see map of German Empire, ref. 2–J). It has manufactures of cotton and wool, and close by lies the fortress of Graudenz, constructed by Frederick II., and commanding the course of the Vistula. Pop. (1890) 20,393.

**Graul**, growl, KARL: religious propagandist; b. at Wörlitz, in Anhalt-Dessau, Feb. 6, 1814. He studied theology at Leipzig, published in 1843 a translation of Dante's *Inferno* with theological explanations, and was in 1844 appointed director of the missionary society of Dresden, which he removed in 1848 to Leipzig in order to give the students the benefit of the university, and from which he retired in 1860 on account of failing health. He concentrated the whole energy of the society on the conversion of the Tamils, a nation of Southern India, numbering about 12,000,000 souls. He visited the country (1849–54), and published a description of his journey (5 vols., Leipzig, 1853–55). He wrote a Tamil grammar, and published a *Bibliotheca Tamulica* (3 vols., Leipzig, 1854–56), containing some of the principal monuments of Tamil literature with translations, partly German, partly English. In defense of his view that the Christian missionary ought to respect the divisions of caste, he wrote an English pamphlet at Madras (1852) and a German at Leipzig (1862). Among his other works are *Unterscheidungslehren der verschiedenen christlichen Bekenntnisse* (Leipzig, 1845; 11th ed. 1884): *Indische Sinnpflanzen* (1864), etc. D. at Erlangen, Nov. 10, 1864. See his biography by G. Herrmann (Halle, 1867).

**Grave Creek**, West Va.: See MOUNDSVILLE.

**Gravel**: See CALCULUS.

**Gravel**: See SAND.

**Gravelines**, grăav'leen': fortified town of France; in the department of Nord, on the Aa, where it falls into the English Channel (see map of France, ref. 1–F). It is most famous from the battle in 1558 in which the Spanish under Count Egmont defeated the French under Marshal de Thermes. Pop. (1896) 5,907.

**Gravelotte**, grăav'lot', **Battle of**, also called the BATTLE OF REZONVILLE, or, by the French, the BATTLE OF ST.-PRIVAT; the greatest and bloodiest battle of the Franco-German war of 1870–71. By the battle of Vionville (Aug. 16) the French army was prevented from marching to Verdun, and Bazaine concentrated his forces nearer Metz, and occupied, with his front facing W., a favorable defensive position, marked by the points of St.-Privat, Amanvillers, Verneville, and Rozerieulles. On the morning of the 18th the Germans were still in doubt whether the French would march toward the N. or whether they would keep their ground. An attack was expected on the day before, but none took place. King William then ordered that the whole army should make a great circuitous movement to the right, so that the left wing would fall in with the French if they tried to march off, while the right wing and the center kept them where they were. Soon reports came from the outposts that the French had not marched away, but were before Metz; and at 10 o'clock orders were given that the army corps as they came in should wheel round to the right, against the French front. The center of the French army was first attacked, the Ninth Corps planting its batteries at noon on the hill of Verneville, and opening a violent fire on the French batteries at Ste.-Marie, St.-Privat, and Amanvillers. But it was 7 P. M. when St.-Privat was taken, and it was completely dark when the battle was finally decided by the failure of the attempt at breaking through the German lines at Gravelotte; the French army was shut up in Metz, and could not escape. The Germans, numbering 211,000, lost about 900 officers and 19,000 men; the French, numbering 140,000, lost between 12,000 and 13,000 officers and men.

**Gravesande**: See 'S GRAVESANDE.

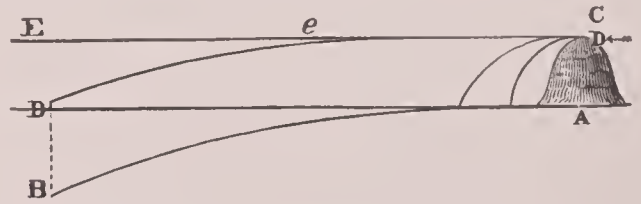
**Gravesend**: town of England; in the county of Kent; on the right bank of the Thames; 24 miles below London, to whose inhabitants it affords a pleasant holiday resort, on account of its fresh air and beautiful scenery (see map of England, ref. 12–K). It contains a town-hall, parish church, Milton parish church, built during the reign of Edward II., custom-house, etc. It has a considerable import trade in coal and timber, and carries on extensive fisheries, especially of shrimps. The municipal borough includes the parishes of Gravesend and Milton. Fruit and vegetables are extensively raised in the vicinity for the London market. Pop. (1891) 24,067.

**Graves's Disease**: See BASEDOW'S DISEASE.

**Graving-docks**: See DOCKS.

**Gravitation** [from Mod. Lat. deriv. of *gravita're*, gravitate, deriv. of Lat. *gra'vitas*, heaviness, deriv. of *gravis*, heavy]: in its widest sense, the tendency which all bodies exhibit to approach each other with a force directly as their masses, and inversely proportional to the square of the distance between them. Two misapprehensions respecting this force are so widely prevalent, even among men of intelligence, that it is worth while to present such a view of the subject as shall remove them. They are (1) that gravitation was first discovered by Sir Isaac Newton; and (2) that it is simply a theory to account for the celestial motions, which may be hereafter disproved and superseded by some other theory. Neither of these views is strictly correct. That bodies in general tend to fall toward the earth is known to all even from earliest infancy; and as this tendency is gravitation, gravitation has been known to all men in all times. What Newton did was to show that the same force which causes a stone to fall extends to the moon and holds her in her orbit, and is only a special case of a force which extends through the entire solar system. He showed that the planets tend to fall toward the sun, the satellites toward the planets, and the moon toward the earth, according to the same law by which an apple falls to the ground.

To the mathematician the passage from the gravitation of an apple to that of the moon is quite simple and easy,




but the non-mathematical reader may not at first sight see how the moon can be constantly falling toward the earth without ever coming any nearer. The following illustration will make the matter clear. Any one can understand the law of falling bodies, by which a body falls 16 feet the first second, three times that distance the next, five times the third second, and so on. If, in place of falling, the body is projected horizontally—like a cannon-ball, for example—it will fall 16 feet out of the straight line in which it is projected during the first second, three times that distance the next, and so on, the same as if dropped from a state of rest. In the annexed figure let A B represent a portion of the curved surface of the earth, and A D a straight line, horizontal at A, or the line along which an observer at A would sight if he set a small telescope in a horizontal position. Then, owing to the curvature of the earth, the surface will fall away from this line of sight at the rate of about 8 inches in the first mile, 24 inches more in the second mile, and so on. In 5 miles the fall will amount to 16 feet, in 10 miles, in addition to this 16 feet, three times that distance will be added, and so on, the law for these short distances being nearly the same with that of a falling body. Now, let A C be a high steep mountain from the summit of which a cannon-ball is fired in the horizontal direction

C E. The greater the velocity with which the shot is fired, the farther it will go before it reaches the ground. Suppose at length that we should fire it with a velocity of 5 miles a second, and that it should meet with no resistance from the air. Suppose *e* to be the point on the line 5 miles from C. Since it would reach this point in one second, it follows from the law of falling bodies just cited that it will have dropped 16 feet below *e*. But we have just seen that the earth itself curves away 16 feet at this distance. Hence the shot is no nearer the earth than when it was fired. During the next second, while the ball would go to E, it would fall 48 feet more, or 64 feet in all. But here, again, the earth has still been rounding off, so the distance D B is 64 feet. Hence the ball is still no nearer the earth than when it was fired, although it has been dropping away from the line in which it was fired exactly like a falling body. Moreover, meeting with no resistance, it is going on with undiminished velocity. And just as it has been falling for two seconds without getting any nearer the earth, so it can get no nearer in the third second, nor the fourth, nor any subsequent second; but the earth will constantly curve away as fast as the ball can drop. Thus the latter will pass clear round the earth, and come back to the point C from which it started, in the direction of the arrow, without any loss of velocity. The time of revolution will be about an hour and twenty-four minutes, and the ball will thus keep on revolving round the earth in this space of time. In other words, the ball will be a satellite of the earth, just like the moon, only much nearer and revolving much faster.

The ball just described is deflected from a straight line 16 feet in a second. The way in which Newton proceeded to find whether the moon was held in its orbit by the gravitation of the earth was to calculate the amount by which the moon was deflected from a straight line every second, and compare this with the gravitation of the earth. It was already known from observations of the moon's parallax that her mean distance was almost exactly 30 diameters of the earth. But the diameter of the earth itself was not known with any accuracy, and the value first used by him was one-eighth too small. The consequence was that the distance of the moon he used in his calculations was also too small, and the result did not agree with the theory of gravitation, diminishing in the inverse square of the distance. But a few years later a new determination of the magnitude of the earth was made by the French geodesists, which enabled Newton to repeat his calculation with exact data. He found that the moon actually dropped $\frac{1}{19}$th of an inch in a second, or $\frac{1}{3600}$th as far as a stone at the earth's surface. The number 3,600 being the square of 60, the distance of the moon in radii of the earth, he was enabled to announce that the force which held the moon in her orbit was the same which made the stone fall, only diminished in the ratio of the square of the moon's distance.

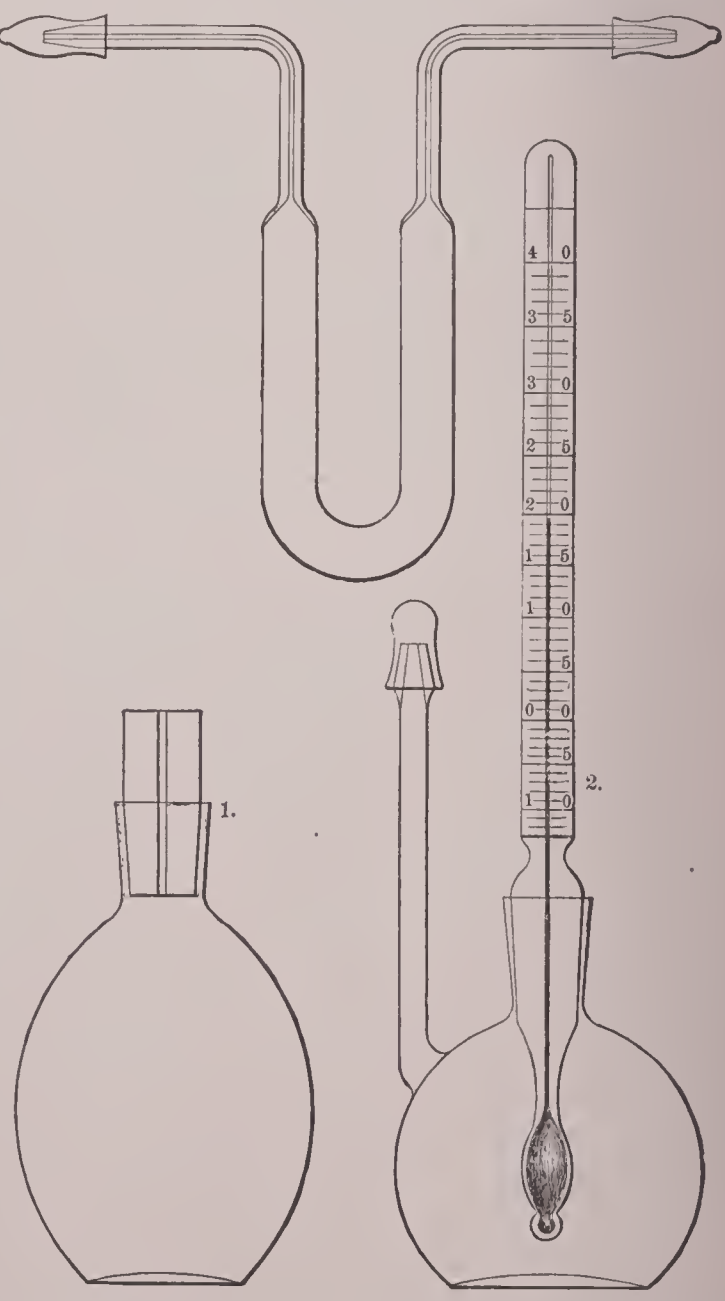
The next step in the demonstration was to show that the planets were held in their orbits by a force directed toward the sun, and inversely as the square of the distance from it. This demonstration was one great object of the *Principia*, and the data from which Newton set out were the laws of Kepler. From the law that equal areas were described around the sun in equal times it was easy to show that the force in question must be directed toward the sun; and from the relation between the distances of the planets and their times of revolution, the law of a force proportioned to the inverse square of the distance followed by a very simple demonstration. It remained to prove that the same law held true for the different distances of one and the same planet from the sun; in other words, that a planet revolving around the sun under the influence of gravitation would describe an ellipse having the sun in its focus. This demonstration occupied the attention of other mathematicians, as well as of Newton, but the latter first succeeded in it, and in doing so completed the theory of the gravitation of the planets toward the sun.

The next step was to apply to the moon the combined gravitation of the sun and earth. It was known that this body in its movement showed deviations from Kepler's laws, and Newton succeeded in showing that most of these deviations could be traced to the attractive force of the sun. But his mathematics were insufficient to enable him to calculate all the inequalities, or to give the exact values of those which he did calculate. Nevertheless, his success was sufficient to justify the enunciation of the greatest law of nature ever discovered: *Every body in nature attracts every other body with a force directly as its mass, and inversely as the square of its distance.* If this law is true in all its generality, then each planet must be attracted by every other planet, as well as by the sun, and its motion must be slightly altered by these attractions. To compute the effect of these attractions is a problem which has occupied the attention of most of the great mathematicians since Newton, and the result has been that the most complicated motions of the heavenly bodies can be predicted years in advance with a degree of accuracy limited only by the mathematician's power of calculating and the practical astronomer's power of observing.

Nor has the demonstration of gravitation been limited to the sun, moon, and planets. In 1772 Maskelyne determined the attraction of a mountain, and this attraction is now shown whenever accurate observations for latitude and longitude are made in the neighborhood of great mountain-chains. Not only so, but Cavendish and Bailly succeeded in measuring the attraction of balls of lead upon very delicately balanced weights, and thus found the mean density of the earth to be about six times that of water. Passing from the smallest things to the greatest, Herschel found that many double stars revolve around each other, and by carefully observing those motions his successors have found that these also attract each other according to the law of gravitation. The gravitation of widely distant stars has not yet been seen, but the distances of these bodies from the earth and from each other are so immense that thousands and perhaps millions of years would be required before any motion due to gravitation could be perceived. One is justified in considering the gravitation of bodies a universal law of nature, governing the action of the smallest masses of matter as well as the suns and planets. S. Newcomb.

**Gravity, Force of**: See the Appendix.

**Gravity, Specific** [*gravity* is from Lat. *gra'vitas*, heaviness, weight, deriv. of *gra'vis*, heavy]: a term (abb. sp. gr.)




used to denote the relative density of a substance. Densities of solids and liquids are compared with water at 4° C.

as a standard; gases sometimes with water at that temperature, sometimes with atmospheric air, sometimes with hydrogen.

In the case of solids, densities are determined (*a*) by weighing a known volume (method of the specific-gravity flask); (*b*) by weighing in air and water (method based upon the principle of Archimedes). In the case of liquids a third method may be added to these, viz., (*c*) method of the hydrometer. One form of hydrometer (that of Nicholson) is used in measuring the density of solids as well as of liquids, but the operation comes under class (*b*).

The specific-gravity flask (Fig. 1) is a bottle of convenient size and form, the glass stopper of which is very carefully adjusted by grinding, so that the contents of the flask will always be the same (at a given temperature) when the stopper is in place. To facilitate the complete filling of the flask with the liquid to be weighed, to the exclusion of the air-bubbles, the stopper usually contains a vertical capillary opening which allows such gas as may be trapped when the flask is stopped, and also all excess of liquid, to escape. To simplify numerical operations it is customary to construct specific-gravity flasks of such sizes that they will contain 25$^{cc}$, 50$^{cc}$, 100$^{cc}$, etc., at some selected temperature (usually 15° C.). In determinations of high precision, however, it is necessary to make a special calibration of the flask, at the temperature at which it is to be used, and to ascertain its coefficient of expansion. In some flasks the stopper consists of a short thermometer, the bulb of which is within, near the center of the contained liquid. This device, which is due to Schmeisser, greatly facilitates knowledge of the temperature at which the filling of the flask occurs.*

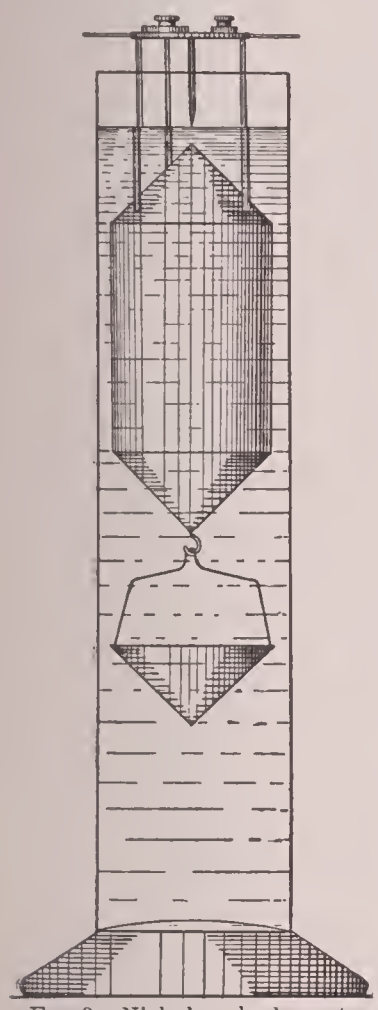


Fig. 3.—Nicholson hydrometer.

For very volatile liquids special forms of the specific-gravity flask are used. One such form is shown in Fig. 2, the essential features of which are a stopper which is air-tight and a capillary neck with a mark to indicate the height to which the flask is to be filled. For gases, the method of weighing in flasks is also used, but with such modifications as the nature of the material to be tested necessitates. In measuring the density of gases and vapors, pressure as well as temperature must be carefully observed, and various corrections and precautions, which in density determinations of solids and liquids may be neglected, become important. In the method of weighing in air and water (*b*) the ordinary analytical balance is commonly used. There are, however, a number of special devices intended to simplify the manipulation, and others, like the Jolly balance and the Nicholson hydrometer (Fig. 3), that are designed to afford convenient, cheap, and portable substitutes for the balance. The method in all of these cases depends upon the fact that the apparent loss of weight when a body is submerged equals the weight of the liquid displaced (principle of Archimedes). It follows, then, that $\frac{\text{weight in air}}{\text{loss of weight in water}}$ = relative density. In the case of solids, structural differences produce very considerable variations of density. Liquids of definite composition and gases, on the other hand, possess densities which may be regarded as true constants. In the following table are given the usual limits between which the densities of a few well-known solids are found. The accepted values for liquids and for certain gases are likewise indicated.

* John Godfrey Schmeisser, *Phil. Transactions*, vol. lxxxiii. (1793) p. 317.



### Table of Densities.

[Excepting where otherwise specified, densities are taken at 0° C., water at 4° C. being the standard.]

*I. Solids (certain Elements).*

| | | | |
|---|---|---|---|
| Aluminium | 2·56– 2·75 | Iridium | 22·42 |
| Antimony | 6·71– 6·86 | Lead | 11·34–11·41 |
| Boron | 2·5 – 2·7 | Manganese | 7·1 – 8·0 |
| Cadmium | 8·55– 8·67 | Nickel | 8·28– 9·2 |
| Carbon (charcoal) | 1·45+1·7 | Osmium | 22·48 |
| Carbon (graphite) | 2·17– 2·33 | Palladium | 10·9 –12·1 |
| Carbon (diamond) | 3·49– 3·53 | Phosphorus | 1·83– 2·34 |
| Chromium | 5·9 – 7·0 | Platinum | 20·9 –21·7 |
| Cobalt | 8·7 – 9·1 | Selenium | 4·2 – 4·8 |
| Copper | 8·8 – 8·96 | Silver | 10·4 –10·6 |
| Gold | 18·6 –19·4 | Sulphur | 1·92– 2·06 |
| Iron (cast) | 7·0 – 7·7 | Tellurium | 5·9 – 6·4. |
| Iron (steel) | 7·6 – 7·8 | Tin | 7·3 |
| Iron (wrought) | 7·8 – 7·85 | Zinc | 7·2 |

*II. Solids (Seasoned Woods).*

| | | | |
|---|---|---|---|
| Apple | 0·66–0·84 | Lignum-vitæ | 1·33 |
| Beech | 0·66–0·83 | Linden | 0·32–0·59 |
| Birch | 0·51–0·77 | Mahogany | 0·88–1·06 |
| Boxwood | 1·28–1·33 | Oak | 0·69–1·03 |
| Cedar | 0·55–0·56 | Pine | 0·34–0·60 |
| Ebony | 1·19–1·23 | Poplar | 0·34–0·52 |
| Horse-chestnut | 0·52–0·63 | Spruce | 0·35–0·60 |
| Larch | 0·44–0·80 | Walnut | 0·64–0·70 |

*III. Solids (Miscellaneous).*

| | | | |
|---|---|---|---|
| Agate | 2·59 | Granite | 2·5 –3·1 |
| Alabaster | 2·7 | Gutta-percha | 0·97 |
| Asbestos | 2·1 –2·8 | Lime (quick) | 2·3 –2·8 |
| Asphalt | 1·12 | Mica | 2·65–3·15 |
| Brass | 8·2 –8·7 | Porcelain | 2·2 –2·5 |
| Bronze | 8·7 –8·9 | Quartz | 2·65 |
| Fluorspar | 3·15 | Rock-salt (NaCl) | 2·28 |
| German silver | 8·3 –8·4 | Sugar (cane) | 1·61 |
| Glass | 2·46–3·9 | | |

*IV. Liquids.*

| | | | |
|---|---|---|---|
| Alcohol (absolute) | 0·8062 | Oil (olive) | 0·92 |
| Benzol | 0·890 | Petroleum | 0·78–0·88 |
| Carbon disulphide | 1·27 | Turpentine | 0·97 |
| Ether (æthyl) | 0·74 | Water (distilled) | 0·99987 |
| Glycerin | 1·26 | Water (sea) | 1·02 |
| Mercury | 13·595 | Ice (at −1°) | 0·918 |
| Oil (linseed) | 0·94 | Ice (at −20°) | 0·920 |

*V. Gases and Vapors at 760 mm. Pressure.*

| | Water at 4° C. = 1·000000. | Air at 0° C. and 760 mm. = 1. |
|---|---|---|
| Ammonia | 0·000762 | 0·5889 |
| Bromine | 0·006870 | 5.3933 |
| Chlorine | 0·003180 | 2·4480 |
| Marsh-gas ($C.H_4$) | 0·000719 | 0·5560 |
| Iodine | 0·011271 | 8·7160 |
| Carbon monoxide (CO) | 0·001251 | 0·9670 |
| Carbon dioxide ($CO_2$) | 0·001977 | 1·5290 |
| Oxygen | 0·001430 | 1·1056 |
| Sulphur dioxide ($SO_2$) | 0·002869 | 2·2340 |
| Nitrogen | 0·001256 | 0·9714 |
| Hydrogen | 0·000090 | 0·0693 |
| Air | 0·001293 | 1·0000 |

E. L. Nichols.

**Grawitz**, Paul Albrecht, M. D.: pathologist and anatomist; b. at Zerrin, in Pomerania, Oct. 1, 1850; educated at Universities of Halle and Berlin; assistant in Virchow's pathological institute, Berlin, 1875–86; Professor of Pathological Anatomy and General Pathology and director of the pathological institute, University of Greifswald, since 1887. Author of pathological papers in Virchow's *Archiv* and of *Atlas der pathologischen Gewebelehre* (Berlin, 1893).

C. H. T.

**Gray**, grā: town of France; in the department of Haute-Saône; on the Saône; 25 miles N. W. of Besançon (see map of France, ref. 5–H). It has a brisk trade in corn, wine, and fruits. Ship-building and iron-making are the principal industries. Pop. (1896) 6,816.

**Gray**, Asa, M. D., LL. D.: botanist; b. at Paris, Oneida co., N. Y., Nov. 18, 1810; received in 1831 his medical degree at the Fairfield College of Physicians and Surgeons, Herkimer co., N. Y.; studied botany with Prof. Torrey, of

New York; was appointed in 1834 botanist to the Wilkes expedition, but declined the post; became in 1842 Fisher Professor of Natural History in Harvard University, from the more active duties of which position he retired in 1873. He was chosen in 1874 a regent of the Smithsonian Institution. Dr. Gray was recognized throughout the scientific world as one of the ablest and most philosophic of botanists. Among his numerous writings are *Elements of Botany* (1836); *Manual of Botany* (1848); the unfinished *Flora of North America*, by himself and Dr. Torrey, the publication of which was begun in 1838; *Genera Boreali-Americana*, also incomplete (1848); *Botany of the United States Pacific Exploring Expedition* (1854); numerous important and elaborate papers on the botany of the West and Southwest, published in the *Smithsonian Contributions*, *Memoirs*, etc., of the American Academy of Arts and Sciences, of which he was for ten years president, and in various Government reports; also *How Plants Grow*, *Lessons in Botany*, *Structural and Systematic Botany*, and other works, forming a series of admirable text-books. In 1861 appeared his *Free Examination of Darwin's Treatise*; in 1877, his *Darwiniana*. He was a frequent contributor to *The American Journal of Science and Arts* and other scientific journals. Elected member of Institute of France, Academy of Sciences, July 29, 1878. D. at Cambridge, Mass., Jan. 30, 1888.

**Gray**, David: poet; b. at Merkland, a small village on the Luggie, about 8 miles from Glasgow, Scotland, Jan. 29, 1838; was the son of a poor handloom-weaver, but succeeded in studying at the University of Glasgow, and went in 1860 to London to seek some literary employment. In that he failed. He was attacked by consumption, returned home to Merkland, and died Dec. 3, 1861. His *The Luggie and other Poems*, with an introduction by Monckton Milnes and a memoir by James Hedderwick, was published in 1862 and again in 1874.

**Gray**, Henry Peters: genre and portrait painter; b. in New York, June 23, 1819. Pupil of Daniel Huntington; National Academician 1842, and president 1869–71. His *Wages of War* is in the Metropolitan Museum, New York; *Cupid Begging his Arrow* in the Pennsylvania Academy, Philadelphia; *Judgment of Paris* in the Corcoran Gallery, Washington. D. in New York, Nov. 12, 1877. W. A. C.

**Gray**, Horace: jurist; b. in Boston, Mass., 1829; graduated at Harvard in 1845, and afterward at Harvard Law School; admitted to the bar in Boston 1851; in 1854 was appointed reporter of the supreme judicial court of Massachusetts, where he served seven years; Aug. 23, 1864, became associate justice of that court, and its chief justice Sept. 5, 1873; was confirmed as associate justice U. S. Supreme Court Dec. 20, 1881.

**Gray**, Isaac Pusey: politician; b. in Chester co., Pa., Oct. 18, 1828; received a common-school education; early began the study of law; spent a number of years successfully in mercantile pursuits; and in 1855 settled at Union City, Ind. In the civil war he was colonel of the Fourth Indiana Cavalry, and recruited the 147th Indiana Infantry. In early life he was first a Whig, then a Republican, but since 1871 has acted with the Democracy. In 1868 he was elected to the State Senate, and served four years; in 1872 was delegate to the Liberal Republican convention; in 1876 was elected Lieutenant-Governor on the Democratic ticket; in 1884 elected Governor. Appointed U. S. minister to Mexico 1892. D. in Mexico city, Feb. 14, 1895.

**Gray**, John Edward, Ph. D., F. R. S.: the son of S. F. Gray, a savant and author; b. at Walsall, England, in 1800; educated as a physician. From 1824 to 1874 he was prominently connected with the British Museum; was one of the most laborious of naturalists, a member of many learned societies, and the author of hundreds of scientific papers and of many valuable catalogues. He published zoölogical reports of the expeditions of the Erebus, Terror, Sulphur, and other historic British exploring ships; edited Turton's *Manual of Land and Fresh-water Shells*; wrote *Illustrations of Indian Zoölogy*, etc. D. in London, Mar. 7, 1875.

**Gray**, John Perdue, M. D.: alienist; b. in Half Moon, Pa., in 1825; graduated in medicine at the University of Pennsylvania in 1848; was immediately appointed resident physician at the Philadelphia Hospital; and from 1853 till his death, in Utica, N. Y., Nov. 29, 1886, he was superintendent of the New York State Asylum for Lunatics. His services were much sought for the treatment of severe cases of insanity and for expert testimony in legal proceedings.

**Gray**, Thomas: poet; b. in Cornhill, London, Dec. 26, 1716, the son of a scrivener of brutal temper and habits; educated at Eton and the Peterhouse, Cambridge; traveled in Italy and France (1739–41) with Horace Walpole; took his legal degree at Cambridge 1742, and afterward lived at the university, in which he was appointed Professor of Modern History in 1768, but never actively engaged in the duties of that position. Gray's fame rests almost entirely upon his *Elegy Written in a Country Churchyard* (1749), which has given him a high position in English literature. He was a man of accurate and refined tastes, retiring and sensitive, fond of learning, art, and philosophic studies, almost effeminate in manners, and his health was always delicate. His published *Letters* are admirable in style and matter, and his Latin verse is good. The *Ode on a Distant Prospect of Eton College* (1747), *Progress of Poesy*, and the *Hymn to Adversity* (1742) are noteworthy among his other poems. D. at Cambridge, July 24, 1771.

**Grayback**: See Knot.

**Gray Friars**: See Franciscans.

**Grayling** [dimin. of *gray*]: popular name of a genus of fishes (*Thymallus*) of the family *Salmonidæ*, resembling the trout in habits and character. It is one of the best of the

Michigan grayling.

game-fishes. The *T. thymallus* is the common grayling of Europe. It is in great request for the table. The *T. ontariensis* is found in some streams of Michigan and in the head-waters of the Yellowstone. Its peculiarly delicate flesh, its fastidious voracity, and the mixture of strength and spirited courage with which it endeavors to free itself from the hook, form a combination of excellences rarely met with in any individual fish. It is closely related to *T. signifer*, a showy inhabitant of the far northern waters of British America. There are other species, chiefly European and Asiatic.

**Gray Powders**: See Mercury, Medicinal Uses of.

**Gray's Peak**: in the Rocky Mountains, in Summit and Clear Creek cos., Col.; 12 miles W. of Georgetown. It is 14,341 feet in height, and was named in honor of Dr. Asa Gray.

**Grayville**: city; White co., Ill. (for location of county, see map of Illinois, ref. 10–F); on the Wabash river and the Clev., Cin., Chi., and St. L., and the Peoria, Dec. and Evansville Rys.; 35 miles N. W. of Evansville, Ind. It is in a rich grain region, has valuable coal deposits near by, and is an important market for hard-wood lumber. It has 2 banks and 2 weekly newspapers. Pop. (1880) 1,533; (1890) 1,999; (1900) 1,948.

**Grazalema**, grăă-thăă-lā'măă: town of Spain, in the province of Cadiz; 53 miles E. N. E. of Cadiz (see map of Spain, ref. 20–D). It is peculiarly situated behind Sierra de Ronda and Cerro de St. Christoval, and is approached only through a very narrow pass. Pop. (1887) 6,389.

**Grazzini**, grăăt-see'nĕe, Antonio Francesco: author; b. in Florence, Italy, Mar. 22, 1503. Very little is known of his personal life, but in the history of Italian literature he acquired a famous name, partly as founder of the Accademia della Crusca, partly by his poetical works (*Le Cene*, a collection of stories in the manner of Boccaccio, reprint. Paris, 1756), and a number of comedies (*La Gelosia*, *La Spiritata*, etc.). He was generally called Il Lasca or Lucuscus by his literary friends. D. Feb. 18, 1583.

**Greasewood**: the *Sarcobatus vermiculatus*, a low shrub of the family *Chenopodiaceæ*; abundant in the Western plains and Rocky Mountains, in barren places which are charged with alkaline salts. Other plants bear the name of greasewood, e. g. *Gutierrezia euthamiæ*, a composite.

Charles E. Bessey.

**Great Barrington**: township (settled 1730, incorporated 1761, and county-seat till 1787); Berkshire co., Mass. (for location of county, see map of Massachusetts, ref. 2–C); on the Housatonic river and N. Y., N. H. and Hartford Rail-

road. It is a prominent and pleasantly situated town, surrounded by beautiful hills. It contains manufactures of woolens, cotton goods, paper, flocks, pig iron, brick, and saw-mill products. It has a high school and a number of graded and private schools. The post-villages of Van Deusenville and Housatonic are within the town limits. It is a popular resort in summer, is supplied with gas, electric light, sewerage and pure spring water, and the main street is lined with large old elms. The territory was purchased from the Indians, and originally bore the name of the Housatonic Propriety. Pop. of township (1880) 4,653; (1890) 4,612; (1900) 5,854.

EDITOR OF "BERKSHIRE NEWS."

**Great Basin**: the largest North American district of interior drainage. It includes nearly the whole of Nevada, the western half of Utah, the eastern fourth of California, and smaller parts of Idaho, Oregon, Wyoming, and Lower California. It is surrounded by Pacific drainage, being bounded on the E. and S. E. by the basin of the Colorado and on the N. by the basin of the Columbia. Its greatest length N. and S. is 880 miles; its greatest width across Utah and Nevada is 570 miles; its area is about 210,000 sq. miles. Its general altitude in the northern part is 4,000 to 4,500 feet, and there is a gradual descent southward. It is divided by a great number of short discontinuous mountain ranges into a series of valleys trending mostly N. and S. The climate is arid throughout, and most of the valleys are without perennial streams; but some of the mountains by which it is margined are so lofty as to accumulate great snow-banks whence streams descend to saline lakes in the desert valleys. Lakes thus dependent on the Sierra Nevada are Winnemucca, Pyramid, Carson, Walker, Mono, and Owens. Great Salt and Sevier lakes depend on the Uinta and Wasatch ranges and the associated plateaus. Humboldt river is exceptional in that it rises in the interior ranges; after a course of more than 200 miles it enters Humboldt Lake. (For the ancient history of the lakes, see BONNEVILLE, LAKE, and LAHONTAN, LAKE.) Several groups of valleys coalesce so as to form broad desert plains. Among these are Great Salt Lake desert, Carson desert, Ralston desert, and Mohave desert. The bottoms of DEATH VALLEY (*q. v.*) and Coahuila valley (see COLORADO DESERT) are several hundred feet below the level of the ocean. Agriculture is dependent on irrigation, and the water-supply is so limited that probably less than 1 per cent. of the land can be cultivated. There is a considerable grazing industry. Gold, silver, lead, copper, and coal are mined in the mountains; iron, sulphur, and ozokerite are also obtained; and the *playas* of the valleys yield borax, salt, and soda.

G. K. GILBERT.

**Great Bear Lake**: in British America, under the Arctic Circle, between lon. 117° and 123° W. It has an irregular outline, is very deep and clear, abounds in fish, and is frozen over for half the year. Its outlet is Bear river, which empties into the Mackenzie river. Area, 7,012 sq. miles.

**Great Bend**: city (founded 1872); capital of Barton co., Kan. (for location of county, see map of Kansas, ref. 6–E); on the Arkansas river and the A., T. and S. F. and the Mo. Pac. Railways; 219 miles W. of Topeka, 284 miles W. of Kansas City, Mo. It is in an agricultural district, with valuable stone quarries and salt mines. It is the seat of Central Kansas College, and has 6 churches, 3 public-school buildings, street railway, electric lights, water-works, grain elevators, flour-mills, and 4 weekly periodicals. Pop. (1880) 1,071; (1890) 2,450; (1900) 2,470.

EDITOR OF "EVENING NEWS."

**Great Bible**: See BIBLE.

**Great Britain** [*Britain* < O. Eng. *Bryten*, Britain; in Gr. Κασσιτερίδες, Ἄλβιον, Βρεττανικὴ νῆσος; Lat. *Albion*, *Britannia*]: the largest island in Europe, and, next to Greenland, New Guinea, Borneo, Madagascar, and Sumatra, the largest in the world, thus called to distinguish it from Lesser Britain or the Bretagne. It is separated from the continent of Europe by the British Channel (La Manche of the French), the narrowest portion of which is called the Strait of Dover (Pas de Calais), and by the German Ocean or North Sea, and from Ireland by the Irish Channel or Sea, which communicates with the open Atlantic through the North Channel and St. George's Channel. The island of Great Britain comprises England, Wales, and Scotland, and lies between lat. 49° 57′ and 58° 40′ N., and between lon. 1° 46′ E. and 6° 13′ W. of Greenwich. Its most southerly point is Lizard Point in Cornwall; its most northerly, Dunnet Head in Caithness; its most easterly, Lowestoft Ness in Norfolk; and its most westerly, Ardnamurchan Point in Argyleshire. Its greatest length is 608 miles; its greatest breadth, between the Land's End and the North Foreland in Kent, 325 miles. Farther N. the island is narrow. Near the frontier of Scotland it is only 64 miles across, and the distance between the Firths of the Forth and Clyde hardly exceeds 30 miles. The area of Great Britain is 83,355 sq. miles, and that of the 931 smaller islands along its coasts 4,616 sq. miles. Of these smaller islands 224 are inhabited. The more important among these are the Orkneys (376 sq. miles), the Shetlands (551 sq. miles), the Hebrides or Western islands (3,141 sq. miles), Anglesey (302 sq. miles), the Scilly islands (6 sq. miles), and the Isle of Wight (156 sq. miles).

Great Britain, Ireland, the Isle of Man in the Irish Sea, and the smaller islands in the British seas are spoken of generally as the *British islands*. Their area is as follows:

| | | |
|---|---|---|
| Great Britain, mainland | sq. miles | 83,355 |
| " " lesser islands | | 4,616 |
| Ireland, mainland | | 32,337 |
| " lesser islands | | 246 |
| Man, Isle of | | 220 |
| Total British islands | | 120,774 |

The United Kingdom includes Great Britain and Ireland, but neither the Isle of Man nor the Channel islands near the French coast, which are not represented in Parliament, in spite of their vicinity to the seat of the imperial government. These islands are in the enjoyment of ancient institutions; and although, in statistical documents, they figure occasionally as if they formed integral parts of the United Kingdom, they are in reality merely British dependencies.

*Physical Geography.*—The British islands rise on a submarine plateau joined to Denmark, Germany, the Netherlands, and France, but separated from Norway by a channel exceeding 200 fathoms in depth. A fall of the sea to the extent of only 102 feet would cause the appearance of an isthmus joining the Netherlands to Norfolk and Lincoln, and the Dogger Bank, at present one of the most productive fishing-grounds, would rise to the surface, a huge flat island, in the middle of the German Ocean. A further fall of 18 feet would cut off the communication between the British Channel and the German Ocean and render superfluous any scheme for bridging or tunneling the Strait of Dover. A total fall of the level of the sea of 180 feet would convert nearly the whole of the southern half of the German Ocean and a considerable portion of the British Channel into dry land. A fall of 240 feet would join Ireland to Great Britain. The depth of the sea increases rapidly at a distance of from 20 to 50 miles to the W. and N. W. of Ireland, the Hebrides, and Shetland islands. The wide channel between the latter and the Faroe islands attains a depth of 640 fathoms (3,840 feet), and that of the Atlantic between Ireland and Rockall (a rock 70 feet high in lat. 57° 32′ N., lon. 13° 42′ W., and the center of a productive fishing-bank) exceeds 1,600 fathoms.

*Coast-line.*—The coast-line of Great Britain has a development of 2,900 miles; that of Ireland of 1,400 miles, minor indentations excluded. On the former island no point is at a greater distance from the sea than 75 miles; on the latter this distance is only 50 miles. The eastern coast of Great Britain is generally unbroken, and there are only a few bays and natural harbors affording shelter to shipping, a deficiency compensated for to some extent by the existence of several estuaries of rivers, such as the Thames and Humber in England and the Forth and Tay in Scotland. The safest harbor along the whole of this coast is that formed by the Cromarty Firth, one of the two arms of the Moray Firth, though it is of small importance commercially. A considerable portion of this coast is flat, especially that of Norfolk and adjoining the sand-choked bay called the "Wash," where the Fens form an extensive marshland. In many parts the sea has encroached upon the land, but elsewhere considerable tracts of country have been conquered from the sea, and are defended against its ravages by dikes and embankments. The northern coast of Scotland, between Duncansby Head and Cape Wrath, is steep throughout, and the west coast, as far S. as the mouth of the Clyde, is intersected by numerous narrow sea-lochs bounded by steep hills and of considerable depth. Narrow "sounds" separate the mainland from Skye, Mull, and others of the Hebrides, and a broad strait, the Minch, separates it from the Outer Hebrides. Among the numerous

peninsulas of that part of Scotland, that of Cantire is the most considerable. It is nearly 60 miles in length, and terminates in the Mull of Cantire. The eastern coast of the Firth of Clyde is generally level, while that of the peninsula of Galloway, farther S., is generally steep, and juts out in the bold Mull of Galloway, the most southerly point of Scotland, in lat. 54° 38′ N. The eastern portion of the Irish Sea forms a vast bay, bounded on the N. by Galloway, on the E. by the English counties of Cumberland and Lancashire, and on the S. by Wales. Its center is occupied by the Isle of Man. Three subsidiary bays open into it—viz., those of the Solway Firth, Morecambe Bay, and Liverpool Bay (with the estuaries of Mersey and Dee). They all abound in sandbanks, which render navigation exceedingly intricate. The peninsula of Wales has generally bold and rugged coasts. Menai Strait, hardly 600 feet in width, separates it from the island of Anglesey. The wide sweep of Cardigan Bay opens here toward the W., and Milford Haven penetrates far inland toward the S. W. This is one of the most secure harbors of the British islands, though, owing to its geographical position, it is but little used. Bristol Channel and the estuary of the Severn separate South Wales from the counties of Somerset and Devon. The most important bays along it are those of Caernarvon and Swansea on the coast of Wales, and of Barnstaple on the coast of Devonshire. The navigation of its upper portion is obstructed by sandbanks. Devon and Cornwall form a peninsula, terminating in the Land's End (50° 4′ N., 5° 42′ W.), the most westerly point of England. The Scilly islands lie off this cape, and have proved fatal to many a homeward-bound merchantman. The coasts of this peninsula are generally steep and celebrated for their picturesqueness. There are several excellent harbors, among which may be mentioned Mount's Bay, the harbor of Falmouth, and that of Plymouth; the latter is protected by a magnificent breakwater, and the celebrated Eddystone lighthouse points out the way to it. The remainder of the south coast of England is generally level. The Bill of Portland, a rocky promontory joined to the mainland by the Chesil Bank, bounds the roadstead of that name to the W. The only other secure harbors on the south coast are those of Southampton and of Portsmouth, opposite the Isle of Wight, the latter the most important naval station of Great Britain. Spithead is a secure roadstead between it and the Isle of Wight. Farther to the E. the South Downs gradually approach the coast and form the bold Beachy Head (532 feet). The coast then again becomes level and, at Dungeness, marshy, but from Sandgate to the North Foreland it is formed of white chalk cliffs. These "white cliffs of Old England" have become proverbial, though their extent is very limited. They owe their prominence in the popular estimation principally to the fact of their first meeting the eye of a traveler coming from the Continent. There are no natural harbors along this coast (that of Dover has been created artificially), but the roadstead called the "Downs," lying between the land and the Goodwin Sands, offers some shelter to shipping. The estuary of the Thames is bounded by low coasts, and sandbanks render its navigation exceedingly intricate. The estuary of the Medway, which opens into it, forms one of the most secure harbors, and has been strongly fortified (Chatham).

*Relief.*—The British islands can not vie with other European countries in the height of their mountains, but they nevertheless possess a variety of relief which removes them far from the monotonous low plains of Northern Europe. England, speaking generally, is a level country, especially toward the E., where the marshy district of the Fens offers an analogue to that met with on the opposite coast of the continent, but it is traversed by table-lands and ridges of varying elevations, and which in the North assume the height of veritable mountains. Wales and Scotland may fitly be described as mountainous countries, while Ireland presents itself as a vast lowland dotted over by isolated mountain groups. The culminating point of the whole country, Ben Nevis, attains an elevation of 4,406 feet.

*Hydrography.*—There are neither large rivers nor large lakes. The largest lake, Lough Neagh in Ireland, covers an area of only 158 sq. miles, while the catchment basin of the Severn extends over only 8,119 sq. miles. But although the rivers are neither large nor of great volume, they carry water all the year round, and their estuaries form excellent harbors and are of great use to navigation. The most considerable rivers are the Tay, Tweed, Humber, Ouse, and Thames on the eastern slope of Great Britain; the Clyde, Mersey, and Severn on the western slope of Great Britain; the Shannon, Bann, Suir, Corib, and Erne in Ireland. There is no other river draining over 1,500 sq. miles.

*Climate.*—The climate of Great Britain is mainly determined by the insular position of the country, to which it owes its mildness and equability, and that absence of extremes which distinguishes it from the climate of continental countries under the same latitude. The Gulf Stream, above all, by sending its warm waters toward the British islands, most potently influences their temperature, which it raises above that of the sea-board countries on the western shores of the Atlantic having the same latitude. The difference between the annual temperature of Penzance (52° F.) and Unst (45°), the former in lat. 50° 11′ N., the latter in lat. 60° 42′ N., amounts to only 7°. In January it is only 4°; in July it rises to 19° F. The potent influence of the Gulf Stream is exhibited, moreover, by the fact of the temperature of places on the west coast of Great Britain being about one degree in excess of that of places on the east coast having the same latitude. The mean annual temperature of England has been estimated at 49°, that of Scotland at 47°, and that of Ireland at 50°, these figures being the means observed at a large number of meteorological stations. S. W. winds are the most prevalent throughout the year, and are generally attended with rain. The rainfall varies exceedingly according to locality. In the greater portion of England and Scotland it does not exceed 30 inches a year, but toward the W. and in Ireland this amount is much exceeded, and in some of the hill districts which catch the clouds as they drift eastward, the amount of rain is equaled only in tropical countries. At the Stye Pass in Cumberland 224 inches fell in a single year. The maximum rainfall in Southwestern Ireland and England takes place in winter, but the greater portion of the country lies within the region of winter rains. Snow falls rarely, except in the hills, where it remains on the ground frequently for three or more months. The mean relative humidity at most places exceeds 80 per cent.

*Geology.*—The geological features of Great Britain are distinguished by the presence of the whole series of recognized stratified rocks, which were first studied here systematically, and in most instances have become typical of similar series met with in other parts of the world. As a rule, the oldest stratified rocks occupy the W. and N. of Ireland, and in going to the E. or S. E. the more recent formations are passed in succession, until the most recent of all are reached, which form the marshland along some parts of the east coast. The Palæozoic strata occupy about one-third of the entire superficies. Their comparative sterility is compensated for, in part, by the existence of mineral treasures, constituting one of the principal sources of Great Britain's eminence as a manufacturing country. The oldest rocks of this series are met with in the Outer Hebrides and on the coast of Ross and Sutherland. They consist principally of crystalline gneiss, and have been recognized as being equivalent to Sir W. Logan's Laurentian rocks of North America. They also constitute nearly the whole of the region of the Grampians, a broad belt, including Strathmore and the central plain, occupied by members of the Carboniferous and Devonian series, separating them from the southern hills. The *Cambrian rocks* of Southern Scotland, Cumberland, and Wales are superimposed upon them. In Scotland they consist of red sandstone and conglomerate, in England and Wales of sandstone, gritstone, and slates. To these succeed the *Silurian rocks*, most fully developed in Wales and in the Cumbrian Mountains. The *Devonian* is most fully developed in Devonshire, but also occurs in Central Scotland. The *Carboniferous series* occupies a broad tract extending from the Bristol Channel to the foot of the Cheviots, and extends thence into Scotland. Within these limits there are no less than fourteen detached coal-fields. Scotland is equally well provided with coal, and five distinct fields occur between the foot of the Grampians and the southern hills. The Permian strata, consisting of magnesian limestone and red sandstone, occupy a considerable area in Durham; and though traceable thence as far as Devon and Cornwall, they are nowhere of great extent. Fine marbles, and in the two latter counties tin and lead, are found in it. The *Triassic measures* are represented by sandstones and variegated marls. They may be traced as a ribbon from Hartlepool in the North to the mouth of the Exe in the South, but are most fully developed in the counties of Leicester, Staffordshire, Warwickshire, Shropshire, and Cheshire. Beds of rock-salt oc-

cur in them in the latter. The *Lias* extends from Yorkshire to the Dorset coast, and detached tracts of it are met to the W. of this line and in Scotland. Jet and alum are found in the rocks near Whitby, on the coast of Yorkshire. The *Oölites* constitute one of the most important among the geological formations, for they yield the best of all building materials. They occupy a belt of country in places 30 miles wide, and extending from Yorkshire to Dorsetshire. In Scotland the Oölites of Brora contain coal. The *Cretaceous rocks*, principally chalk with intercalated sands and clays, exceedingly rich in fossils, occupy a considerable portion of Southeastern England, and altogether surround the *Wealden* clays and sands of Kent and Sussex. The chalk hills can be traced from Flamborough Head in Yorkshire to Hants, and extend thence on the one hand into Wilts, Dorset, and Devon, and on the other, through the counties to the N. and S. of the Thames, to the shores of the German Ocean and of the British Channel, where they form chalk cliffs. The *Tertiary formations* are limited to a portion of the south coast, of which Hants forms the center, to the valley of the Thames and the coast of Essex and Suffolk, to the lowlands surrounding the Wash and the basin of the Humber. On the east coast of England they occur on the Solway Firth, on the coast of Lancashire, and on the Bristol Channel. They consist of Eocene clays, sands, and marls, of Pliocene ferruginous sands and marl, and of Pleistocene deposits. Apparently the Miocene is not represented. *Eruptive rocks*, such as granites, porphyries, syenite, and basalt, are met with principally in the hills of Devon and Cornwall, in Wales, in the Cumbrian Mountains, in the Cheviots, and throughout Northern Scotland.

The *flora* and *fauna* of Great Britain correspond generally with those of continental Europe, and there are only a few species which are peculiar to it. The flora is represented by 1,600 species of phanerogamous and 4,800 of cryptogamous plants. The flora of by far the greatest portion of the island resembles that of Germany; that of the mountains in Western Ireland corresponds more or less to that of the Pyrenees; that of Devon and Cornwall agrees in many respects with the flora of Northwestern France; the flora of Northern France is most fully represented in Southwestern England, particularly in the chalk hills; while the vegetation of the mountains of Wales, North England, and Scotland has many affinities with that of the Alps or of Scandinavia. Perhaps the most remarkable example of a plant of one of the continental countries named not being likewise indigenous to Great Britain is that of the Norway spruce. The lemming offers a similar instance among animals. Only one species of fir (*Pinus sylvestris*) is indigenous to the British islands, and together with the yew and juniper it is the only representative of the coniferous family. Of other trees there are the oak, elm, beech, birch, poplar, willow, ash, alder, hornbeam, and hazelnut, but numerous others have been acclimated, such as the cedar, maple, sycamore, and chestnut. The indigenous fruit-trees yield plums, cherries, apples, sloes, pears, medlars, and nuts, and several others have been introduced, but generally require the protection of a wall to arrive at maturity. There is likewise a great variety of edible berries. Wheat, oats, barley, and rye are the cereals which are cultivated. The summers are not hot enough for maize. In the south of England and Ireland many sub-tropical plants thrive in the open air.

With respect to the animal world, the bones of elephants, tigers, rhinoceroses, hippopotamuses, and alligators have been discovered in the rocks of Great Britain; but this is the only record that they once existed. The hyæna disappeared more recently, and there is documentary evidence to prove that wild oxen (the urus), wild boars, bears, beavers, and wolves were numerous in early times. All these have now disappeared, the wolf as recently as 1710. Irrespective of domesticated animals there are 52 species of mammals, viz., 7 bats, the hedgehog, 2 shrews, the badger, the mole, the weasel, the polecat, the stoat, the beech and pine marten, the otter, the fox, the wildcat, the common and the bearded seal, 8 species of mice and rats, the squirrel, the hare, the alpine hare, the rabbit, the stag, the fallow deer, and the roe, besides 16 species of whale. There are 274 species of birds, viz., 22 birds of prey, 101 perching birds, 14 gallinaceous birds, 59 wading birds, and 78 swimming birds. There are about 170 salt and fresh water fish, including the pilchard, the herring, the salmon, and trout. Much has been done for the promotion of fisheries by establishing a close time and by purifying the rivers, and the results are already showing themselves in a more plentiful supply of salmon. The number of reptiles is exceedingly small. These are a lizard (very rare), 3 species of eft, and 4 of snake, including the poisonous viper. The Amphibia are represented by the frog, toad, and matterjack, all harmless. There are perhaps 500 species of Testacea, among which are the oyster and the mussel. Scotland in former times was celebrated for its pearl-fishery.

*Population.*—The following table conveys information on the population of the United Kingdom, inclusive of the Isle of Man and the Channel islands, for the years mentioned:

| COUNTRIES. | 1811. | 1831. | 1871. | 1891. |
|---|---|---|---|---|
| England and Wales | 10,164,256 | 13,896,797 | 22,712,266 | 29,001,018 |
| Scotland | 1,805,864 | 2,364,386 | 3,360,018 | 4,025,647 |
| Ireland | 5,956,460 | 7,767,401 | 5,412,377 | 4,704,750 |
| Islands in the British seas | 80,000 | 103,710 | 144,638 | 147,870 |
| Totals | 18,006,580 | 24,132,294 | 31,629,299 | 37,879,285 |

There generally reside in foreign countries no less than 2,900,000 natives of the United Kingdom (U. S. (1890) 2,772,000), and in British colonies about 1,800,000. Taken as a whole, the population of the United Kingdom has not decreased during any period for which there are trustworthy census returns. Its increase since 1811 amounts to 110 per cent. The increase, however, has varied considerably during different periods. It was most rapid in 1811–21, immediately after the termination of the great wars, and least so in 1841–51, when the potato disease, combined with cholera, took away many lives and gave an immense impetus to emigration. During the former period the annual increase amounted to 1·40 per cent., during the latter to 0·26 per cent. only. But while the population of the kingdom increased as a whole, that of particular districts has exhibited a decrease, and the increase in the remainder has been very unequal, having been most considerable in the manufacturing districts, the large towns of which absorb an increasing proportion of the rural population, very much to the detriment of the physique of the people. During 1881–91 the population of England and Wales increased 11·6 per cent., that of Scotland 7·8 per cent., but that of Ireland decreased to the extent of 9·1 per cent. In Ireland the decrease has been almost universal, extending even to the large towns, Belfast and Dublin alone excepted. In Scotland a considerable decrease took place in the northern and southern counties, but was more than compensated for by an increase in the population of the central manufacturing districts. Emigration has at all times, and particularly since 1840, considerably interfered with the increase of the population. Since 1815 as many as 13,132,231 emigrants are supposed to have left the British islands, but many of these were foreigners. Between 1853 and 1892 the number of emigrants was 9,990,037, of whom 7,550,512 were of British birth.

The number of emigrants to places out of Europe from 1885 to 1892 was as follows:

| YEAR. | Total. | English. | Scotch. | Irish. | Foreigners. |
|---|---|---|---|---|---|
| 1885 | 264,385 | 126,260 | 21,367 | 60,017 | 56,741 |
| 1886 | 330,801 | 146,301 | 25,323 | 61,276 | 97,901 |
| 1887 | 396,494 | 168,393 | 34,424 | 78,970 | 115,007 |
| 1888 | 398,494 | 170,822 | 35,873 | 73,233 | 118,566 |
| 1889 | 342,641 | 163,518 | 25,354 | 64,923 | 88,846 |
| 1890 | 315,980 | 139,979 | 20,653 | 57,484 | 97,864 |
| 1891 | 334,543 | 137,881 | 22,190 | 58,436 | 116,036 |
| 1892 | 321,397 | 133,815 | 23,325 | 52,902 | 111,355 |

Of the 299,238 persons of British origin who emigrated in 1900, 189,447 went to the U. S., 50,445 to British North America, and 15,782 to Australasia. The number of immigrants during the same epoch (1885–92), as far as registered, was 1,841,200, of whom 1,230,506 were of British origin, and only 610,694 foreigners, the final loss by emigration being thus reduced to 671,919.

Taken as a whole, the United Kingdom is one of the most densely populated countries of the world, though there are extensive mountain tracts and waste lands included in it which support only a small population. The density is as follows (1891):

| | Persons per sq. mile. |
|---|---|
| England | 541 |
| Wales | 206 |
| Scotland | 135 |
| Ireland | 144 |
| Isle of Man | 253 |
| Channel islands | 1,230 |
| Mean | 314 |

A remarkable feature in the distribution of the population consists in the large number of populous towns. The town population is more numerous, proportionately, than in any other country of which we have trustworthy returns. The number of towns of 50,000 inhabitants and their population are as follows:

| COUNTRIES. | Number of towns. | Inhabitants. | Percentage total population. |
|---|---|---|---|
| England and Wales. .. ..... | 62 | 11,780,246 | 41 |
| Scotland..... | 7 | 1,398,919 | 35 |
| Ireland ..... | 3 | 576,296 | 12 |
| Totals ..... | 72 | 13,755,461 | 37 |

They are here given in detail:

| | | | |
|---|---|---|---|
| London (with West Ham). | 4,435,902 | Gateshead..... | 85,709 |
| Glasgow ..... | 656,946 | Plymouth..... | 84,179 |
| Liverpool ..... | 517,951 | Halifax..... | 82,864 |
| Manchester..... | 505,343 | Wolverhampton..... | 82,620 |
| Birmingham..... | 429,171 | South Shields..... | 78,431 |
| Leeds..... | 367,506 | Middlesborough..... | 75,516 |
| Sheffield ... ..... | 324,243 | Cork..... | 75,345 |
| Edinburgh (with Leith).. | 333,268 | Walsall..... | 71,791 |
| Belfast..... | 255,950 | Rochdale ..... | 71,458 |
| Dublin ..... | 245,001 | Tottenham..... | 71,336 |
| Bristol ..... | 221,665 | St. Helens ..... | 71,288 |
| Bradford..... | 216,361 | Stockport ..... ..... | 70,253 |
| Nottingham ..... | 211,984 | Paisley..... | 69,295 |
| Kingston-upon-Hull ..... | 199,991 | Aston Manor..... | 68,639 |
| Salford .... ..... | 198,136 | York..... | 66,984 |
| Newcastle-on-Tyne ..... | 186,345 | Southampton..... | 65,325 |
| Portsmouth..... | 159,255 | Greenock..... | 63,498 |
| Dundee ..... | 155,675 | Leyton..... | 63,106 |
| Leicester..... ..... | 142,051 | Willesden..... | 61,266 |
| Oldham..... | 131,463 | Northampton..... | 61,016 |
| Sunderland ..... | 130,921 | Reading..... | 60,054 |
| Cardiff..... | 128,849 | West Bromwich..... | 59,489 |
| Aberdeen..... | 123,327 | Merthyr Tydfil.... ..... | 58,080 |
| Blackburn..... | 120,064 | Ipswich..... | 57,360 |
| Brighton. ..... | 115,402 | Bury..... | 57,206 |
| Bolton..... | 115,002 | Wigan. ..... | 55,013 |
| Preston..... | 107,573 | Hanley ..... | 54,846 |
| Croydon ..... | 102,697 | Devonport. ..... | 54,736 |
| Norwich ..... | 100,964 | Newport (Mon.)..... | 54,695 |
| Birkenhead..... | 99,184 | Warrington..... | 52,742 |
| Huddersfield..... | 95,422 | Coventry..... | 52,720 |
| Derby..... ..... | 94,146 | Hastings..... | 52,340 |
| Swansea..... | 90,423 | Grimsby..... | 51,876 |
| Ystradyfodwg..... | 88,350 | Bath. ..... | 51,843 |
| Burnley..... | 87,058 | Barrow-in-Furness..... | 51,712 |

The annual number of births, deaths, and marriages to 1,000 living is as follows (1891):

| COUNTRIES. | Birth-rate. | Death-rate. | Marriage-rate. |
|---|---|---|---|
| England and Wales..... | 31·4 | 20·2 | 7·8 |
| Scotland..... | 31·2 | 20·7 | 6·9 |
| Ireland ..... | 23·1 | 18·4 | 4·5 |
| United Kingdom ..... | 30·4 | 20·0 | 7·0 |

It should, however, be stated that the registration in Ireland is exceedingly defective, and that no dependence can therefore be placed upon the above figures. To every 1,000 males there are about 1,064 females in the United Kingdom, 1,064 in England, 1,072 in Scotland, 1,029 in Ireland. This disparity is due to the larger proportion of men who emigrate or who are abroad as soldiers or mariners.

*Nationalities.*—According to place of birth, the population of the United Kingdom is distributed as shown in the following table (1881):

| COUNTRIES. | English. | Scotch. | Irish. | Natives of British colonies. | Foreigners and born at sea. |
|---|---|---|---|---|---|
| England and Wales.. | 21,692,165 | 213,254 | 566,540 | 96,467 | 143,840 |
| Scotland..... | 70,482 | 3,061,531 | 207,770 | 10,469 | 9,766 |
| Ireland ..... | 67,881 | 20,318 | 5,306,757 | 8,367 | 9,054 |
| Totals..... | 21,830,528 | 3,295,103 | 6,081,067 | 115,303 | 162,660 |

English is spoken by the educated classes throughout the British islands. Cymric has maintained itself in Wales, Gaelic in the Highlands of Scotland, on the Isle of Man, and in Ireland, more especially in Connaught and Munster. These Celtic dialects, however, are gradually losing ground in spite of the efforts made to keep them alive. Cymric is still understood by 950,000 people in Wales, and the language is extensively used in churches and schools and in newspapers. In Scotland (1891) 254,415 persons still understand Gaelic, but only 43,738 do not speak English. In Ireland (1861) 1,105,536 spoke Irish, in 1881 the number was 949,932, in 1891 only 680,174.

*Occupations of the People.*—The following table exhibits the distribution of the population according to occupations:

| DIVISIONS. | England and Wales, 1881. | Scotland, 1881. | Ireland, 1891. |
|---|---|---|---|
| *Males.* | | | |
| Professional class ..... | 450,955 | 65,499 | 138,971 |
| Domestic class ..... | 258,508 | 25,292 | 34,490 |
| Commercial class ..... | 960,661 | 126,743 | 81.012 |
| Agricultural class..... | 1,318,344 | 215,215 | 845,691 |
| Industrial class..... | 4,975,178 | 675,964 | 404,155 |
| Indefinite and non-productive classes. | 4,856,256 | 690,762 | 814,634 |
| Totals ..... | 12,619,902 | 1,799,475 | 2,318,953 |
| *Females.* | | | |
| Professional class ..... | 196,120 | 30,604 | 75,272 |
| Domestic class ..... | 1,545,302 | 151,273 | 220,654 |
| Commercial class ..... | 19,467 | 5,383 | 2,161 |
| Agricultural class..... | 64,840 | 57,322 | 91,068 |
| Industrial class..... | 1,578,189 | 256,689 | 252,255 |
| Indefinite and non-productive classes. | 9,930,619 | 1,437,827 | 1,744,387 |
| Totals ..... | 13,334,537 | 1,936,098 | 2,385,797 |

*Agriculture.*—The soil of Great Britain is almost exclusively devoted to the production of breadstuffs and of grasses, roots, etc., as food for cattle. The principal cereals cultivated are wheat, barley, and oats. Beans and peas are of some importance; turnips and swedes are the principal green crops. Potatoes are relatively most extensively cultivated in Ireland, where they constitute the principal food of the laboring population. The cultivation of hops (51,000 acres) is confined to England, that of flax almost entirely to Ireland. Orchards are most extensive in the S. W. and S. of England. Among minor objects of cultivation may be mentioned rape, saffron, coriander, caraway, teasel, madder and woad, mustard, licorice, camomile, peppermint, and other medicinal plants, but none of these occupies a considerable area. The beet, which is used largely on the Continent for the manufacture of sugar, is used in Great Britain almost entirely as food for cattle, as there are no protective duties which enable home-made sugar to compete with foreign produce. The land of the United Kingdom available for agricultural purposes is almost entirely in the hands of a small number of landed proprietors,* from whom it is leased by the actual cultivators of the soil. Formerly the tenure of the tenants was of a very uncertain nature, and they could claim nothing for permanent improvements. In this respect a change for the better has taken place, particularly in Ireland; even in Great Britain outgoing tenants are compensated for unexhausted improvements.

The following are the leading agricultural statistics of the United Kingdom (in thousands of acres) and in numbers of live stock:

| NATURE OF CROPS, ETC. | 1871. | 1881. | 1892. | 1900. |
|---|---|---|---|---|
| Corn crops..... | 11,833 | 10,655 | 9,329 | 8,682 |
| Green crops ..... | 5,271 | 4,803 | 4,467 | 4,279 |
| Flax..... | 174 | 154 | 72 | 48 |
| Hops..... | 60 | 65 | 56 | 51 |
| Bare fallow, uncropped .... | 566 | 818 | 484 | 320 |
| Clover and sown grasses ... | 6,236 | 6,384 | 5,973 | 5,977 |
| Pasture (exclusive of mountain heath)..... | 22,527 | 24,763 | 27,533 | 18,234 |
| Woods and plantations..... | 2,500 | 2,787 | 2,896 | 3,038 |
| Remainder..... | 28,475 | 27,203 | 26,832 | 37,013 |
| Total area..... | 77,642 | 77,642 | 77,642 | 77,642 |
| Horses (agricultural only).. | 1,742,599 | 1,923,619 | 2,067,549 | 1,991,286 |
| Cattle..... | 9,346,216 | 9,905,013 | 11,519,417 | 11,413,613 |
| Sheep... ..... | 31,403,500 | 27,896,273 | 33,642,808 | 30,978,923 |
| Pigs..... | 4,136,616 | 3,149,173 | 3,265,898 | 3,650,406 |

The "remainder" includes about 12,000,000 acres of rough pasture land in Great Britain, besides the considerable area covered with water or occupied by houses, roads, etc. The land under tillage has decreased about 15 per cent. since 1871, while there has taken place a corresponding increase in permanent pasture. This is entirely due to the fact that the British farmer is unable to grow wheat as cheaply as it can be grown in America and in India, and consequently devotes more attention to the breeding of cattle. The estimated average yield per acre (1899) was as follows: Wheat, 33·06 bush.; barley, 32·16 bush.; oats, 42·01 bush.; pota-

* About 1876 there were 1,173,683 freeholders (outside of London), but of these 852,438 owned less than an acre of land, while 10,911 owned each 1,000 acres or more, or, between them, 72 per cent. of the total area of the British islands.

toes, 4·89 tons; hay, 1·53 tons. The total produce for 1899 was: Wheat, 67,260,000 bush.; barley, 74,533,000 bush.; oats, 166,140,000 bush.; beans and peas, 11,997,000 bush.; potatoes, 5,837,000 tons; turnips and swedes, 20,370,000 tons; and hay of all kinds, 230,329,691 cwt. Until about 1793 the British isles had no need of foreign food-supplies, but ever since that period the demands of an increasing population required increasing imports not only of cereals, but also of meat and all kinds of agricultural and dairy produce. The imports of 1891 (for home consumption) thus included 89,539,355 cwt. of wheaten flour (or its equivalent in wheat), 26,825,625 cwt. of corn (maize), 2,986,585 cwt. of rice, 3,152,916 cwt. of potatoes, 3,296,533 cwt. of butter and margarine, 1,976,019 cwt. of cheese, 507,407 oxen, 344,504 sheep, and 9,305,322 cwt. of all kinds of meat. Time will show whether the introduction of the *petite culture*, which it is attempted to foster by allotments of less than an acre to laborers, will increase the agricultural output. Of such allotments there existed nearly half a million in 1890. See GREAT BRITAIN in Appendix.

*Fisheries.*—The rivers and the seas surrounding the British islands abound in fish. The number of persons engaged in the fisheries in 1899 was 108,513 (41,424 in England, 38,508 in Scotland, 25,569 in Ireland), with 27,229 boats. In 1900 in Great Britain the value of fish caught and landed was about £9,673,274. Salmon are caught almost exclusively in the rivers of Scotland and Ireland; the herring-fisheries are carried on principally from the Scotch ports; the pilchard is caught on the coasts of Cornwall and Devonshire, and England (Essex and Kent) rejoices in the possession of the best oysters. Up to 1830 it was sought to encourage the fisheries by the payment of premiums. This system, however, proved fallacious, and while in 1830 only 329,537 barrels of herring were cured throughout Great Britain, the export alone in 1891 amounted to 952,000 barrels. In 1891 there were landed 11,860,918 cwt. of fish and 854,275 cwt. of shell-fish, besides 55,000,000 oysters, etc., of a total value of £7,008,985. The Scotch and Irish salmon-fisheries yielded in addition to this £560,000.

*Mining and Metallurgical Industries.*—Among the valuable minerals which from immemorial times have been worked in Great Britain coal occupies the foremost rank. The position of the coal-basins has already been indicated. They cover an area of about 12,000 sq. miles, and if worked to the depth of 4,000 feet they will be exhausted in the course of 700 years if the present rate of consumption continues. The coal raised in 1899 by 729,009 miners amounted to 220,094,781 tons, having a value of £83,481,137. The iron industry is the most important next to that of coal. It has assumed gigantic proportions since 1740, when coal was first used for smelting the ore. Then the produce of pig iron only amounted to 17,350 tons; in 1806 it was 250,000, in 1823 443,066, in 1860 2,826,752, in 1881 8,144,449, in 1891 7,406,064, and in 1899 9,421,435 tons. The iron ores of Great Britain are generally associated with the coal-beds, which enhances their value. The price of pig iron has varied very greatly, and while a ton in 1873 was valued at 125*s.*, its price gradually declined until in 1886 it was only 43*s.* In 1891 it had once more risen to 53*s.* Copper is mined principally in Cornwall and Devon, as well as in Scotland and Ireland. Lead has been worked in Derbyshire from the time of the Romans, but has since been discovered in other parts of the island, including Cornwall and Devon, the only counties furnishing tin, and celebrated on that account among the Phœnicians. The ores of zinc, arsenic, manganese, antimony, nickel, silver, gold, etc., are of subordinate importance. The quantity and value of metals produced from British ores in 1891 were as follows:

| | | |
|---|---|---|
| Pig iron | 4,528,312 tons. | £11,885,819 |
| Fine copper | 720 " | 40,708 |
| Metallic lead | 32,205 " | 400,687 |
| White tin | 9,353 " | 881,139 |
| Zinc | 8,891 " | 212,495 |
| Silver (from lead ore) | 279,792 ounces. | 52,534 |
| Other metals (gold, etc.) | | 14,071 |
| Total | | £95,142,368 |

In addition to these, 3,590,800 tons of foreign ores were smelted in Great Britain. If we add to the above the value of the other non-metallic minerals (rock-salt, 2,043,571 tons, stone, clay, shale, etc.), of the coals not used in smelting or in mines (say £53,000,000), it will be found that the value of the metallic and mineral produce of the United Kingdom amounted to about £160,524,000 in 1891.

*Manufactures.*—Among the great textile industries of the country that of woolens is the oldest. It was carried on under the dominion of the Romans, but in spite of protective duties and other well-meant laws enforcing the use of woolen stuffs, it was only after the immigration of Flemish weavers (1668) that really good cloth was prodneed. English broadcloth enjoys a deserved reputation, and the continuous growth of the industry may be seen from the fact that the wool retained for home consumption, which in 1874 amounted to 340,000,000 lb., rose in 1891 to 480,000,000 lb. The cotton industry has been of some importance since the invention of the spinning-jenny in 1767, and has since assumed astounding proportions. In 1766 the value of all cotton goods was estimated at £600,000, in 1846 at £36,000,000, and in 1874 at £100,500,000. Of cotton, there were retained for home consumption 1,006,000,000 lb. in 1868, 1,499,000,000 lb. in 1887, and 1,813,000,000 lb. in 1891. The linen manufacture is important. Its principal seats are in Scotland and Protestant Ireland. The manufacture of silk was introduced in the fourteenth century, and subsequently was much improved by Huguenot immigrants (1665). In 1890 there were in the United Kingdom 7,160 textile factories, employing 1,084,631 persons, and furnished with 53,641,062 spindles and 822,489 power-looms. The leading textile manufactures were:

| TEXTILES. | Factories. | Spindles. | Power-looms. | Operatives. |
|---|---|---|---|---|
| Cotton | 2,538 | 44,504,819 | 615,714 | 528,795 |
| Wool | 1,793 | 3,406,002 | 61,831 | 148,729 |
| Worsted | 753 | 3,072,250 | 67,391 | 148,324 |
| Linen | 357 | 1,196,334 | 48,714 | 107,583 |
| Jute | 116 | 280,039 | 14,107 | 44,810 |
| Silk | 623 | 1,029,353 | 11,464 | 41,277 |

These were divided as follows:

| COUNTRIES. | Factories. | Spindles. | Power-looms. | Operatives. |
|---|---|---|---|---|
| England | 6,180 | 50,211,216 | 722,406 | 858,252 |
| Scotland | 747 | 2,712,735 | 71,471 | 154,591 |
| Ireland | 263 | 1,016,112 | 28,612 | 71,788 |

Next to the textile industries the most important are the metal manufactures, ranging from the production of rails to that of steam-engines, iron ships, and of the finest cutlery and silversmith's work. The English potteries supply goods appreciated throughout the civilized world. The breweries are of great importance, for beer is the national beverage of England, while spirits are more highly prized by the Scotch and Irish. See GREAT BRITAIN in Appendix.

*Transportation.*—The roads have been constructed to a very small extent by Government (in Wales, Scotland, and Ireland). The majority of them are maintained from local rates and managed by highway boards. The old turnpike roads, which were constructed by private speculators on condition of their being permitted to levy a toll, have almost entirely passed into the hands of the local authorities, their builders in many instances having suffered serious losses. The importance of the rivers as navigable highways has been alluded to already. They are connected with each other by an extensive system of canals, 3,907 miles in length, the whole of them being constructed since 1755, for the greater part by private companies. The railways have to a great extent superseded canals and roads. Tramways have been in use in some of the mining districts since 1797, but the first locomotive railway was opened in 1830, and since that time they have rapidly increased in extent. They are without exception the property of private companies. Their total length in 1862 was 10,870 miles; in 1873, 16,082; in 1899, 21,700. In 1899 the capital of the railways amounted to £1,152,317,501; 1,106,691,991 passengers and 310,000,000 tons were conveyed by rail; and the working expenses amounted to 55 per cent. of the total receipts. In 1900 there were 1,177 miles of tramway. Of railways (mostly double-track), there were in England 15,044 miles, in Scotland 3,480 miles, and in Ireland 3,176 miles.

The shipping holds the first rank among the commercial marines of the world, for it has been calculated that no less than 55 per cent. of all steam-vessels and 31 per cent. of all sailing vessels belong to it. In the foreign as well as home trade the British flag by far exceeds the flags of all other nations combined, and this result is achieved without differential duties, for even the coasting trade is open to foreigners on equal terms with the natives. In 1800 the mercantile marine included 15,724 vessels of 1,698,515 tons; in 1860, 27,663 vessels of 5,758,687 tons; in the beginning of 1900, 20,196 vessels of 9,164,342 tons. There has been a

very great increase in the tonnage since 1860, but still more remarkable has been the increase of steamers, viz., from 2,000 to 7,720, and of their tonnage from 454,327 to 5,307,204. To this fleet must be added the colonial marine (14,542 vessels of 1,688,277 tons), and it will be seen that the British flag is represented on the ocean by a total of 36,085 vessels of nearly 10,000,000 tons. The tonnage of the vessels which entered the ports in 1899 from foreign ports was 79,214,000 tons (of which British, 24,793,000 tons), and coastwise 56,312,586 tons. The lighthouses and light-ships are managed by the Trinity Board and two boards for Scotland and Ireland. There are 360 shore-lights, 50 lightships, and 250 life-boat stations.

Since 1870 the post-office has managed the telegraph-lines, which were purchased by the Government for about £9,000,000. It likewise manages numerous savings-banks, and grants life-annuities in behalf of the state. In 1892 it delivered 1,768,000,000 letters, 215,000,000 post-cards, and 708,000,000 newspapers and book-parcels; issued 10,346,630 money orders for £28,429,634, and forwarded 69,685,480 telegraphic messages.

*Commerce.*—There are neither export nor protective duties, for the customs duties levied upon articles which are likewise manufactured in the United Kingdom are balanced by corresponding excise or stamp duties. Probably no tariff is so simple as that of the United Kingdom. It includes cocoa, coffee, chicory, tea, tobacco, wine, dried fruit, beer and ale, malt, vinegar, spirits, plate, and playing cards. Commercial activity has assumed most gigantic proportions, for Great Britain not only exchanges her own products for those of foreign countries, but likewise acts as the agent for continental and other foreign markets. The extent of the commercial movement, for a number of years, is shown in the following tabular statement:

| YEARS. | Total imports. | Exports of British produce. | Exports of foreign and colonial produce. |
|---|---|---|---|
| 1875 | £373,939,577 | £223,465,963 | £58,146,360 |
| 1880 | 411,229,565 | 223,060,446 | 63,354,020 |
| 1885 | 370,967,955 | 213,115,114 | 58,359,194 |
| 1890 | 420,691,997 | 263,530,585 | 66,721,533 |
| 1891 | 435,441,264 | 247,235,150 | 61,878,568 |
| 1892 | 423,892,178 | 227,060,224 | 64,400,420 |

These figures do not include the value of the merchandise transshipped in British ports. A vast proportion of the imports consists of articles of food, condiments, and stimulants (42 per cent.), and of raw material to be used in manufactures (33 per cent.). Manufactured goods constitute only about 15 per cent. of the total imports. The exports of British produce, on the other hand, include 83 per cent. of manufactured goods. The table below gives the imports and exports from and to the principal countries for 1890 and 1892, in thousands of pounds sterling:

| DIVISIONS. | IMPORTS. | | EXPORTS. | |
|---|---|---|---|---|
| | 1890. | 1892. | 1890. | 1892. |
| *British possessions.* | | | | |
| British India, Ceylon, etc. | 41,377 | 39,363 | 37,450 | 30,930 |
| Australasia | 29,356 | 30,545 | 22,994 | 19,265 |
| British North America | 12,444 | 14,571 | 7,228 | 7,427 |
| British West Indies | 2,989 | 3,143 | 3,834 | 3,103 |
| Cape and Natal | 6,096 | 5,463 | 9,110 | 7,919 |
| West Africa | 1,076 | 1,788 | 871 | 1,403 |
| Mauritius | 265 | 230 | 320 | 770 |
| Channel islands | 959 | 1,171 | 727 | 270 |
| Totals | 94,562 | 96,274 | 82,534 | 71,087 |
| *Foreign countries.* | | | | |
| Northern Europe | 43,427 | 34,957 | 13,260 | 12,544 |
| Central Europe | 69,368 | 71,532 | 37,094 | 33,418 |
| Western Europe | 60,660 | 58,295 | 25,169 | 21,911 |
| Southern Europe | 11,497 | 9,472 | 12,577 | 9,904 |
| The Levant | 13,197 | 16,078 | 10,157 | 9,394 |
| Northern Africa | 2,090 | 1,801 | 1,149 | 1,063 |
| Western Africa | 1,101 | 418 | 1,610 | 1,078 |
| Eastern Africa | 941 | 845 | 1,283 | 934 |
| Indian seas | 3,308 | 3,970 | 2,792 | 3,128 |
| South Sea islands | 51 | 68 | 200 | 64 |
| China and Japan | 7,118 | 5,432 | 13,231 | 10,595 |
| U. S. of America | 97,357 | 108,200 | 32,077 | 26,485 |
| Mexico and Central America | 1,884 | 1,548 | 2,901 | 2,128 |
| Foreign West Indies | 326 | 179 | 3,059 | 2,213 |
| South America, Northern | 687 | 858 | 2,264 | 1,732 |
| " " Pacific | 4,524 | 5,446 | 4,246 | 4,506 |
| " " Atlantic | 8,821 | 8,325 | 17,909 | 14,836 |
| Fisheries | 112 | 121 | 30 | 40 |
| Totals | 326,463 | 327,545 | 181,008 | 155,973 |
| Grand totals | 421,025 | 423,819 | 263,542 | 227,060 |

The following tables show the declared real value of the principal articles of British commerce imported and exported in 1882 and 1892:

PRINCIPAL IMPORTS.

| ARTICLES. | 1882. | 1892. |
|---|---|---|
| Grain and flour | £63,559,315 | £58,176,451 |
| Cotton, raw | 46,654,570 | 37,888,356 |
| Sugar, raw and refined | 25,001,317 | 19,770,837 |
| Wool | 24,995,674 | 26,827,908 |
| Wood and timber | 17,146,209 | 17,180,739 |
| Tea | 11,043,884 | 10,090,106 |

PRINCIPAL EXPORTS.

| ARTICLES. | 1882. | 1892. |
|---|---|---|
| Cotton manufactures and yarn | £75,796,205 | £65,965,740 |
| Iron, all sorts | 28,621,433 | 19,529,258 |
| Steel | 2,976,873 | 2,233,932 |
| Woolen and worsted manufactures | 22,167,269 | 21,959,575 |
| Machinery | 9,564,616 | 14,798,716 |
| Linen and jute manufactures | 9,698,895 | 8,904,445 |
| Coal, cinders, and fuel | 11,932,247 | 16,811,070 |

The value of dead meat imported in 1892 was £22,359,162, and of silk manufactures £11,289,692.

There was an immense increase in the amount of grain and flour imported in the period between 1846 and 1892. In 1846 the imports of grain and flour retained for home use was 17 lb. per head of population; in 1891 the amount thus retained was 244 lb. per head. The principal articles on which customs are collected are tobacco, spirits, tea, and wine. The total receipts of customs in 1890–91 were £19,753,907. In 1890 duty was levied on goods of the value of £29,671,692, or about 7 per cent. of the total imports.

*Religion.*—Great Britain is essentially a Protestant country, but in Ireland the majority are Roman Catholic. Established churches survive in England and Scotland, but in all other respects absolute equality and liberty in religious matters prevail. In 1892 the Established Church had an estimated following in England and Wales of 13,500,000, and the Roman Catholic 1,354,000. The Methodist Churches had 800,000 members, the Independents 360,000, and the Baptist 300,000. The Church of Scotland had 599,531 communicants; all other Presbyterian Churches 526,604; the Roman Catholics in Scotland numbered 326,000. In Ireland the Roman Catholic population in 1891 was 3,547,307; the Church of Ireland (Protestant Episcopal) had 600,103 members, and the Presbyterian Churches 444,974.

*Education.*—For a long time Great Britain might fairly have been accused of not providing sufficiently for the elementary education of the growing population. Scotland has had a school law since 1696; in Ireland a system of national education was inaugurated in 1845; but in England the Government contented itself with making *pro rata* allowances to such among the schools as chose to submit to certain regulations. A great step in advance was taken in 1870 by the formation of school-boards. Since that time the illiteracy of the people, as far as this may be judged of from a knowledge of the art of writing, has been steadily decreasing. Scotland is the best-educated section of the United Kingdom, for in 1891 only 3·9 per cent. of the men and 6·4 per cent. of the women were unable to sign the marriage register. In England the proportions were 6·4 and 7·3; in Ireland, 20·4 and 20·9 per cent. In all these cases the proportion of the illiterates is greater among the Roman Catholics than among the Protestants. There were in 1891 throughout the kingdom 30,986 public elementary schools; 5,587,815 children were present at the annual inspection, but the average attendance throughout the year had been only 4,800,857. Government granted (in 1892) £6,263,350 toward the support of these schools, in addition to a payment of £600,054 toward the support of 3,477 so-called science and art schools, which are attended by nearly 250,000 pupils. An academic education may be secured at sixty-eight colleges (1,319 professors, 22,500 students), and there are numerous medical and other professional schools.

*Social Condition and Provident Institutions.*—There is no better standard for measuring the well-being of a population than the quantity of food consumed by it in the course of a year. The data in this respect are incomplete, but they enable us to form some idea of the manner in which the bulk of the population live. The annual consumption per head is about as follows: Wheaten flour, 350 lb.; rice, 9 lb.; potatoes, 330 lb.; meat, 95 lb.; game and poultry, 5 lb.; fish,

42 lb.; currants and raisins, 4·82 lb.; sugar, 56 lb.; tea, 5·4 lb.; coffee, 0·76 lb.; cocoa, 0·57 lb.; spirits, 8¼ pints; wine, 3¼ pints; beer, 242 pints; tobacco, 1·61 lb. The wages of the industrial classes are sufficiently high, as a rule, to enable them to live in comfort, but in many parts of the country the wages of agricultural laborers do not exceed 12*s.* to 15*s.* ($3 to $3.75) a week. The trades-unions exercise considerable power, and they have succeeded in forcing up the rate of wages and reducing the hours of labor. Of provident and co-operative industrial societies there existed in 1890 1,498 with 1,064,316 members, and a capital of £12,272,671. There were also 2,422 building societies with a share capital of £35,296,799. In Ireland none of these societies has taken firm root. The money deposited in savings-banks rose from £160,669,224 in 1881 to £228,967,134 in 1891.

The poor law of England dates from the year 1834, and those of Scotland and Ireland are modeled upon it. Each poor union, consisting, as a rule, of several parishes, is bound to provide for its own poor by granting either outdoor or indoor relief. Schools and infirmaries are connected with each work- or poor-house. The number of paupers on Jan. 1, 1892, was 951,612 (England, 754,485; Scotland, 93,288; Ireland, 103,839), as compared with 1,008,879 on the same day in 1882.

*Political Institutions and Government.*—The government is a constitutional monarchy. The sovereign represents the executive, while legislation is the work of the imperial Parliament. The "act of settlement" settles the succession upon the descendants of Sophia of Hanover, and no change in the act can be made except by consent of Parliament. The heir-apparent since Edward III. assumes the title of Prince of Wales. The Civil List (*q. v.*) granted to the Queen amounts to £385,000 a year, in addition to which she receives the revenues of the duchy of Lancaster (£50,000 net). The members of the royal family receive annuities amounting to £188,000, and the Prince of Wales, in addition, receives the revenues of the duchy of Cornwall (£64,000 net). The royal palaces are Buckingham, St. James's, and Kensington Palace in London, Windsor Castle, Balmoral (Scotland), and Osborne House (Isle of Wight). The royal arms are quartered, and exhibit three lions in red in the first and fourth quarters for England, a red lion in gold for Scotland, and a golden harp in blue for Ireland. The shield is supported by a lion and a unicorn. The motto is *Dieu et Mon Droit.* The king or queen is the fountain of honor. There are orders of chivalry—viz., those of the Garter (founded 1349), of the Thistle (1540), of St. Patrick (1783), of the Star of India (1861), of the Bath (1399), of St. Michael and St. George (1815), of the Indian Empire (1887), of Victoria and Albert (for ladies, 1862), and of the Crown of India (1878), and a Distinguished Service order (1886). The Victoria Cross is bestowed for deeds of valor performed in the field. Parliament consists of the sovereign, the House of Lords, and the House of Commons, and no act obtains the force of law until it has been passed by all three. The House of Lords numbers 479 members, including 6 princes of the blood, the 2 archbishops and 24 bishops of the Established Church of England, 403 peers of the United Kingdom, 16 Scottish representative peers (elected for each Parliament), and 28 Irish peers (elected for life). More than two-thirds of the peerages are of recent creation; only 14 go back to the fifteenth century. The Lord High Chancellor presides over the sessions of the House of Lords. The House of Commons consists of 670 members (495 for England and Wales, 72 for Scotland, and 103 for Ireland). Of these, 284 are the representatives of boroughs, 377 represent rural constituencies, and 9 the universities. In 1885 the right of voting was extended to all householders and to lodgers paying an annual rent of £10. All elections are by secret vote and ballot, and the regulations against bribery and undue influence are stringent. Members are not paid for their services, nor are they able to compensate themselves by an exercise of patronage, as all Government appointments are made for life. The total number of electors (1892) was 6,161,456, as compared with 3,152,910 in 1883. Each English member represents 58,590 inhabitants; each Scotch member, 55,910; each Irish member, 45,677. The sovereign appoints the members of the privy council, the lord mayor of London being the only *ex-officio* member, but public business is in reality conducted by a cabinet council, whose members are likewise appointed by the sovereign, but are responsible to Parliament. Their appointment is consequently virtually made by the party. The members of the cabinet are the first Lord of the Treasury (generally Prime Minister), the Lord High Chancellor (the highest legal official and president of the House of Lords), the Chancellor of the Exchequer, Secretaries of State for the Home Department, Foreign Affairs, the Colonies, War, and India, the first Lord of the Admiralty, the President of the Board of Trade, the President of the Local Government Board, the Postmaster-General, the First Commissioner of Works, the Vice-President of the Council on Education, the Chief Secretary of the Lord-Lieutenant of Ireland, the Secretary for Scotland, and the Chancellor of the Duchy of Lancaster. The legal advisers of the crown are an attorney-general and a solicitor-general, who both go out with the cabinet. In Ireland the crown is represented by a Lord-Lieutenant. (See Ireland.) For details on local government, see England, Scotland, and Ireland.

*Finance.*—The United Kingdom is probably the only state in Europe which has made a serious and successful effort to reduce its national indebtedness, notwithstanding the increased requirements for sanitary, social, and educational reforms. The revenue, which during the first decade of the nineteenth century amounted to £54,374,000 per annum, fell during the fourth decade (1831–40) to £51,339,000, but rose during the ninth decade (1881–90) to £89,600,000, and reached in 1899–1900 a total of £119,839,905. Customs duties are charged upon spirits, beer, wine, tobacco, tea (4*d.* a pound), coffee, cocoa, and a few other articles. Excise duties (countervailing the import duties) are levied upon distillers and brewers, upon passenger-fares (where the fare exceeds 1*d.* a mile), and upon licensed victualers. Death-duties constitute the principal item under "stamps." There is an insignificant land-tax and a duty upon houses valued at £20 a year or more. A property and income tax (6*d.* in the pound) is levied upon the annual value of property and of profits, but incomes of less than £150 are exempt, while an abatement of £120 is allowed on all incomes not exceeding £400 per annum. The gross amount of annual incomes assessed was, in 1871, £465,479,000; in 1899, £758,571,709—the share of England being £653,686,806; that of Scotland, £71,753,602; and that of Ireland, £33,131,301.

The various sources of revenue were in 1899–1900: Customs, £23,800,000; excise, £32,100,000; estate, £14,020,000; stamps, £8,500,000; land tax, £790,000; house duty, £1,670,000; property and income tax, £18,750,000; post-office and telegraphs, £16,650,000; crown lands, £450.000; Suez Canal shares, £834,003; miscellaneous, £2,275,902—total, £119,839,905. Including all local taxes and duties the taxation per head of the population amounted to 47*s.* in 1835, to 57*s.* in 1884, and to 65*s.* in 1892.

The expenditure in 1899–1900 amounted to £133,722,406—viz., charges of debt and other Consolidated Fund services, £25,951,406; army, £43,600,000; navy, £26,000,000; civil services, £22,530,000; customs and inland revenue, £2,800,000; post-office, telegraph, and packet service, £12,841,000. The civil-service charges included £12,563,455 for education, science, and art, and £3,817,765 for administration of justice.

The national debt has rapidly increased after each war, but much has been done toward its reduction. Its capital value, from its origin to the year 1900, has been as follows:

| | |
|---|---|
| At the Revolution, in 1688 | £664,263 |
| At the accession of Queen Anne, in 1702 | 12,767,225 |
| At the accession of George I., in 1714 | 36,175,460 |
| At the accession of George II., in 1727 | 52,850,797 |
| At the commencement of the Spanish war, in 1739 | 46,613,883 |
| At the end, in 1748 | 75,812,132 |
| At the commencement of the Seven Years' war, in 1756 | 74,575,025 |
| At the end, in 1763 | 132,716,049 |
| At the commencement of the American war, in 1775 | 126,842,811 |
| At the end, in 1784 | 243,063,145 |
| At the commencement of the French war, in 1793 | 239,663,421 |
| At the end, in 1802 | 537,653,008 |
| At the Peace of Paris, in Sept., 1815 | 861,039,049 |
| At the commencement of the Crimean war, in 1854 | 769,082,550 |
| Mar. 31, 1857 | 808,108,722 |
| Mar. 31, 1900 | 628,978,783 |

*Administration of Justice.*—The House of Lords, or rather four lords of appeal (law lords), presided over by the Lord Chancellor, is an appellate tribunal for the whole of the United Kingdom, but only as regards civil cases, while a "judicial committee of the privy council" hears appeals from the colonies. See Courts.

The police force of the whole of the United Kingdom numbers 60,668 men. In 1881, 22,544 persons were committed for trial and 15,883 convicted; in 1899 these numbers were 15,150 and 11,863 respectively—a decrease which

is not unfairly ascribed to the general increase of wealth and the beneficial influences of education.

*Army.*—The maintenance of a standing army is dependent upon an annual vote of the House of Commons. The forces are recruited by voluntary enlistment, but all citizens are nevertheless liable to be enrolled in the militia. The men in the regular army are enlisted for three to twelve years, and after the expiration of this term of service they are encouraged to enter the army reserve. The number of recruits enlisted in 1892 was 41,659, of whom 29,238 were natives of England. The militia is likewise recruited by voluntary enlistment, and has its militia reserve. Its training generally extends over four weeks in the year. There are, in addition to these, the yeomanry cavalry and the volunteer corps—the former an ancient institution, the latter formed since 1859. The regular army consists of 31 regiments of cavalry, 110 horse, field, and mountain batteries of six guns each, 72 batteries of garrison artillery, 72 regiments (148 battalions) of infantry, 50 companies of engineers, a telegraph and a bridging battalion, 2 West India regiments (Negroes), etc. The militia includes 139 battalions of infantry, 32 divisions of garrison artillery, and 2 divisions of engineers. Of yeomanry there are 40 regiments; of volunteers, 204 battalions of infantry, 62 brigades of garrison artillery, and a large body of technical troops. To these have to be added the Indian army, and the militia and volunteer corps of the principal colonies.

The effective strength of these forces in the beginning of 1893 was approximately as follows:

| | |
|---|---|
| Regular army | 220,000 |
| Army reserve | 76,600 |
| Militia | 105,000 |
| Militia reserve | 30,400 |
| Yeomanry cavalry | 14,100 |
| Volunteers | 216,000 |
| Native army of India | 162,000 |
| Volunteer corps in India, Ceylon, etc. | 20,000 |
| Canada, active militia | 39,000 |
| Australia, regulars and volunteer militia | 36,000 |
| Cape and other colonies | 10,500 |
| Total | 929,600 |

On Dec. 1, 1900, the total home and colonial troops, exclusive of 66,581 men of the Indian establishment, numbered 610,733. Of these 210,293, exclusive of officers, were in South Africa.

*Navy.*—The navy has at all times been the pet of the nation, which looks upon it as the chief bulwark against foreign invasion. It is, comparatively speaking, a creation of modern times. Queen Elizabeth had the command of only 42 vessels of 17,000 tons; Cromwell left 150 vessels. In 1863 the navy consisted of 567 steamers (including 29 ironclads) and 267 sailing vessels. In the beginning of 1894 there were afloat and in a serviceable condition 77 ironclads of 618,500 tons, 88 protected vessels of 309,915 tons, and 336 unprotected vessels of 198,634 tons. These last included 10 torpedo cruisers, 31 torpedo gunboats, and 147 torpedo boats. In addition to these there were 26 fast merchantmen which have been built expressly with the view of being converted into armed cruisers in time of war. In 1900 there were 15 vessels of more than 14,700 tons, and 1 each of 15,000 tons and 18,000 tons building. In Jan., 1901, the effective navy consisted of 381 ships (37 battleships, 131 cruisers, and 213 gunboats, torpedo boats, and destroyers). To this number should be added 48 modern craft under construction, and 118 old ships of little fighting value, and 11 "reserve merchant cruisers." The navy is manned by 110,680 men (inclusive of 18,800 marines); and there are also available 4,200 men of the coast guard and 28,000 of the naval reserve. The great dock-yards at Portsmouth, Chatham (or Sheerness), Devonport, and Pembroke employ over 20,000 workmen. See NAVAL ACADEMIES and SHIPS OF WAR.

*History.*—On May 1, 1707, the union between England and Scotland was established, and though the Scotch, at first, were highly indignant at this event, they soon became reconciled to it, and now look upon it as a great blessing. For years after the union, intrigues for the restoration of the Pretender (the representative of the exiled Stuarts) disturbed the peace of the country. Queen Anne was succeeded in 1713 by the Elector of Hanover, who took the title of George I. The Whigs, led by Walpole, now regained the ascendency, and a rising in favor of the Pretender, led on by the Earl of Mar in Scotland and the Earl of Derwentwater in England, was speedily crushed (1715). Five years later a commercial crisis, brought about by the South Sea Bubble, wrought ruin in thousands of households. George II. succeeded in 1727, Walpole continuing in power as Prime Minister. He was forced into a war with Spain (1739), who had given offense to British merchants by checking the illicit trade carried on by them in South America. This war terminated ingloriously. Soon afterward Great Britain became involved in the Austrian war of succession. The battle of Dettingen (June 17, 1743) was won, but the victory of the French at Fontenoy paralyzed the efforts of Great Britain during the rest of the campaign, and the Peace of Aix-la-Chapelle (1748) left both nations, as far as territories were concerned, in the position they held before the war. Meanwhile, a second attempt had been made by Prince Charles Edward Stuart to regain the throne, but was crushed at Culloden (1746). During the Seven Years' war Great Britain sided with Prussia, and though 40,000 men, under the Duke of Cumberland, were compelled to surrender Hanover to the French, Clive drove the French from India, while Wolfe conquered Canada (Quebec captured Sept. 18, 1759). George III. reigned 1760–1820, a most eventful period. A war with France and Spain largely added to the extent of the colonial empire (Treaty of Paris, 1763). The government of the Tories caused much dissatisfaction, but it was allayed by the appointment of Pitt, Earl of Chatham, as Prime Minister. An attempt to tax the North American colonies drove them into rebellion, and led to the formation of the U. S. (July 4, 1776). Fox, Burke, and Sheridan were the leading Whig statesmen during this epoch, but the foremost position must be assigned to the younger Pitt, who held office until his death in 1806. In 1793 he declared war against France without any real cause, but simply because his sympathies were anti-republican, and this war can be said to have terminated only with the battle of Waterloo (1815). In this period fell the war with the U. S. (1812–14). An Irish rebellion, assisted by a French force, was an incident of the wars with France, but Great Britain, though suffering occasional defeats on land, finally was victorious. Among the naval battles were those of Cape St. Vincent, Aboukir, Trafalgar (1805), while Vittoria and Waterloo proved great victories on land. These wars had increased the national debt to an immense amount, and led to great distress among the working-classes, whose discontent it was endeavored to suppress by severe measures. With George IV. an era of reform set in. Commercial reforms were introduced by Huskisson and Canning, and an act emancipating Roman Catholics was passed in 1829. After the accession of William IV. (1830) the British reformers gained in strength and a Whig ministry under Earl Grey again came into office, after an exclusion of more than fifty years. This ministry passed the first Parliamentary Reform Bill (1832), decreed the abolition of slavery (1834), and reformed the poor law and the municipal corporations. William IV. died in 1837, and was succeeded by Queen Victoria. Among the statesmen who have swayed the destinies of the country since her accession, the most prominent are Sir Robert Peel, Lord John Russell, the Earl of Derby, Lord Palmerston, Gladstone, Disraeli, and Lord Salisbury; and for a further account of the history of this period, see the articles under these titles. The principles of free trade had their most able advocates in Cobden and Bright, who succeeded in abolishing the corn-laws (1846), and in carrying other measures for the removal of restrictions on trade and commerce. The political institutions of the country have become largely democratized, not only in consequence of parliamentary reform acts passed between 1867 and 1888, but also through Lord Russell's municipal reform of 1835 and Mr. Ritchie's Local Government Act of 1888, which transferred the local administration from the "gentry" to popularly elected bodies. Much has been done to promote education (Foster's School Act, 1870), and the social requirements of the working population have not been neglected. Ireland has occupied a disproportionate share of the House of Parliament, but in spite of the disestablishment of the Protestant Episcopal Church (1869), and of five Land Acts intended to insure the interests of the tenants and to enable them to become owners of the land they till, the agitation for HOME RULE (*q. v.*) is carried on as actively as ever. Of the many wars which Great Britain has been called upon to wage in defense of the real or supposed interests of the empire, that which was jointly undertaken with France in defense of Turkey (Crimean war, 1854–56) was the most formidable, but it contributed noth-

ing toward a solution of the Eastern question. In India a fearful mutiny broke out, but was quickly quelled. Afghanistan was the scene of military operations in 1841–42 and 1878–79; China was compelled by military operations to enter into commercial treaties (1840–42, 1858). In Africa (Egypt) the rebellion headed by Arabi was suppressed in 1882, and an army of occupation has remained there. The Sudan, however, was given up after a fruitless attempt to relieve Khartum, heroically defended against the Mahdists by Gen. Gordon (1885). British troops have also fought in Abyssinia (1867), Ashantee (1873–74), Zululand (1879), the Boer war (1880–81). See PARLIAMENT, ENGLAND, WALES, SCOTLAND, IRELAND, ISLE OF MAN, and CHANNEL ISLANDS; also GREAT BRITAIN, HISTORY OF, in the Appendix.

The area and population of the whole of the British empire, including crown colonies, which are entirely controlled by the home Government; colonies possessing representative institutions, in which the home Government retains control of public officers and retains a veto on legislation; and colonies possessing *responsible governments*, in which the crown appoints the governor only and still retains a veto on legislation, are as follows:

| DIVISIONS. | Area, sq. m. | Population. |
|---|---|---|
| *Europe and Mediterranean:* | | |
| ‡United Kingdom | 120,550 | 37,731,410 |
| †Isle of Man | ..... | 55,598 |
| †Channel islands | 75 | 92,270 |
| *Gibraltar | 2 | 25,870 |
| †Malta | 120 | 165,660 |
| †Cyprus | 3,720 | 289,900 |
| *Asia:* | | |
| *§British India | 1,862,620 | 289,156,000 |
| *Aden, *Perim, §Kamaran | 2,700 | 172,000 |
| §Bahrein islands | 230 | 30,000 |
| †Ceylon (and Maldives) | 25,480 | 3,038,500 |
| *Straits Settlements | 36,250 | 935,000 |
| §Borneo | 79,110 | 525,000 |
| *Hongkong | 29 | 221,441 |
| *Africa:* | | |
| *Gambia | 2,700 | 14,266 |
| *§Sierra Leone | 15,000 | 180,000 |
| *§Gold Coast (and protectorate) | 46,000 | 1,905,009 |
| *Lagos and §Yoruba | 21,100 | 3,000,010 |
| §Niger territories and Oil River | 500,000 | 17,500,000 |
| ¶Orange River Colony | 48,326 | 207,503 |
| ¶Transvaal Colony | 119,139 | 1,094,156 |
| ‡Cape Colony | 272,885 | 1,609,960 |
| *Basntoland | 9,720 | 218,902 |
| †Natal | 20,460 | 543,913 |
| *Zuln and Tonga lands | 17,800 | 201,304 |
| §Bechuanaland protectorate | 386,200 | 80,000 |
| §British Central Africa | 524,000 | 1,600,000 |
| §Zanzibar (protectorate) | 1,200 | 200,000 |
| §British East Africa (Ibea) | 1,000,000 | 6,500,000 |
| §Northern Somali coast | 40,000 | 200,000 |
| §Socotra | 1,384 | 10,000 |
| †Mauritius and dependencies | 881 | 397,637 |
| *St. Helena | 45 | 4,120 |
| *Ascension island | 35 | 360 |
| §Tristan da Cunha | 40 | 61 |
| *America:* | | |
| ‡Canada | 3,438,000 | 4,833,000 |
| ‡Newfoundland (with Labrador) | 162,730 | 203,000 |
| †Bermudas | 20 | 15,100 |
| †West India islands | 13,184 | 1,362,782 |
| *British Honduras | 8,000 | 31,471 |
| †British Guiana | 88,800 | 288,300 |
| *Falkland islands | 6,500 | 1,789 |
| *Australasia:* | | |
| ‡Queensland | 668,497 | 422,776 |
| ‡New South Wales | 310,700 | 1,132,234 |
| ‡Victoria | 87,884 | 1,140,405 |
| ‡South Australia | 903,690 | 320,431 |
| ‡Western Australia | 975,876 | 49,782 |
| ‡Tasmania | 26,216 | 154,424 |
| ‡New Zealand | 104,471 | 670,651 |
| *New Guinea | 90,000 | 300,000 |
| *Fiji | 7,451 | 120,245 |
| §Minor islands in Pacific | 1,460 | 12,000 |

‡ Responsible government. † Representative government.
* Crown colony. § Protectorate, etc.
¶ Military government.

SUMMARY.

| DIVISIONS. | Area, sq. m. | Population. |
|---|---|---|
| Europe | 124,467 | 38,360,708 |
| Asia | 2,006,419 | 294,077,941 |
| Africa | 3,026,915 | 35,467,501 |
| Australasia | 3,176,245 | 4,322,948 |
| America | 3,717,234 | 6,735,442 |
| Totals | 12,051,280 | 378,964,240 |

E. G. RAVENSTEIN.



**Great Cacapon**: See CACAPON.

**Great Catawba**: See CATAWBA.

**Great-circle Sailing**: a method of navigating a ship so that her course will be along an arc of a great circle which joins any two points on the earth's surface, that is, along a circle the plane of which extended through the globe passes through its center and divides it into two hemispheres. That this is the shortest possible distance between any two points might be demonstrated on mathematical principles. It may be made apparent, however, by measurement on an artificial globe; for any one may satisfy himself of its truth by stretching a thread between two places in nearly the same latitude and considerably distant in longitude. Theoretically, then, this is the true line of sailing for ships. The foundation of their course must be the track which the spherical nature of the globe points out as the shortest distance between two given harbors. But a mere inspection of the globe shows at once that this rule, based on its spherical form, is modified by geographical considerations, by the natural projections of the continents, and by islands and rocks which lie across or near the great-circle arcs. The experience of the navigator has further taught him the prevalence in different quarters of the world of constant and powerful winds and currents, by making use of which on one course, or avoiding them on another, he gains more than by following rigorously the great-circle arc. The navigator's rule therefore must be that he sail his vessel on a great circle wherever the land, rocks, or shoals do not intervene, or where the prevalence of powerful currents or adverse winds will not lessen his speed more than the difference between the distance on a great circle and that of another route more favored in these respects. When compelled to deviate from a rigorous following of this shortest line, he may gain time by resorting to composite sailing; that is to say, to sailing on successive arcs of great circles between intermediate points selected to suit the winds, currents, and projections of land. His inquiry will be which course will be the shortest, taking into view all the impediments in his way.

The idea of sailing on the arc of a great circle must have occurred to many as soon as the earth was known to be a sphere. Sebastian Cabot planned his voyages on this true idea. The earliest English systems adopted it. Until the invention of Mercator's chart (in 1569) distant voyages were thus made in preference to sailing on what is known to mariners as the rhumb or spiral curve, which cuts all the meridians at the same angle. The progress of navigation up to Mercator's day may be thus briefly stated: When the invention of the compass first gave to ships their unfailing guide and covered the seas with commerce, the cross-staff and the astrolabe gave the latitude approximately by observations of the sun and stars. But the gross distortions of the sea-charts in use, especially in voyages remote from the equator, misrepresented the sphere and misled the mariner. His next recourse was to globes, of which some famous pairs were made, having on them the tracks of distant voyages. Yet the plane chart, being more easy and convenient for daily use, kept its place until Gerard Mercator, of East Flanders, supplied his improvement. The directions of the compass or "compass courses" on his charts are straight lines; and, as the mariner works most easily on a plane surface, he could lay down his courses with a parallel rule on this chart, on which he found the meridians parallel, and yet proportional to the parallels of latitude. Mercator's method at once found favor, and brought great-circle sailing into comparative disuse. For, besides the advantages we have named for the eye which could see the whole track and determine how far it could be followed, there were other practical reasons against great-circle sailing. There was the very severe labor of calculations in an age before the invention of logarithms, and a yet greater difficulty in determining the ship's position in longitude, until the precise places of the heavenly bodies were given in nautical almanacs, and until the subsequent introduction of the lunar method. The usual mode of navigation was to steer on a line which would bring the ship to the latitude of her destination, when she would be about midway, and then to sail on that parallel until the port was reached—a method even now frequently practiced.

For the reasons which have been given, and because the great circle projected on Mercator's chart appears not as a straight course, but as a curve, and *seemingly a longer* course than the rhumb, the latter idea until recently has

continued to prevail, notwithstanding the greater distance which it is known the ship must go over. Within the last few years, however, intelligent navigators have begun to substitute the great-circle route wherever practicable. The improvements in the aids to navigation have removed the old difficulties. In addition to the use of logarithms, the tables furnished by the astronomer-royal for sweeping an arc of a circle on Mercator's chart approaching the projection of a great circle, and such methods as those found in the tables of Towson and others, have relieved the navigator of the old tedious processes. The accuracy of the star-places in our nautical almanacs, and the perfection of the chronometers of our day, aid in determining a ship's longitude as closely as her latitude, and our increasing knowledge of ocean metcorology lends a most valuable assistance in regard to the winds and currents. Beyond all this, the introduction of ocean steamers has changed the whole aspect of navigation. It is an age in which, as the eminent hydrographer Fitzroy remarked, "to steer on the arc of a great circle is much required since steamers compete so keenly on the ocean," valuing even an hour's gain in voyages of great length. The routes recommended by Capt. Maury between a number of prominent ports are chiefly great-circle routes. The great steam-packets adopt this method. For the introduction of steam has enabled the mariner to shape his course and lay the ship's head whichever way he pleases, independently, in a great measure, of winds or of deflecting currents. In the case of distant voyages, as from Great Britain to Australia, the great-circle route may abridge the distance more than 1,000 miles, and in shorter distances, where the gain in distance is small, the gain in time may be important. Even for sailing vessels a knowledge of great-circle sailing will often greatly aid the navigator in shaping his course. A striking illustration is offered in the extreme case of a ship sailing from a point in high latitude to another on the same parallel 180° distant in longitude. The great-circle route is across the pole, while the rhumb-line is along the small circle, the parallel of latitude E. or W., the two courses differing 90°. Since any arc of a small circle drawn between the two points, and lying between the pole and the parallel, is less than the arc of the parallel, a ship sailing on one of these small circles nearly W. would make a less distance than on the Mercator's rhumb or parallel due E.

What seems most needed for great-circle sailing is an improvement in the construction of charts. The present sea-charts, constructed almost without exception on Mercator's projection, do not show great circles to the eye directly. The mariner wishing to sail on one has to lay down the arc on which he usually sails on short courses. His method is to compute the great-circle course at least once a day, making allowance in the intervals for the change of azimuth. But these constructions and computations constitute a task too tedious for the ordinary navigator. A partial remedy for this is supplied by Chauvenet's great circle protractor; the complete remedy would be the construction of charts on the gnomonic projection. On this projection the eye is supposed to be at the center of the sphere. The arcs on the circumference are on planes which are tangents to that center. Thus the great circles are projected as straight lines. Charts on this projection are as conveniently used by the navigator as those on Mercator's projection. The Government of the U. S. has ordered the preparation of such sea-charts, under the direction of its hydrographic office. For full information on great-circle sailing, see Maury's and Coffin's *Navigation*; Godfray and Fitzroy's pamphlets; Airy in *Monthly Notices Roy. Astron. Soc.*, vol. xviii.; Towson's *Tables*; *Nautical Magazine* for 1847.

CHARLES H. DAVIS, REAR-ADMIRAL U. S. N.

**Great Falls**: city and port of entry (founded by Paris Gibson in 1887): capital of Cascade co., Mont. (for location, see map of Montana, ref. 4–F): at the junction of the Sun and Missouri rivers, near the falls of Missouri, and on the G. F. and Canada, the Gt. Northern, and several branch railways. It is in an agricultural region, and near by are rich mines of gold, copper, silver, lead, iron, and coal, and quarries of sandstone. It contains 6 churches, Y. M. C. A. building, several public schools, public library, 6 banks, an opera-house, street railways, electric-light, telephone, water, and sewage plants, and 2 daily and 4 weekly newspapers. An immense dam at Black Eagle Falls gives abundant power for manufacturing. For smelting silver and copper there are 3 plants that cost $5,000,000. Pop. (1890) 3,979; (1900) 14,930.

EDITOR OF "DAILY LEADER."

**Great Fish River**: a large stream in British America, flowing some 500 miles in a N. E. course to Cockburn Bay, an arm of the Arctic Ocean. It is not navigable. Its mouth is in lat. 67° 8′ N., lon. 94° 40′ W. Another river of the same name in the Cape Colony, Africa, rises in the Snowy Mountains and enters the Indian Ocean in lat. 33° 25′ S., after a course of 230 miles.

**Great Grimsby**, grāt′ grimz′bi: parliamentary and municipal borough of England, in the county of Lincoln, on the estuary of the Humber (see map of England, ref. 7–J). It has the only good harbor, with the exception of that of Hull, on the east side of England. Grimsby is supposed to be the place where the Danes landed on their first invasion of England. It has an immense fishing-trade, and is connected by steamers with Baltic ports. The imports of merchandise at this port have an annual value of about £4,500,000, and the exports £7,750,000: entrances and clearances of merchant marine, about 3,500 vessels each annually. Besides the fisheries the principal industries are ship-building, flax-dressing, and brewing. The borough returns one member to Parliament. Pop. (1891) town, 51,876; parliamentary borough, 51,691; (borough 1901) 63,119.

**Great Kanaw'ha River**: a river of West Virginia, formed by the junction of Gauley and New rivers; flows N. W. for 98 miles through a picturesque region abounding in coal, iron, and salt, and joins the Ohio river at Point Pleasant. By a system of locks and movable dams, constructed at a cost of $4,000,000, slack-water navigation is maintained on it throughout the year to within 2 miles of its source.

**Great Manitou'lin**: an island belonging to Ontario; in the northern end of Lake Huron, S. of the North Channel; 140 miles long and of very irregular outline, especially on the north side. It is well wooded, and contains several large lakes and several villages. M. W. H.

**Greatorex**, ELIZA: See the Appendix.

**Great Pedee' River**: a river formed in North Carolina by the union of the Rocky and the Yadkin rivers. It flows S. S. E. into South Carolina, and reaches Winyaw Bay. In its lower course it is often called the Waccamaw, properly the name of an affluent. The principal tributary is the Little Pedee. It is navigable 150 miles.

**Great Salt Lake**: the largest lake in the GREAT BASIN (*q. v.*), in Northwestern Utah, between the Rocky Mountain system and the Sierra Nevada. The lake was examined by Fremont in 1843, surveyed by Stansbury in 1849–50, and studied later by several Government geologists, especially by King and Gilbert. It is about 80 miles long and 30 to 50 wide; it is a very shallow sheet of water, not over 50 feet at deepest, and less than 20 feet on the average, lying with flat shores on a desert plateau, 4,250 feet above the sea. Its dimensions vary greatly, following variations in rainfall, the water being low from 1840 to 1860, about 8 feet higher from 1870 to 1880, and low again in 1890. Its area increased from 1,750 sq. miles in 1850 to 2,170 in 1869. In earlier Pleistocene time the lake was much larger. (See BONNEVILLE, LAKE.) Its tributaries are the Bear river from the N. E., Weber from the E., and Jordan from the S. The lake waters are densely salt, their specific gravity being 1·1+. The saline contents vary from 14 to 22 per cent., according as the lake is high or low. The dissolved substances are chiefly common salt, of which the lake is estimated to contain 400,000,000 tons, and of which some 20,000 tons have been taken from it annually. No fish live in the lake, its fauna being limited to a small brine shrimp (*Artemia gracilis*) and the larva of a fly (*Ephydra gracilis*). A railway runs from Salt Lake City to Black Rock (17 miles), an extensive bathing establishment, visited by many persons for the novelty of a bath in the dense lake, in which the body easily floats, head and shoulders above water. W. M. DAVIS.

**Great Slave Lake**: a body of water in British America, between 60° 40′ and 63° N. lat., and 109° 30′ and 117° 30′ W. lon. It is very irregular in outline, is 300 miles in greatest length, 5 miles in breadth, abounds in islands, is frozen over for half the year, and has in part high wooded and rugged shores. The rivers Hay, Peace, Athabaska, English, Slave, Linah, and other large streams swell its waters, which are discharged into the Mackenzie river.

GREAT SLAVE RIVER flows 300 miles from Lake Athabaska to Great Slave Lake. Its shores are in part alluvial and fertile. Its upper course is broken by rapids.

**Great Valley** (of Virginia and Tennessee): See APPALACHIAN MOUNTAINS.

**Great Wall of China**: See CHINA, GREAT WALL OF.

**Great Weever** [*weever* is either another form of *weaver*, deriv. of *weave*, or from O. Fr. *vivre*, a kind of fish (whence

Great weever.

older Eng. *wiver*)]: a European marine fish of the family *Trachinidæ*; the *Trachinus draco*, a small fish, dreaded for the serious wounds its spines inflict. Whether any venomous substance is secreted by the fish and introduced by means of the spines is a point which has not been settled.

**Greaves**, JOHN, M. A. (*Gravius*): mathematician and antiquary; b. at Colmore, Hants, England, in 1602; became a fellow of Merton College, Oxford, 1624; M. A. 1628; was Professor of Geometry in Gresham College, London, 1630–43; traveled extensively in the East, making archæological and scientific collections, 1637–40; was Savilian Professor of Astronomy at Oxford 1643–48, but was ejected by the Puritans. Among his works are *Pyramidologia* (1646); *Discourse on the Roman Foot and Denarius* (1647); *Elementa Linguæ Persicæ* (1649); *Epochæ celebriores* (1650); *Astronomica quædam* (1652); and miscellaneous papers. D. in London, Oct. 8, 1652.

**Grebe** [from Fr. *grèbe*, grebe, from Breton *krib*, comb, crest]: a common name for the diving birds of the family *Colymbidæ*, or *Podicipedidæ*, characterized by the absence of a tail, flatness of the tarsus, and broadly lobed toes. The neck is long, the bill, in most species, slender and sharp, the wings rounded and rather weak, the plumage shining and silky. Grebes are principally inhabitants of temperate regions, and are found on both fresh and salt water, resorting invariably to the former in the breeding season. They are most expert swimmers and divers, but, owing to the fact that the legs are placed far backward, these birds are awkward on land. Grebes breed in marshes and ponds, building a floating nest of aquatic plants, so low that the eggs are sometimes partly in the water.

Grebe.

The differences between the spring and winter plumage of the grebes are very great, the colors being plainer, and the singular crests and ruffs with which some species are adorned during the breeding season being absent. The great crested grebe (*Colymbus cristatus*), which is confined to the temperate regions of the Old World, is among the largest species of the group, being 2 feet or more in length. The upper part of the body is a shiny blackish brown, with a light patch on the wing, the under parts are satiny white, marked with red and gray upon the sides. The cheeks and throat are white, a collar on the neck is rusty red.

The commonest species of the U. S. is the little-eared grebe (*Colymbus auritus*), which is widely distributed throughout North America. The little grebe, or dab-chick (*Colymbus minor*), only 9 or 10 inches long, is common in Europe, and represented in America by a very similar bird (*Colymbus dominicus*.) The pied-billed grebe (*Podilymbus podiceps*), readily distinguishable by its thick, short bill, is found throughout the greater portion of North America, and is very abundant in the Eastern U. S. The silky plumage of the under parts of various species is much used for the manufacture of muffs and trimming for cloaks. The marvelous dexterity of grebes in swimming and diving has earned for them the common names of dipper, water-witch, and hell-diver. They are among the few birds which possess the power of sinking the body in the water, leaving the head and neck alone projecting. F. A. LUCAS.

**Grecian Architecture**: the art of building as developed in Greece and her colonies. The special characteristic of Grecian buildings is extreme simplicity of disposition and of construction, combined with extraordinary delicacy and refinement of proportion and detail. A temple like the Parthenon contained no windows, no chimneys, and no second story more extensive than a gallery on each side within; it had no vaulting of any sort and no arches; there was no mortar in its walls, which consisted, like the columns themselves, of block laid upon block of stone or marble; its roof was a plain gabled roof, running from end to end; its plan was no more elaborate than this—that a broad portico surrounded a plain inclosed oblong space divided across once or twice. The only principle of construction in the whole edifice was vertical support; it was all post-and-beam building of almost the most primitive type. The thoughts of the builders were thus left free for the study of minute refinements of adornment. It is clear that a great deal of thought was expended on the determination of the number and exact curve of the flutings of the column; to the *entasis*, or almost invisible outward swell of the bounding line of the column; to the *echinus*, or rounded part of the capital in the Doric style, with its very subtle convex molding, rounded boldly above and coming almost flat below, where it is nearest and opposite to the eye, and finally cut off sharply by three or four strongly drawn dark lines, which separate the outward swell of the capital from the inward-tending slow curves of the shaft. No one of these features is very much varied in the different temples; they are always nearly the same; but in minute differences of proportion, curve, and contrast the builders found constant employment for their decorative power. So in the slight and shallow carving which was applied to some few flat surfaces and to some moldings, only about a dozen different kinds of patterns were in use during a great epoch to be measured only by centuries; but the skillful and tasteful decorative artists of the time found employment enough in varying very slightly the outline and the section of those simple leaf-patterns and meanders. They were in search of effect. Their object was to produce a strong general impression upon the mind. Obviously it was more feasible to do this by clinging to one never-changing type and merely elaborating it and modifying it, toning down this detail and emphasizing that one, than by trying novel methods of design. They were doing on a very large scale what every designer does in a small way; they were engaged in working up the ideally perfect simple, oblong, columnar, gable-roofed building. We may wonder at their patient sticking to one thing so long, but we are not in doubt as to what they were trying to do.

Thus, in the celebrated curved stylobates and sloping columns of the Parthenon, they were devoting infinite care and keen perception to a very common device. A long, straight, horizontal line is apt to seem to sag downward, and architects in modern times screw up the tie-beams of their church roofs to a *camber*, to overcome that impression and remove it by contradicting it. So the Parthenon builder set his marble steps at the foot of his colonnade a few inches higher in the middle than at the ends, and carefully smoothed the long, slight curve between. So the corner columns are set a little out of the true vertical, they slope inward a very little; and why? Merely that the eye may not fancy that it sees the upright shafts diverging a little at top as if about to separate and fall outward, as might easily appear but for this device.

It must be pointed out that this contentment with simple and often-repeated architectural features came of the overwhelming importance in the Grecian world of realized human sculpture. With the Greeks, sculpture did not develop itself out of building, but grew up apart. Figure sculpture is not with them a greater and richer architectural adornment; it is an art by itself, concerned with the nude form of man and woman, and with drapery cast about the form of man and woman. The builder provided two or three places in his building where such sculpture might be set up—that is to say, the two *pediments* for statues "in the round"; the *metopes* for reliefs, which indeed were often very high reliefs, almost statues, in their conception; and certain flat spaces of *cella* wall for lower reliefs when asked for. Many a temple had but little of this sculpture; some temples had none of it; but the builder and the carver of formal leafage and the like did not on that account try to increase the richness of their own work. It seems not to have occurred to them that architectural carving might approach nearer to nature or take

more immediate inspiration from nature. If the life-like gods and heroes would come to their walls and gables, well; if not, there was still no reason why the adornment by means of sharply cut straight lines, slightly raised small circles, little flattened balls surrounded by deep grooves and alternating with sharp points and the like—why such adornment as that, or even the conventional leaf-ornament near it, should be mingled with freer and more expressive sculptured forms. They stopped short, awestruck by the splendor of fully developed sculpture of the human form, removed by this awe of theirs from all desire to work up leafage and blossoms, birds and beasts, or even man in a more picturesque and less purely sculptural treatment, into ornament for their simple buildings. To erect a most delicately chiseled and carefully built frame for sculpture was clearly the chosen problem of the artist in architectural forms, nor did he care much for any other.

The free use of painting did not change the conditions of the problem at all, for it was used alike on the sculpture itself and on all parts of the building. It may well be, however, that this painting gave to the whole composition a unity which we can not perfectly understand. As we conceive the front of a temple, with the immense group of statuary, above life-size, in its gable, this statuary is well set to be seen, and is well framed by the building; but may not the painting have brought all together into a greater harmony and made it more perfectly one composition than is conceivable without it?

In these remarks we have considered rather the temples of Doric style than the fewer Ionic, or than the very few Corinthian structures of true Grecian origin. The Ionic buildings seem to be of a more sophisticated style, more self-conscious, more deliberately architectural, less *naïf* and simple. The builders of the Ionic temples, abandoning in great measure paint for contrast of color in the marbles used, as in the Erechtheion, or carving moldings into patterns in places where the Doric style left all plain, in simple parallel members, or working at the perfecting of an elaborate capital with spiral volutes, instead of the plain round cushion of the Doric style, seem to have been trying to make their style more comprehensive and more in control of its own sculpture than was the Doric.

In this connection it is noticeable that the two or three best-known attempts at sculpture closely allied to the architecture are connected with Ionic buildings. The caryatides of the Erechtheion at Athens, the *columnæ cœlatæ* or adorned columns of the great temple at Ephesus, and the gigantic friezes at Pergamon will at once suggest themselves. In the first instance draped female figures serve as pillars, and carry on their heads an entablature especially designed for its unusual position—much reduced in the number of its parts and simplified. These figures are of the noblest and most appropriate design, and are of the highest value as showing what the Greeks could have done with architectural sculpture as distinguished from that which is independently conceived. In the second instance, human figures in relief are carved upon the lowest part of the shafts of some, not all, of the columns of the external row—a poor device, in no way worthy of imitation, but suggesting much as possible. In the third instance, a composition of the most original and indeed unique character results. (See PERGAMON and SCULPTURE.) All these are of Grecian origin and of the time of Grecian supremacy. What was done under the Roman dominion, in this style and in the Corinthian, seems to have been a fairly natural working out of that general scheme, an emancipation of post-and-lintel architecture from its subservience to sculpture. That this was done without the amazing refinement of the earlier work can only be regretted. Epochs of great architecture have been few; the Greek epoch had closed before the Roman demand for temples began, and no Romano-Greek epoch was to follow until the new world began under the Byzantines.

RUSSELL STURGIS.

**Gre'cian Games**: contests of skill, endurance, or strength among the ancient Greeks. Young and vigorous societies, like children and youth in general, indulge freely in play, and accord great importance to sports and shows. It has been argued that in both cases the readiness to expend physical vigor and mental ingenuity on exercises from which no material benefit is expected proceeds from a surplus of vitality. Schiller pointed out that the same craving for relief in action, which he calls the sportive instinct (*Spieltrieb*), is at the basis of all art that is not purely utilitarian. The designation of *play*, which still clings to the most serious musical and dramatic performances, tends to confirm his view. The energy, then, with which the ancient Greeks as a nation applied themselves to a great variety of private and public sports may serve as an additional evidence, if any were wanted, of their exuberant vitality. It is not necessary to assume that the popular sports were instituted and fostered because of incidental benefits supposed to arise from them; for sports conducted for a purpose cease to be pure recreations, and so generally lose their hold on popularity. Also it will be observed that the arguments advanced by advocates for the furtherance or toleration of particular sports, as that cock-fighting stimulates military valor (Themistocles), or that the object of horse-races is to improve the breed, are of a specious sort. Still, sports so popular as to become social and public institutions have rarely been such as contemporary public opinion condemned, whatever might be the feeling of moralists, philosophers, and legislators.

It is to the credit of the Grecian spirit that bloodshed and brutality or revolting exhibitions found no place in their public amusements, as was the case, e. g., with the Latin and Etruscan peoples, or as has been the case among the Latin and Saxon peoples, not to speak of Africans or North American Indians. Yet everything here also is relative. The same Oriental sense of dignity which can not understand why Europeans should descend to do their own dancing found the promiscuity of the Greek arena very plebeian, and this feeling was shared by the Romans. Again, the chances of serious injury and even death incurred voluntarily in the Greek games make them more comparable with mediæval tourneys than with modern amateur exhibitions. Least in conformity with customary Oriental or Roman or Christian ideas was the indifference of the Greeks to exposure of the person, or nudity. *Græca res est nihil velare.* But so far from being a rapidly disappearing relic of a savage condition, this indifference was with the Greeks of classical times largely an acquired one, due on the one hand directly to the habit of gymnastic exercises, and on the other to the great limitation of intercourse between the sexes. It is probably safe to say that where now a change of clothing is made for convenience in physical exercise, a Greek would not have scrupled to doff every vestige of clothing. And it must be remembered that physical exercises engaged a thousandfold more participation and attention with the Greeks at large than among the modern civilized nations. Another point to be noted in relation to Grecian games is the keen spirit of rivalry that seems to have animated the Greeks in every sphere of action. "Ever to excel and keep himself superior to others" (αἰὲν ἀριστεύειν καὶ ὑπείροχον ἔμμεναι ἄλλων), the admonition of the aged Peleus to his son Achilles on his departure for Troy, is the quintessence of the Greek idea of successful living. For this no effort was too intense, no sacrifice too great. Nor was any activity too lofty and sacred, or yet too trifling, to be subjected to the rules governing competitive contests; so the chanting of hymns to the gods at their festivals, instances of heroism in battle, honorable political activity (often honored at Athens by the award of a gold wreath worth 1,000 drachmas). Artistic talent also was enlisted in organized contests; the musician, the poet, the painter, the sculptor were pitted against rivals of their own craft, judged by juries of experts, and awarded prizes, most commonly of an honorary rather than of a material value. The great Attic dramatists and their works were, so to speak, products of the competitive masques held in honor of Bacchus. Pindar and Corinna sang original lyric compositions against each other in a Bœotian poetic contest. Dubious tradition recorded a similar set contest at Chalcis, Eubœa, between Homer and Hesiod, the epic poets. A perhaps equally dubious tradition represents the sculptors Phidias and Alcamenes as competing with each other by means of a public exhibition of models or statues, and that such contests were not unknown among sculptors of that age is attested by the boast of Paionios, inscribed on the pedestal of his *Flying Victory* at Olympia, that "he also won a victory in fashioning the finials for the (great Olympian) temple," as against the same Alcamenes, probably. The competitive public exhibition made by the painters Zeuxis and Parrhasius is a well-known story. It is certain that these keen rivalries served as a sharp stimulus to the artists called upon to compete, and indirectly hastened the progress of each art as a whole. But at the same time it must not be forgotten that the natural development of an art or of

an artistic form was at times retarded by the rigidity of the rules governing set contests. Take, for instance, the rule adopted at Athens for the theatrical exhibitions, by which the number of actual actors in any piece was limited to two and later to three. Or the narrow compass of notes, not exceeding that of the human voice, within which Greek instrumental music moved and had its being. The last form of the Greek lyre or cithara had but eighteen strings in all. Free modulations on an instrument of less were severely reproved in the fourth century B. C. In the sixth, the Spartan judges gave the greatest living musician, Terpander, the option of cutting the lowest or the highest of the eight strings they counted on his instrument, because the rules formulated under his own direction at an earlier date allowed but seven. More slight and ephemeral was the interest of sundry curious public and private contests held in popular favor, such as the beauty shows of women occasionally instituted in Greek rural communities, a custom of which the tale of Trojan Paris and the three goddesses seems a poetic precipitation. Banquets were enlivened by rivalry at the game *kottabos*, a contest of marksmanship in which the lees in the drinkers' cups furnished the missiles, and a resonant disk or other metal contrivance the target. The competitive wake that often finished off the banquet in the "wee sma' hours" involved the carrying off of a prize cake by the man who could keep his eyes open the longest. Sports which to-day would be adjudged very secular indeed, when they had in them artistic elements, were not held unworthy of recognition as obligatory features of festivals in honor of the gods, or of the heroic dead at funerals and funeral anniversaries. "They honor thee with set contests in song, in dancing, and in boxing," are words occurring in the Homeric hymn to Apollo (v. 149). The term *Grecian games* most commonly suggests these contests (*ἀγῶνες*), as the most popular among the public amusements. For this reason, and because of their greater peculiarity, they demand more attention in this article than the impromptu and unpretentious games of Greek children and of Greek adults in moments of relaxation from cares and social restraint.

*Gymnastic Exercises.*—In the eighth book of Homer's *Odyssey*, and in the twenty-third book of the *Iliad*, descriptions of the gymnastic exercises that were ordinarily subjects of competition at large festival gatherings held in heroic times occur with abundance of detail. These passages afford a sufficiently exact picture of the sports themselves and of the customs connected with them, and also, incidentally, of the esteem in which proficiency in the various sports was held. The occasion in the *Odyssey* is the entertainment of Ulysses by the Phæacians and their king; in the *Iliad* it is the funeral of Patroclus, and Achilles is the giver of the games. In the *Odyssey* (viii., v. 57 to v. 380) there is first a sacrifice of sheep, swine, and oxen. The assembly dines on the meat of these when roasted, and presently listens to an epic ballad sung by the court poet with instrumental accompaniment. Next contests in boxing, wrestling, leaping, and running are announced. Sixteen Phæacian youths enter the lists. The foot-race is first, on a course measured off on the dusty plain; the winner reaches the goal a furrow length ahead of the rest. Wrestling and leaping follow; single winners are named. Elatreus wins in the disk-throw, not announced in the programme, and a son of King Alcinous in boxing. Finally Ulysses tries a throw with a heavier stone than was used by the Phæacian contestants, and far outthrows them. He boasts equal proficiency with the bow and at the spear-throw, in answer to a previous insinuation that he was no athlete (= gentleman), and the Phæacians tell of their nautical skill, but there are no more contests. Instead, the nine judges prepare the performance of an intricate dance, footed by young Phæacians to a new song by Demodocus, and followed by another dance varied with ball-play by two sons of Alcinous. In the *Iliad* more stress is laid on the prizes offered by Achilles to each competitor, but of course differing in value. These are women, horses, mules, oxen, new bronze caldrons, and ingots of gold and iron. There is a chariot-race of five heroes, who drive their own spans around a distant turning-post. Then a gloveless boxing-match, two wrestling-bouts between Ajax and Ulysses resulting in a tie, a foot-race of three entries, and spear-throwing. The question of a foul is settled by an appeal to oath. Other contests narrated (vv. 798 to 893), as putting the (iron) shot, pigeon-shooting, and a joust in armor between single combatants for first blood, appear due to interpolation, not being conducted under the same rules, nor coinciding with Nestor's reminiscences of his own prowess, in the same five contests named above, at the funeral games of a king of the Epeians. The historic period knows only the same six exercises as are played here, including the disk-throw. These and dancing are the physical exercises taught in the schools and practiced at the public games. But the rules are more specific, and there are many variations; for the principal ones, see article on OLYMPIAN GAMES. Other separate articles deal with the ISTHMIAN, NEMEAN, PANATHENAIC, and PYTHIAN GAMES. In seaside towns water sports, swimming and rowing races, often furnished entertainment. Archery seems to have fallen quite out of favor.

*Children's Games.*—Greek babies played with rattles, and a little later with tiny imitations of houses, household utensils, wagons, boats, animals, and men. Knowing youngsters fashioned their own toys of clay, wax, leather, wood. Imaginative little boys rode sticks for horses, or played soldiers in imitation of their fathers. Little girls dressed and tended their dolls, jointed or unjointed. Other toys were metal hoops, furnished with rings to jingle, and the same varieties of tops familiar to us: hand-spinners, whip-tops, string-spinners; also buzz-tops of clay. The others were of wood, and had specific names. The skipping-rope seems to have been unknown. Rope and wooden swings are mentioned, the latter presumably see-saws. Tame and untamed quadrupeds, birds, reptiles, and insects harnessed to little wagons and otherwise persecuted deserve mention. Games with knuckle-bones, dice, and coins, of skill or chance, merge into gambling, and so remain in great favor with adults also. The precursors of most modern catch games can be identified. But the game of games, in equal favor with Greek boys, girls, and adults, was ball. Special ball-grounds (*σφαιριστήρια*) were reserved for it.

The principal ancient authority is the *Lexikon* of Julius Pollux; the best modern account is given by K. F. Hermann, in his *Lehrbuch der griechischen Antiquitäten*, vol. iv., ed. Blümner; see also Guhl and Koner's *Life of the Greeks and Romans*. ALFRED EMERSON.

**Grecian Mythology**: the collective myths of the Greeks. Mythology was so closely interwoven with Grecian civilization in general that there is hardly any Greek author from whose writings something may not be learned concerning the Greek gods. Poets and philosophers, historians and orators, mathematicians and astronomers—all have something to say about their gods, and thus the whole Greek literature may be mentioned as the first source for the study of Grecian mythology. Another source, as important and almost as rich, is the Greek art. It is hardly too much to say that without the aid of the Greek sculptors a true appreciation of the manner in which the Greeks conceived of their gods could never have been attained. The love-stories of Zeus are of a character so light and frivolous that, in spite of their bright beauty and the brilliant symbolization to which they invite, they seem altogether incompatible with the idea of the Father and Ruler of the world. But after seeing the head of Zeus as modeled by Phidias, one understands that these stories form only a subordinate element of the Greek idea of the king of the gods. More direct sources of information are the writings of the old Greek and Latin mythographers, who collected, systematized, and interpreted the myths. The most important among the Greeks are Apollodorus, *Bibliotheca*; Conon, *Narrationes*, an epitome of which is preserved by Photius; Ptolemæus, *Nova historia*; Parthenius, *Narrationes Amatoriæ*; Antoninus Liberalis, *Transformationes*; Joannes Pediasimus, *De Herculis laboribus*; and Nicetas, *Deorum cognomina*; among the Latins, Hyginus, *Fabulæ*; Fulgentius, *Mythologiarum Libri Tres*.

With Hesiod and Homer the formation of the myths is finished; the ideas are individualized into perfectly plastic figures and perfectly epic actions. With Euripides and Plato the dissolution of the myths has begun; the forms are broken asunder and considered only as symbols of the ideas. On being transferred from Athens to Rome the Greek myths hardly underwent any other changes than that of names, though the Greek and Roman gods were by no means identical: Cronus was called Saturnus; Zeus, Jupiter; Poseidon, Neptunus; Ares, Mars; Hephæstus, Vulcanus; Hermes, Mercurius; Hera, Juno; Athene, Minerva; Artemis, Diana; Aphrodite, Venus; Hestia, Vesta; Demeter, Ceres; Dionysus, Bacchus; Leto, Latona; Persephone, Proserpina; Selene, Luna; Eros, Amor, etc.

Two of the most interesting points of a mythology are its cosmogony and its eschatology, or its doctrines concerning that which goes before and that which follows after life on earth. The ideas which the Greek mythology contains of the origin of the world are very remarkable, and their symbolizations very suggestive. Uranus (heaven) and Gaia or Gæa (earth) arose out of chaos, and their children were the wild and unruly powers of nature, the Titans. One of the Titans, Cronus (time), who eats his own children, slew his father and ruled the world for some time. But Uranus had cursed his sons, and the curse was fulfilled. Zeus, a son of Cronus, rose against his father, and, after a horrible contest, which convulsed the whole world, he confined him and the other Titans in Tartarus, and raised his throne in Olympus, in the light-region above the sky. Much weaker are the ideas of the Greek mythology concerning that which will take place after death, though in course of time they become very elaborate. To the dying man Hermes came and led him to Hades, the realm of shadows, where the deceased live forever, but live a bloodless life. Achilles said of it that he would rather be a swineherd on earth than the king of Hades. Later, the poets and philosophers tried to bring some life into this dead, monotonous, shadowy region. When the deceased had paid his obolos, a small coin which his children or friends had placed in his mouth, Charon would ferry him over the Styx which flowed between life and death and surrounded Hades. Arrived at the other side of the Styx, he had to pass by Cerberus in order to gain the large plain where Minos sat to judge the coming. According as the judgment read, he then turned either to the left into Tartarus, where Tantalus, Ixion, and others were tortured, or to the right into the Elysian Fields, where there was a never-setting sun and spring twice a year. But these ideas of a final judgment and an eternal punishment or reward never obtained a fast hold of the conscience of the Greek people. They were a dream, not a conviction.

From Olympus Zeus reigns over the world and mankind. After the fall of Cronus his three sons divided the realm. Zeus chose the upper region, the heaven; Poseidon, the ocean; and Pluton, Hades; the earth was common to them all. But, in spite of this division, Zeus is the highest ruler, the king and father of the gods. What the myths have to tell of him is mostly love-affairs, but in these stories courtship seems only to be a form by which different ideas, generally physical, are symbolically represented. Thus he falls in love with Io, the wanderer, the moon. But his wife, Hera, the earth, being jealous, transforms Io into a cow, the crescent resembling a pair of cow's horns, and puts Argos with the thousand eyes, the stars, to watch her. Hermes, the god of the dawn which makes the stars wane, kills Argos, and Io escapes in the embraces of Zeus, as the moon vanishes in the resplendent light of the sun. Around the throne of Zeus stand Poseidon, Apollon, Ares, Hephæstus, Hermes, Hera, Pallas Athene, Artemis, Aphrodite, Hestia, and Demeter; in a somewhat lower sphere, Pluton, Hecate, Helius, Selene, Dionysus, Leto, Persephone, Themis, and Æolus; still lower, the Graces, Muses, Oceanids, Nereids, Nymphs, Dryads, and Hamadryads; and at last on the outskirts of divinity, the monsters, Cerberus, the Gorgons, the Harpies, Pegasus, Chimæra, the Sphinx, the Centaurs, and the Sirens. Such deities as Ate, Adrastea, the Eumenides, and Nemesis occupy a peculiar position. They all refer to the feeling of justice. Nemesis does not occur in Homer. She is first mentioned by Hesiod, but later poets and philosophers developed the idea with a mystic grandeur which overawed Olympus itself. From Nemesis, the just measure, the inevitable consequence, the iron connection between cause and effect, no one was exempted, not even Zeus himself. It is also very remarkable that a principle of evil, such as Siva in the Indian, Ahriman in the Persian, and Loke in the Scandinavian mythology, is not found in the Grecian. See MYTHOLOGY.

The literature of mythology is vast, and the chief general works are cited under the title MYTHOLOGY. For the special treatment of Grecian mythology, see Gruppe, *Die Griechischen Culte und Mythen in ihren Beziehungen zu den Orientalischen Religionen* (Leipzig, 1887); Lobeck, *Aglaophamus sive de theologiæ mysticæ Græcorum causis* (Königsberg, 1829); Preller, *Griechische Mythologie* (Berlin, 1888); H. D. Müller, *Mythologie der Griechischen Stämme* (Göttingen, 1867); Rhode, *Psyche* (Freiburg, 1890); von Wilamowitz, *Euripidis Herakles* (Berlin, 1889); Welcker, *Griechische Götterlehre* (Göttingen, 1863); Bötticher, *Der Baumkultus der Hellenen* (Berlin, 1856); Maury, *Histoire des Religions de la Grèce antique* (Paris, 1859); Petersen, *Das Zwölfgöttersystem der Griechen und Römer*; Petersen, *Religion oder Mythologie, Theologie und Götterverehrung der Griechen* (Leipzig, 1870); Harrison, *Mythology and Monuments of Ancient Athens* (London, 1890); Foresti, *Mitologia Greca* (Milan, 1892); Dyer, *Studies of the Gods in Greece at Certain Sanctuaries Recently Excavated* (London, 1891); Petiscus-Raleigh, *The Gods of Olympus* (New York, 1892); Seeman, *The Mythology of Greece and Rome* (New York, 1890); Gayley, *Classic Myths in English Literature* (Boston, 1893). Revised by J. R. S. STERRETT.

**Greece** [from Lat. *Græcia*, Greece, derivative of *Græcus*, Greek, a Greek. The Greek words are Ἑλλάς, Greece, and Ἕλλην, a Greek]: the southern part of the most eastern of the three European peninsulas which project into the Mediterranean Sea. The ancient Greeks called their country *Hellas*, and styled themselves *Hellenes*. The Romans originated the designations *Greece* and *Greeks*, giving the name *Græcia* to the country and *Græci* to its inhabitants, from the name of a small tribe (*Graikoi*) in Epirus, with whom they first came in contact as they approached Hellas. Aristotle (*Meteor.*, i., 14) is the first Greek author who applies the term Græci to designate the Hellenes. During the Middle Ages, and even in the present century, they sometimes called themselves *Graikoi*, but more often *Romaioi*, Romans, in consequence of the influence of the Eastern Roman or Byzantine Empire. The term *Hellas* originally indicated only a small district in Thessaly, and was subsequently used to designate all the widely extended regions settled by the Greek people. It is the term still most in favor among the modern Greeks. The official title of their present sovereign is "King of the Hellenes."

Ancient Greece, exclusive of Epirus and Macedonia, which were not usually considered as included in its limits, extended from 40° N. lat. to 36° 23′. It was bounded on the N. by the Cambunian Mountains, which separated it from Macedonia. The Ægean Sea was on the E., the Cretan on the S., and on the W. were the Ionian and the Adriatic. Its greatest length was from N. to S. about 250 miles, its greatest breadth 180 miles. Its area, including Eubœa (1,410 sq. miles), was 21,121 sq. miles (Clinton, *F. H.*, ii., 385). Heeren, however, makes its superficial extent, inclusive of all the islands, 29,600 sq. miles. The area of Epirus was 4,690 sq. miles, and Macedonia, the northern boundaries of which varied at different times, was considerably larger. Modern Greece is much more limited in extent. Not only did the great powers decide that Epirus and Macedonia, which took a prominent part in the war of the Greek revolution (1821–28), should remain under Turkish control, but that Thessaly, a part of Acarnania, and most of the islands should be given back to the authority of the Sultan. Thus the new state was deprived of more than one-third of the territory of ancient Greece proper. This was a bitter disappointment to the Greeks. In 1834 the northern boundary was fixed on a line 137 miles long, following mainly the summit of the range of Mt. Othrys from 39° 11′ N. and 22° 42′ E. on the Gulf of Volo (Pagasetikos Kolpos) to Menidhi at 39° 3′ N. and 21° 5′ E. on the Gulf of Arta (Ambrakikos Kolpos), in the W. The British protectorate over the Ionian islands, existing since 1815, was continued, but they were finally annexed to Greeee in 1864. At the Congress of Berlin (1878) the great powers showed themselves generally favorable to a rectification of the frontier in the interests of Greece, but without formulating definite stipulations. However, by the treaty of June 14, 1881, the Greeks acquired a strip of Epirus and almost all of Thessaly, which were detached from the Ottoman Empire and annexed to their kingdom. The area of free Greece in 1896 was 25,014 sq. miles, which has been slightly reduced in consequence of the disastrous war with Turkey in 1897.

Greece is very irregular in shape, a sort of rude triangle. It is almost surrounded by water, terminating on the S. in Cape Matapan (Tænarum Promontory), the most southern point in Europe. It is divided near the middle by the Corinthian and Saronic Gulfs, which were separated by the Isthmus of Corinth, only 3½ miles wide. The three natural divisions of ancient Greece were Northern Greece, which extended from the Cambunian Mountains to the Ambracian and Malian Gulfs; Central Greece, or the territory between these gulfs and the Isthmus of Corinth; and the Peloponnesus, now called the Morea, which lies S. of the isthmus. There were anciently seventeen states, which varied greatly in ex-

# GREECE

Scale of Miles

10 20 40 80 120 160

Longitude H 20 East from I Greenwich

Longitude H 97 East from I Washington

tent, population, and importance. In the N. were Thessaly on the E. and Epirus on the W.; in the center were East and West Locris, Phocis, Bœotia, Ætolia, Acarnania, Megaris, and Attica; in the Peloponnesus were Corinthia, Sicyonia, Argolis, Achaia, Arcadia, Elis, Messenia, and Laconia, with its famous capital, Sparta. The islands were of three classes: (1) Those near the coast including Corcyra, Paxos, Leucadia, Ithaca, Cephallenia, Cythera, Hydria, Calauria, Ægina, Salamis, Poros, Eubœa (Negropont), and Scyros; (2) those scattered in the Ægean Sea, as in the W. the Cyclades—Ceos, Cythnos, Seriphos, Rhenea, Siphnos, Cimolos, Naxos, Paros, Syros, Myconos, Tenos, Andros—grouped around the sacred island Delos, and in the E. the Sporades—Syme, Telos, Nisyros, Carpathos, Casos, Cos, Leros, Patmos, Icaria, Rhodos—under which term the more northerly islands of Thasos, Samothrace, Lemnos, Imbros, Tenedos, Lesbos, and Chios are sometimes included; and (3) the large separate islands of Crete and Cyprus in the Mediterranean.

*Colonies.*—So numerous were the colonies and dependencies of ancient Greece along the coasts of the Mediterranean and Black Seas and of the Mediterranean islands that the larger part of "Hellas" was situated outside the Hellenic peninsula. Geographically these may be considered in four great groups: (1) Those in Western Asia Minor; (2) those farther N., especially on the shores of the Ægean, Marmora, Adriatic, and Black Seas; (3) those on the north coast of Africa; (4) those on the Western Mediterranean in Italy, Sicily, Gaul, and Spain. Only the most prominent will be mentioned: (1) These formed three minor groups, the Æolian in the N., the Ionian in the middle, and the Dorian in the S. The chief of the eleven Æolian cities were Cyme, Smyrna, and, on the island of Lesbos, Mitylene; of the twelve Ionian cities Phocæa, Clazomenæ, Colophon, Ephesus, Miletus, Samos, Chios; of the Dorian, Cnidos, Halicarnassos, Cos. Miletus in the seventh and sixth centuries B. C. was, after Tyre and Carthage, the chief commercial city of the world. It is said to have itself founded eighty colonies. Ephesus monopolized the inland trade of Asia Minor. In these Asiatic cities originated Greek philosophy, poetry, and history. They gave birth to Thales, Anaximander, Anaximenes, Anaxagoras, Pythagoras, Homer, Sappho, Anacreon, and Herodotus. (2) On the Ægean, Abdera and Ænos; on the Marmora, Cyzicos, Perinthos, Chalcedon, Chrysopolis, Byzantium (Constantinople); on the Black Sea, Heraclea Pontica, Sinope, Amisos, Cerasos, Trapezos, Phasis, Dioscurias, Phanagoria, Theudosia, Tomi, Odessos, Mesembria, Anchialos; on the Adriatic, Corcyra, Apollonia, Ancona. The Black Sea colonies controlled the trade of Scythia and of the northern east. (3) Naucratis in Egypt and the Pentapolis of Cyrenaica. (4) In Southern Italy, Brundusium, Tarentum, Sybaris (Thurium), Crotona, Rhegium, Neapolis (Naples), and Cumæ, the last the most ancient of the colonies in Italy. So powerful and populous were these cities that South Italy was called Magna Græcia. In Sicily, Messana (Messina), Naxos, Catana, Syracusæ, Hybla, Segeste, Gela, Agrigentum, Selinus, Himera, and Lipara on the island Lipara; in Gaul, Massilia (Marseilles), Olbia (Hyères), Nicæa (Nice), Antipolis (Antibes); and in Spain, Saguntum.

*Physical Features and Climate.*—No other country in Europe presents such topographical variety. Mountain systems, sometimes rising precipitously from the sea, traverse it in every direction. The coast-line is exceedingly extended in comparison with the small superficial area. In this respect it surpasses the other European countries just as Europe does the other continents. Less than Portugal in size, it has a longer coast-line than the whole Pyrenean peninsula, which embraces a territory almost seven times greater than that of Greece. Its division by mountains into little patches, between which communication is difficult, and the continual indentation of its shores by narrow and deep gulfs and bays, have powerfully affected the character of the people and determined their history and civilization.

The mountain system of Northern Greece is a dependence of the great Hæmus range. The chain of Pindus forms a sort of backbone, extending S. S. E., and separating Thessaly from Epirus. Some of its peaks are over 6,500 feet high. Othrys and Œta are its prolongations toward the S. Near the shore are Olympus in Macedonia and Ossa and Pelion in Thessaly. Still farther S. are thrown off the spurs of Parnassus, Helicon, Cithæron, Parnes, Hymettus, Pentelicus, and Laurium. The mountains of the Morea are entirely distinct from those of Northern Greece. N. of Arcadia E. and W. stretch Cyllene and Erymanthos. From them proceed irregular chains to the very extremities of the Peloponnesus. Many of the rivers so famous in history, though formidable torrents in spring, are hardly more than brooks or dry beds in summer. The Peneus traverses the narrow vale of Tempe between Olympus and Ossa. In Epirus the Aoüs (Voïousa) and Acheron empty into the Adriatic, the Oropos and Aracthos into the Gulf of Arta, and the Achelous (Aspropotamos), 120 miles long—the largest river in Greece—into the Gulf of Corinth, after flowing between Acarnania and Ætolia. In Central Greece are the Evenos, Daphnos, the Bœotian Cephissos, and the Attican Cephissos; in the Morea the Alpheus, Eurotas, and Styx (Mavra Neria). Some rivers disappear in subterranean receptacles called *catavothra*. There are many small lakes, as Copaïs in Bœotia, and Stimphalis in Arcadia.

The Pindus range is composed of primitive and metamorphic rocks, such as granite, mica-schist, and serpentine. Parnassus, Helicon, and Pentelicus consist mainly of hard gray limestone, the characteristic rock of Greece, which often assumes the form of the finest marble. There are no active volcanoes, but traces of volcanic action are everywhere manifest in the forms of the mountains, rent by fissures, and in mineral springs. The hot springs of Thermopylæ and the mephitic vapors which inspired the priestess at Delphi are famous from antiquity. Caverns abound, of which the Corycian cave near Delphi is the most interesting. Many of the islands indicate volcanic origin, the semicircular harbors being the craters of extinct volcanoes of which one side has broken down. Copper, lead, silver, more rarely iron, and even gold are found. The silver mines at Laurium in the south of Attica were formerly valuable and are still worked. Antimony, cobalt, manganese, and sulphur exist, and also salt. Gypsum and porphyry are quarried, but the most beautiful products of the quarries are the white marble of Mt. Pentelicus, and the red and green marbles of the Peloponnesus and of some of the islands. The marble of Paros was specially esteemed by the ancient sculptors. The group of Santorin (Thera), Theracia, Aspro Nisi, and the three Kaimenis has been often the scene of active volcanic phenomena, the latest being in 1866 and 1878. Earthquakes have always been frequent and destructive both in continental and insular Greece.

The climate varies according to location. In March the heat of summer may be found in Laconia, the warmth of spring on the Corinthian Gulf, and the severity of winter in Arcadia. Near the coast snow is rare, while on some of the mountains it remains nearly the entire year. A cold N. wind prevails throughout the summer, generally violent during the day and dying away at night. This is followed in late September and October by the W. wind and in winter by the S. E. wind, both charged with rain. The siroeco often sweeps over the south part of the country. The climate was apparently more healthful in ancient times than to-day. Complete destruction of the forests and lack of cultivation have resulted from the calamities of every sort which Greece endured until she attained independence. In consequence, in very many parts of the country fogs are prevalent, malaria abounds, and the inhabitants suffer greatly from fever. Attica, however, has a pure, dry atmosphere and a sky of deep and beautiful blue.

*Population.*—Modern Greece is divided into sixteen (since July 17, 1899, twenty-six) nomes (*νόμοι*), which correspond in name and often in extent to the states of ancient Greece. These nomes are divided into eparchies (*ἐπαρχίαι*), which are furthermore divided into demes (*δῆμοι*). It is estimated that the population decreased one-third during the devastations of the Greek revolution. In 1832 it was 612,608, which in 1853 had risen to 1,042,529, with 230,000 in the Ionian islands. In 1870 the total population was 1,457,894; in 1889, 2,187,208; and in 1896, 2,433,806. The annual increase from 1870 to 1879 was at the rate of 1·87 per cent.; from 1879 to 1889, 1·05 per cent.; and from 1889 to 1896, 1·61 per cent. The entire population, with the exception of 37,000 foreigners and about 100,000 Albanians, may be reckoned as Hellenic. Two-thirds of the adult males are engaged in agriculture and pasturage and about one-seventh in commerce. In 1889 138,350 Greek citizens were resident abroad. In the Ottoman Empire there are about 5,000,000 Greeks, subjects of the Sultan. The principal towns are Athens, pop. (1896) 111,486; Piræus, 42,169; Patras, 37,958; Tricala, 21,149; Corfù, 17,918; Hermoupolis or Syra, 17,894; Volo, 16,232; Larissa, 15,373; Zante, 14,650; Calamata, 14,298; Pyrgos, 12,705; and Tripolis, 10,465. Thus Athens increased 4,235 in seven years, Piræus 7,842, and Hermoupolis 4,104.

DIVISIONS AND POPULATION OF GREECE.

| NOMARCHIES. | Area, sq. miles. | Population, 1896. |
|---|---|---|
| NORTHERN GREECE— | | |
| Attica and Bœotia | 2,472 | 313,069 |
| Phocis and Phthiotis | 2,044 | 147,297 |
| Acarnia and Ætolia | 3,013 | 170,565 |
| PELOPONNESUS— | | |
| Argolis and Corinth | 1,442 | 157,578 |
| Achaia and Elis | 1,901 | 236,251 |
| Arcadia | 2,020 | 167,092 |
| Messenia | 1,221 | 205,798 |
| Laconia | 1,679 | 135,462 |
| ISLANDS— | | |
| Eubœa and Sporades | 2,216 | 115,515 |
| Cyclades | 923 | 134,747 |
| Corfù | 431 | 124,578 |
| Zante | 277 | 45,032 |
| Cephalonia | 302 | 83,363 |
| THESSALY— | | |
| Arta | 395 | 39,144 |
| Trikala | 2,200 | 176,773 |
| Larissa | 2,478 | 181,542 |
| Totals | 25,014 | 2,433,806 |

*Products, Industry, etc.*—In ancient as in modern times the domestic animals of Greece were the horse, ass, mule, ox, sheep, goat, hog, and dog. Oxen are used for agriculture; sheep and goats constitute the wealth of the rural population. In ancient times swine's flesh was the favorite meat; now it is mutton. The bear, wolf, boar, lynx, wild cat, jackal, deer, etc., are found in the mountains; eagles, vultures, hawks, owls, etc., are numerous, and game is abundant. Many of the mountains have been stripped of their forests, so that the fertility of the soil and the climate have been unfavorably affected. Taygetus, Parnassus, Helicon, and others have not been denuded. The pine is the most common tree; the beech, chestnut, cypress, and oak are found. The soil is thin, and agriculture is backward. Irrigation is practiced, but the implements generally are as primitive as in the days of Hesiod. Mountains and marshes occupy one-half of the land, and only one-fifth of the remainder is cultivated. The state owns more than three-fourths of this, renting it on the metayer system, the oxen and seed being furnished by the proprietor, who receives a large percentage of the crop. Wheat, barley, and maize are raised; rice is produced in the plains of Argos and Marathon, and in the marshy regions. Cotton and tobacco grow in the plain of Argos and elsewhere. Vineyards are numerous, but the wine is poor. In Laconia, Messenia, and the islands the mulberry is cultivated for the silkworm. Almonds, figs, oranges, lemons, and other fruits abound. Olives are produced in all parts of Greece; the oil is used for light and instead of butter. The currant, or small Corinthian grape, is raised in large quantities along the shores of the Gulf of Corinth and on the islands. The figs of Attica and the honey of Hymettus are proverbially excellent. Manufactures are unimportant. In the towns they are of cutlery, earthenware, hardware, articles in leather, silk, hats, cotton and woolen cloths, brandy, vinegar, etc.; in the country cotton and woolen cloths are woven. Ship-building is carried on at the seaports, and salt is made in a few places. See GREECE in the Appendix.

*Commerce and Transportation.*—The position of Greece, the conformation of the country, its numerous bays and islands, all tend to make the Greeks a seafaring people. For centuries it was in the pathway of commerce. Its exports have always been the simple products of the country. The imports are manufactured goods from Western Europe, such as cloths, hardware, and fancy articles; coffee, rice, drugs, and spices from Turkey. The grain-trade of the Black and Mediterranean Seas is almost exclusively in the hands of Greek merchants. The principal ports are Hermopolis (*Syra*), the center of steam-navigation in the Levant; Hydra, Spezia, Corcyra (*Corfù*), Zacynthus (*Zante*) on the islands; Piræus (the port of Athens), Patras, Missolonghi, and Nauplia. In 1821 Greece had 440 vessels, of 61,450 tons burden, most of which were destroyed in her revolution, when her navy became so distinguished. In 1898 her commercial marine amounted to 118 steamers, with a capacity of 87,845 tons, and 1,152 sailing vessels, with a capacity of 238,196 tons. The ports have been improved and lighthouses erected. The Euripus between Bœotia and Eubœa has been rendered navigable, and the Isthmus of Corinth is pierced by a ship-canal, which was opened for traffic in 1893. Until modern times there were very few roads that were practicable for carriages; but the means of communication have been greatly improved, and in 1896 about 2,043 miles of good roads had been constructed. In Jan., 1869, the first railway was opened in Greece. In 1898 the railways open for traffic were 591 miles in length, while 300 miles were under construction. The postal service is good, and has 401 post-offices, handling, in 1899, 6,091,398 letters and post-cards.

*Form of Government.*—The government is a constitutional hereditary monarchy. King Otho governed the country from 1833 to 1843 without a constitution. The liberty-loving Greeks effected a bloodless revolution on Sept. 14, 1843, and a national assembly was called, which framed a constitution that was approved by the king Mar. 16, 1844. It established hereditary monarchy, and the Holy Orthodox Catholic and Apostolic Church as the state church. All persons are equal before the law; personal liberty is inviolate; titles of nobility and slavery are forbidden; the right of petition, trial by jury, the freedom of the press, the public administration of justice, the independence of the judiciary, the security of letters and domicile, are all guaranteed. The king appoints his ministers, seven in number, who are responsible to the legislature, and take part in its deliberations. At first there were a senate (Γερουσία), named by the king for life, and a house of representatives (Βουλή), elected by the people for four years. But in 1864, after the expulsion of Otho and the accession of George I., the senate was abolished, and the legislative power was vested in the *Boule*, which now consists of 207 members. The suffrage is universal, and elections are by ballot. A council of state examines all bills, and may offer amendments to the boule within a certain time. The king must be a member of the Greek Church, unless special exception is authorized. The king receives 1,125,000 drachmas (£40,718) per annum, and has a palace in Athens and a summer residence in Corcyra (*Corfù*). The present king is George I., second son of Christian IX., King of Denmark; b. Dec. 24, 1845. He accepted the crown from the national assembly June 5, 1863. He married Olga, daughter of the Grand Duke Constantine of Russia, Oct. 27, 1867. The crown prince, Constantine, b. Aug. 2, 1868, received the title Duke of Sparta. See the article GREECE, HISTORY OF MODERN.

*Defense.*—All able-bodied men in Greece are held to military service for nineteen years, two of which must be in the regular army. In 1900 the army consisted of 25,180 men, all others in the service being styled national guards. The officers are chiefly graduates of the military school at Athens. The navy consists of 3 port-defense armor-clads, 6 cruisers, 17 torpedo-boats, and 12 gunboats. There are 3,165 sailors, who are obtained by conscription among the seafaring people. The police or *gendarmerie* often need the assistance of the regular army against the brigands. Brigandage, for which the Government is often unjustly blamed, is becoming more and more frequent, and is a relic of the war of independence.

*Finance, etc.*—The debt of Greece in 1900 was 701,967,000 drachmas in gold, and 173,690,760 paper drachmas, contracted mainly in achieving her independence. This was greatly increased in 1897 by the operations in Crete and the war with Turkey. The revenue in 1899 was 107,085,658 drachmas and the expenditure 103,418,273 drachmas. The revenue is derived from duties on imports, a tithe of the gross product of the farming lands, and a royalty of 25 per cent. as rent for the lands belonging to the state.

*Administration of Justice.*—The supreme court of Greece is called the Areopagus. The kingdom is divided into four judicial districts, each having a royal court of appeal; there are thirteen primary courts of appeal, and 120 justices of the peace. The judicial legislation is excellent, and is based mainly on the Code Napoléon. Criminal cases and offenses of the press are tried by jury. Judges and advocates must have received the degree of LL. D. from the University of Athens or from one of the universities of Europe, and must have passed a satisfactory examination before a special commission. The judges are appointed by the king, and removable, but they are noted for their independence and integrity. Punishments are fines, imprisonment, and in capital cases death by guillotine. The prisons are rather defective in construction and administration.

The *religion* established is the Holy Orthodox Catholic and Apostolical Church, to which nearly all the population belong. All religions are tolerated, but proselytism is forbidden, and in 1889 there were only 14,677 members of other Christian churches, 5,792 Jews, and 24,165 Mohammedans. The Church in Greece became virtually independent of the patriarchate of Constantinople at the time of the revolution (1821), and was or-

ganized by decree July 15 (27), 1833, upon the model of the Russo-Greek Church, but its independence was not acknowledged by the patriarch until 1850. Its supreme council is the Holy Synod of five members, appointed annually by the king. The Metropolitan Archbishop of Athens is *ex officio* the president, and a majority must be archbishops or bishops. Two royal officials may assist in the deliberations of this body, which elects archbishops and bishops, who must be approved by the crown. There are 26 archbishops and 29 bishops—one for each nome. There are 4 ecclesiastical seminaries, containing 115 students. A certain degree of instruction is prescribed for all priests, and the higher dignitaries are selected only from those of the highest culture and blameless lives. The priest is generally married, but must have married while a deacon, and can not marry a second time without demitting his office. The priests do not preach, but other well-qualified persons are appointed to do so. The archbishops and bishops are paid small salaries by the state, but the priests depend upon their flocks, and receive only a meager support. The monks inhabiting the numerous monasteries are ignorant and degraded.

*Education.*—By law, all children between five and twelve are required to attend school; but the law is not rigorously enforced. Under Otho primary schools were established by law in every deme. Education is free even in the university. In 1835 there were 71 primary schools, with 6,721 pupils; 21 Hellenic schools, with 2,528 pupils; 3 incomplete gymnasia, and an inchoate university. In 1900 there were 3,154 primary schools with 3,172 teachers and 164,450 pupils, 268 of the so-called Greek schools with 727 teachers and 16,000 pupils, 38 gymnasia with 252 professors and 4,425 pupils, 16 private schools with 1,474 pupils, besides 1 commercial school, 2 agricultural schools, and a Trade and Industrial Academy. To enter the University of Athens, Greek students must have completed the course of the gymnasium. It opened in 1837 with 52 students; in 1899 it had 2,853, of whom 802 were from abroad, chiefly Turkey. There are the four faculties of theology, law, philosophy (literature and science), and medicine. The university has a large library and valuable museums. Baron Sinna, a wealthy Greek of Vienna, erected an astronomical observatory on the Hill of the Nymphs at Athens. He and other Greeks have founded other public institutions. Polytechnic schools exist in several places; archæological, medical, natural history, and other societies exist at Athens.

The press is free in Greece. Art is not much cultivated, and time alone can determine whether the Greeks have inherited the æsthetic nature of their ancestors.

Authorities.—The handbooks of Baedeker and Murray, and the works of Maurer, Schmidt, and Wyse. Of the greatest importance are the official publications of the Greek Government and of the consuls of Great Britain, France, and Germany. Revised by E. A. Grosvenor.

**Greece, History of Ancient:** The early history of Greece is enveloped in the clouds of fable. In the exploits of imaginary heroes are presented the movements of nations, and the events of an era are shadowed forth in the traditions of a people.

*Mythological Age.*—The earliest inhabitants of Greece were probably the Pelasgi, an Aryan nation who came from the high table-land of Asia, passed around the Caspian Sea into Europe, and settled in Greece and Italy. They left traces of their existence in the religion of the Greeks, in the names of places, and in the walls composed of huge stones found in various places. They were composed of various tribes, among whom the Hellenes were the most powerful, and before whom the others disappeared. Their original seat, according to Aristotle (*Meteor.*, i., 14), was near Dodona in Epirus, but they first appear in the southern part of Thessaly about B. C. 1384. The Hellenes represented themselves as the descendants of a common ancestor, Hellen, son of Deucalion and Pyrrha. The name Pelasgia was supplanted by that of Hellas, denoting at first a small district, and subsequently the entire land inhabited by the Hellenes. The names Greece and Greeks are derived from the Romans. The Hellenes were divided into Dorians, Æolians, Ionians, and Achæans, descended respectively from Dorus and Æolus, sons of Hellen, and Ion and Achæus, sons of Xuthus, the third son of Hellen. Hellen and his sons were purely mythical persons. These four divisions of the Hellenic people were distinguished from one another by their institutions, and even the peculiarities of their language. The physical features of the country exerted a powerful influence upon the people, determining their character, giving form to their political institutions, and assisting in the development of a peculiar type of civilization. High mountains and small inclosed plains open to the sea tended to produce a bold, adventurous people, who loved individual liberty, who were jealous of the rights of their little states or cities, but who could rarely unite for a grand purpose except under a conqueror or a pressing necessity. There are traces of Oriental influence in Greece, and tradition attributes the first elements of civilization to colonies from the East. To Cecrops, a native of Sais in Egypt, Attica is said to have owed the institution of marriage, religion, and the foundation of Athens. Argos is said to have been founded by Danaus, an Egyptian, and the Peloponnesus owes its name to Pelops, a Phrygian, son of Tantalus, who by his wealth and influence became King of Mycenæ. Cadmus, a Phœnician, is said to have built Cadmea, afterward the citadel of Thebes, in Bœotia. The earliest forms of the Greek letters, and especially their names, show their Phœnician origin; weights and measures, and ship-building also, the Greeks probably received from the Phœnicians.

*Heroic Age.*—From the appearance of the Hellenes in Greece, about B. C. 1384, to the siege of Troy, B. C. 1184, is called *the heroic age.* The heroes were represented as of divine descent—superior to ordinary men in qualities of mind and body. Hercules was the national hero of Greece, and his labors represented in mythical form the triumph over physical and moral evil, the attainment of wealth and power. Theseus represented the establishment of civil government in Attica, and Minos the triumph of law and social order. So the expedition of the Argonauts under Jason presents the progress of commerce; and the Trojan war, the greatest of the heroic achievements, as sung by Homer in the *Iliad* and the *Odyssey*, gives not only a vivid picture of the manners and institutions of early Greek society, but also exhibits the contest between Greek and Oriental civilization. Although the Greeks were divided into many small communities, yet there were bonds of union in their community of blood and language, of religious rites and festivals, of manners and character. In these respects they were distinguished from all other people, whom they styled barbarians. Their most celebrated oracles were at Dodona and at Delphi, and public games (see Isthmian, Nemean, Olympian, and Pythian Games) were held in honor of different gods at stated intervals. Thus the Greeks were brought together and reminded of their common origin and mutual interests. The state of society in Greece in the earlier ages was not unlike that of the feudal ages in Europe. Each state had its own king, whose authority was not limited by laws, but was partially restrained by the council of chiefs, or *boule.* The *agora*, or assembly of the people, merely met to hear the decision of the kings and chiefs. There were three classes of persons—the nobles, powerful and wealthy; the freemen, some of whom possessed estates; and the slaves. The manners even of the highest class were simple; nobles were proud of their skill in the manual arts, and their wives and daughters performed the various household duties. The Greeks dwelt in fortified towns adorned with palaces and temples, and the poems of Homer attest alike their skill in war and their culture in poetry and in art. War was their delight, and even piracy was honorable. Æolus, son of Hellen, succeeded his father, and his descendants occupied Central Greece, and even the west coast of the Peloponnesus. The Æolians were widely scattered, and became a seafaring people. The Achæans in the heroic age were the most warlike of the Greeks, and their chiefs were the most distinguished in the Trojan war. At that time they dwelt in Thessaly, and also possessed Mycenæ, Argus, and Sparta in the Peloponnesus. The Dorians and Ionians were of small importance in the earlier history. The former were confined to Doris, a small mountainous district between Thessaly and Phocis; the latter were settled on the north coast of the Peloponnesus and in Attica. In historical times these became the leading races of Greece, the Dorians being represented by Sparta, the Ionians by Athens. Thucydides (i., 12) speaks of the migrations that occurred among the Greeks. The Dorians overran the Peloponnesus B. C. 1104. This invasion was styled the "return of the Heraclidæ," because led by the descendants of Hercules, who had long been fugitives from Argos. The country was divided among the leaders, and the defeated Achæans drove out the Ionians from the north coast of the Peloponnesus, which portion was henceforth called Achaia. The Ionians went to Attica, and thence to Asia Minor. The earliest migration from Greece was in B. C. 1124, when the Æolian clans proceeded from Thessaly

and Bœotia to the north of Asia Minor and the islands of Lesbos and Tenedos. The Ionians followed B. C. 1040, and settled on the coast of Lydia and the islands of Chios and Samos. The Dorians soon after settled the south part of the coast and the islands of Rhodes and Cos. Cumæ was founded B. C. 1050 by a colony from Cyme in Asia and Chalcis in Eubœa. Colonies were subsequently planted in the south of Italy and in Sicily. So numerous and important were the colonies in Southern Italy that it was called Magna Græcia. Colonies were also planted at Cyrene in Africa, Massilia (Marseilles) in Gaul, and along the coast from Greece to the mouth of the Danube, at Selymbria, Byzantium, and many other places. These colonies show the hardy and adventurous spirit of the Greeks. The most noted in Asia were Smyrna, Ephesus, and Miletus; in Italy, Sybaris, Croton, and Tarentum; in the island Corcyra; and Syracuse and Agrigentum in Sicily.

*Establishment of Colonies and the Persian Wars.*—We have already alluded to the migrations of the Greeks, which occurred shortly after the Trojan war. Colonies were of two classes—the one sent out under chosen leaders with religious ceremonies, and were really independent; the other were merely garrisons. The Greek settlements in Asia Minor and the adjacent islands consisted of Æolians in the north, Ionians in the middle, and Dorians and Achæans in the south. These colonies were conquered by Crœsus, King of Lydia, who ascended the throne B. C. 560. Cyrus, King of Persia, overthrew him B. C. 546, and also subdued the Greek cities except Samos. The Ionians revolted against the Persians, B. C. 500, and the Athenians sent twenty ships and the Eretrians sent five to assist them. The combined forces entered, plundered, and accidentally burned Sardis. Great numbers were slain in the retreat. The Athenians returned home, and the enraged Darius, King of Persia, vowed vengeance upon them. He crushed the rebellion, and then sent Mardonius, his son-in-law, to punish the Athenians and Eretrians. Mardonius crossed the Hellespont, conquered Thrace and Macedonia, but lost 300 ships and 20,000 men in a hurricane at Mt. Athos, and led his forces back to Asia (B. C. 492). Datis and Artaphernes were now sent with 600 galleys, besides transports, and 110,000 men. They captured Eretria, and landed on the plain of Marathon, under the guidance of Hippias. Sparta, the leading state of Greece, through superstition, did not send aid in time. Only the little town of Platæa sent 1,000 heavy-armed soldiers to assist the 10,000 Athenians, and a few slaves as light-armed troops. Under the skillful leadership of Miltiades, assisted by Callimachus, Aristides, and Themistocles, the Athenians gained a most brilliant victory (B. C. 490). The Persians lost 6,400, the Athenians only 192, who were buried on the field, and the mound over their remains still exists. The Persians sailed back to Asia. Athens had saved Greece and gained immortal glory. The conduct of Ægina in favoring Persia led to a war between her and Athens. This war and the foresight of Themistocles made Athens a maritime power. She prepared a fleet of 200 ships, to which 20 were annually added. In B. C. 480, Xerxes, the son of Darius, led an immense army against Greece. He threw a bridge of boats across the Hellespont and cut a canal through Mt. Athos. When he reached the pass of Thermopylæ his land and sea forces amounted to 2,641,610, and the attendants swelled the number to 5,283,220. So great was the terror inspired by this vast army that only a few cities of the Greeks took part in the Congress which Athens and Sparta summoned to meet at Corinth. A stand was made at THERMOPYLÆ (*q. v.*). Xerxes conquered Greece, except Delphi, as far as Athens, which was burned. The Persian fleet sustained heavy losses in storms on the Greek coast and in battle at Artemisium, but after the battle at Thermopylæ the Greek fleet retreated to Salamis. It was prevented from dispersing only by the skill and policy of Themistocles. The Persians had about 1,200 vessels; the Greeks had less than 400, of which 200 were Athenian. The battle took place in the narrow strait between Attica and Salamis. Xerxes from his throne on the shore beheld the defeat of his fleet and the loss of 200 vessels. Becoming alarmed, he returned to Asia, leaving Mardonius with 350,000 men in Thessaly to conclude the war. Mardonius again invaded Attica, and the Athenians again abandoned their city. Their patriotism, and their intimation to Sparta that they might not continue this course, at last alarmed and aroused the Spartans. A Greek army of 110,000 defeated the Persians at Platæa (B. C. 479), and Mardonius was slain. On the same day the Persian army was defeated and their fleet burned at Mycale in Asia. The patriotism and sacrifices of Athens had made her the leader of Greece, and the treachery of Pausanias, the Spartan commander, confirmed her position.

The confederacy of Delos was now formed against Persia, and delegates from the different states met regularly in the temple of Apollo and Artemis on that island. Aristides the Just, who had been ostracized, but returned to take part in the battle of Salamis, fixed the assessment in ships or money on the different states. The yearly amount was 460 talents, nearly $500,000, and the treasury was in Delos. Athens was now rebuilt, and through the energy and diplomacy of Themistocles was surrounded with walls, and Piræus became its port. From the battle of Marathon (B. C. 490) to the beginning of the Peloponnesian war (B. C. 431) was the most brilliant period of Athenian history. Themistocles had created her navy, Aristides had conciliated her allies, Cimon increased her reputation, and Pericles enlarged her resources, formed alliances, and conquered her enemies. The prosperity of Athens excited the jealousy of Sparta, and her treatment of her allies produced great dissatisfaction. She had freed the Greek cities in Asia Minor from taxation, but the death of Cimon, who had been recalled, brought an end to the Persian war (B. C. 448). Athenian power culminated in the defeat of the Thebans at Œnophyta (B. C. 456).

*Age of Pericles.*—Pericles revolutionized the Athenian constitution amid many struggles, making it completely democratic, impairing the power of the Areopagus or supreme court, and of the senate of five hundred. He endeavored to consolidate Athenian power, and but for her arrogance and unwise conduct she might have continued much longer to exercise the hegemony or leadership of Greece. A revolution in Bœotia and her defeat by the Thebans at Chæronea (B. C. 447) were the beginning of her reverses. She soon lost her control of Central Greece, and Pericles reconquered only Eubœa. By the thirty years' truce (B. C. 445) she abandoned all her acquisitions in the Peloponnesus. Pericles now devoted himself to the internal affairs of the city. He erected the Propylæa, the Parthenon, and the temple of Victory on the Acropolis, the Theseum and other buildings in the city. He built the long walls to the Piræus and sent out colonies. Athens became the center of art and literature. Architecture and sculpture reached their highest excellence. The greatest names in Greek literature adorn this century: in tragedy, Æschylus, Sophocles, and Euripides; in comedy, Aristophanes; in history, Herodotus and Thucydides; all of whom, except Herodotus, were Athenians, and even he resided at Athens.

*Peloponnesian Wars.*—Athens had lost her supremacy on land, and her allies in the confederacy of Delos were dissatisfied with the heavy tribute (now 600 talents) exacted by Athens, her misapplication of it, and the oppression of the members. Samos revolted, but was subdued and punished. Nearly all, however, waited only an opportunity to free themselves. A dispute between two Corinthian colonies led to the war that overthrew Athens. The Lacedæmonians were urged by their allies to declare war against Athens. War was determined upon at Sparta B. C. 431, although it was precipitated by a treacherous attack of Thebes upon Platæa. This war was one of races and of principles; Athens represented the Ionian tribes, democracy, and progress; Sparta, the Dorians, aristocracy, and conservatism. Athens was a maritime power, and controlled Eastern and Asiatic Greece and most of the islands; Sparta was a land power, and controlled Western Greece, Southern Italy, and Sicily. The states with Athens were mainly subject allies; those with Sparta constituted a voluntary confederacy. Athens had great financial resources; Sparta depended upon occasional contributions. The Peloponnesians, except Argos and Achaia, were with Sparta, hence the name of the Peloponnesian war. It may be divided into three periods: (1) From its beginning to the Peace of Nicias (B. C. 431–421); (2) from its peace to its rupture by the Spartans (421–413); (3) from this rupture to the capture of Athens (413–404). The contest was one of the most memorable in history. For more than twenty years the desolations of war were experienced not only in the peninsula, but on the islands and about the Greek colonies along the shores of the Mediterranean. During the whole of this period it was uncertain which of the two contending states would ultimately prevail. But the scale was finally turned in favor of Sparta. The victory of Ægospotami (B. C. 405) destroyed the Athenian fleet; and the Spartan general Lysander compelled the surrender of Athens in the following year. The city was completely humbled; her walls were demolished to the

music of the flute, her ships were surrendered, and she was stripped of all her foreign possessions.

*Spartan Supremacy.*—Oligarchical principles triumphed with Sparta, and decarchies with a Spartan harmost were appointed in the Athenian cities. At Athens a committee of thirty, known as the Thirty Tyrants, supported by a Lacedæmonian garrison, supplanted the democracy, and a reign of terror ensued. Throughout Greece the rule of Sparta became more cruel than that of Athens had ever been, and a revulsion of feeling occurred in reference to Sparta and Lysander. Thrasybulus and other exiles seized Phyle on Mt. Parnes, took the Piræus, defeated the force of the Thirty, and killed their leader, Critias. The Thirty were deposed and a committee of ten was appointed. Lysander came with a Lacedæmonian force, but was superseded by King Pausanias. Matters were finally arranged; a general amnesty was proclaimed, the obnoxious laws were changed, Thrasybulus and the exiles entered Athens, and the democracy was restored (B. C. 403).

It was at this time that Socrates, the wisest and best of the Greeks, a martyr for the truth, was put to death upon the false charge of infidelity and corrupting the youth. The Anabasis, or expedition of Cyrus the Younger to dethrone his brother, Artaxerxes, occurred B. C. 401. Xenophon led back from Cunaxa to the sea the 10,000 Greeks who were a part of the army. The weakness of Persia was thus revealed to the Greeks. A war ensued between Sparta and Persia. Agesilaus was called home from Asia by the troubles in Greece, which were aided by Persia. The Thebans defeated the Spartans and slew Lysander at Haliartus (B. C. 395), and compelled Pausanias to retreat. Athens, Corinth, Argos, and other states formed an alliance with Thebes against Sparta. Agesilaus defeated the allies at Coronea (B. C. 394), but Conon and Pharnabazus destroyed the Lacedæmonian fleet at Cnidus, and the Spartans lost their maritime supremacy. The combined fleet came to Greece, and Conon rebuilt the fortifications of the Piræus and the long walls. The war continued with varying success in Greece and in Asia until Sparta induced Persia to impose a disgraceful peace on the Greeks (B. C. 387). Sparta now attacked Bœotia, seized the citadel of Thebes by treachery, and conquered Olynthus. Her power on land was at its height B. C. 379, and her unpopularity was commensurate. Pelopidas and other exiles recovered Thebes; Athens and Thebes organized a confederacy of seventy cities against Sparta. A war of seven years ensued, and through Athenian jealousy of Theban success the Peace of Callias was made (B. C. 371). Thebes refused to sign the peace unless acknowledged as the head of Bœotia.

*Theban Supremacy.*—In the war that ensued, Epaminondas, the great Theban commander, utterly defeated the Spartans at Leuctra (B. C. 370). This event electrified Greece. Epaminondas next ravaged Laconia, established an Arcadian confederation at the new city, Megalopolis, and restored the Messenians. Sparta fell at once from her high position, and even asked the aid of Athens. Pelopidas settled disturbances in Thessaly and in Macedonia, and Epaminondas again successfully invaded the Peloponnesus. Pelopidas and other deputies went to the King of Persia, who declared Thebes to be the head of Greece (B. C. 366). Pelopidas was slain in an expedition into Thessaly. A war broke out between Elis and Arcadia, the Mantineans and Spartans supporting the former. Epaminondas marched into the Peloponnesus to assist the Arcadians. He gained a decisive victory over the combined force at Mantinea (B. C. 362), but himself fell mortally wounded. The greatness of Thebes began and ended with this able man. Peace was now made, according to his dying advice. Greece was now completely exhausted by these struggles. Athens regained some of her former prosperty, but lost much in every way by a war with her allies, whose independence Persia compelled her to acknowledge (B. C. 355).

*Macedonian Supremacy.*—A new power was now rising in the neighborhood of Greece. Macedonia lay N. of Thessaly; its people were despised as barbarous; its kings claimed to be of Hellenic descent. Philip, the youngest son of Amyntas II., became King of Macedon B. C. 359, at the age of twenty-three. He took Amphipolis and defeated the Illyrians. He conquered Pydna, Potidæa, and Thrace as far as the Nestus, thus gaining control of the gold mines of Pangæus, which yielded him 1,000 talents annually. The Sacred war, between Thebes and Phocis, prepared the way for Philip's supremacy. The Amphictyonic council imposed a heavy fine on the Phocians for cultivating sacred soil. Driven to desperation, they seized Delphi and appropriated the sacred treasure. Philip appeared as champion of the Delphic god, slew the Phocian leader, and became master of Thessaly. An Athenian army prevented him from passing Thermopylæ. Demosthenes, the great Athenian orator, now appeared as the opponent of Philip. When Philip threatened Olynthus, Demosthenes infused more energy into the Athenians. His *Olynthiacs* and his *Philippics* are among his most celebrated orations. Olynthus was taken B. C. 347, and many other towns fell into Philip's hands. By deceit and bribery he gained as much as by war. He induced the Athenians to make peace, but excluded the Phocians, who soon surrendered. They were ruined, and the Amphictyonic council at Delphi gave him the seat of which the Phocians were deprived. He shared in the honor of presiding at the Pythian games, and in B. C. 346 Macedon became the leading state of Greece. His attempts on Byzantium, Perinthus, and the Chersonesus were successfully resisted by aid of the Athenians. He went into Greece to conduct a sacred war against Amphissa, but seized Elatea, showing that he aimed at Bœotia and Attica. Demosthenes aroused the Athenians to resistance. They united with the Thebans, and on Aug. 7, B. C. 338, was fought the battle of Chæronea, which crushed the liberties of Greece. Philip treated Thebes with severity, but offered advantageous terms of peace to Athens. A congress of Greek states, except Sparta, met at Corinth, declared war against Persia, and appointed Philip commander-in-chief. While making preparations for the expedition he was assassinated, and his son Alexander, then twenty years old, succeeded him. He was thoroughly educated. The courage and energy he displayed secured his appointment as leader of the expedition against Persia. He suppressed disturbances in Thrace and Illyria. Thebes revolted, and was utterly destroyed, save Pindar's house, and the inhabitants reduced to slavery. Greece was terror-stricken, and leaving Antipater as regent Alexander set out for Asia with 35,000 soldiers (B. C. 334). He marched along the coast of the Propontis, and defeated the Persians at the river Granicus. Turning S., he took Sardis, then Ephesus, Magnesia, Miletus, and many other places. In the spring he received re-enforcements at Gordium, marched E. without resistance until he reached Issus, where he defeated the immense army of Darius, 600,000 strong. He conquered Phœnicia and Egypt in twenty months. With 47,000 troops he marched toward the center of the empire, and encountered and defeated the immense army of Darius about 20 miles from Arbela. The capitals, Babylon, Susa, and Persepolis, with their enormous treasures, surrendered. Three years were spent in conquering the northeast provinces of the Persian empire, and then Alexander advanced into India, conquered Porus, and overran what is now called the Punjaub. His army refused to go farther than the Hyphasis (Sutlej), and he then descended the Indus, and after terrible sufferings returned to Persepolis. At the height of his power, he now meditated the conquest of Arabia. After a banquet, given in connection with the preparations, he was seized with a fever and died (June 28, B. C. 323). His plans perished with him, and his empire was divided among his generals. Philip Arrhidæus, his half-brother, was proclaimed king, reserving, however, to Alexander's child by Roxana (whom he had also married), if a son, a share in the empire. Perdiccas eventually became the guardian of Philip, Roxana, and her son Alexander, but was murdered in Egypt. Antipater now became regent; Ptolemy received Egypt; Seleucus took the satrapy of Babylon; and Antigonus had Susiana, Phrygia, Lycia, and Pamphylia. Harpalus had wasted the royal treasures at Ecbatana, and fled when Alexander returned from the East. Demosthenes was falsely accused of receiving a bribe from Harpalus at Athens, and was fined and imprisoned, but managed to escape. Upon the death of Alexander, Hyperides in Athens and Demosthenes in exile endeavored to arouse the Greeks to revolt, but only the smaller states joined Athens. Antipater took refuge in Lamia, but was re-enforced, and defeated the allies at Crannon in Thessaly (B. C. 322). Demosthenes had been recalled to Athens, but was now demanded as one of the conditions of peace. He escaped to Calaurea, and in the temple of Poseidon took poison and died. Antipater died soon after, leaving the regency to Polysperchon, and not to his son Cassander. He, however, shortly became regent, and murdered Olympias, and finally Roxana and her son. Various changes occurred in the East.

*Achæan League and Roman Conquest.*—After the death of Cassander, Macedonia changed rulers repeatedly and rap-

idly, until Antigonus Gonatas gained control of nearly all Greece. His oppression caused the revival of the Achæan league (251 B. C.). It was originally for religious purposes; it now embraced Athens, Corinth, Megara, Ægina, Salamis, and the Peloponnesus, except Sparta, Elis, and a few others. In B. C. 221 Sparta opposed the league, but by the assistance of the Macedonians was completely defeated. An Ætolian league had been formed in Central Greece which defeated the Achæans, and Philip, King of Macedonia, was called in by the latter. He gained several victories, but soon made peace. Siding with Carthage in her struggle, he was defeated by the Romans. Philopœmen led the Achæans and defeated the Lacedæmonians, allies of Rome. The Romans made peace and retired, but at the close of the second Punic war they declared war against Philip, and both the Ætolian and the Achæan leagues joined them. He was defeated at Cynoscephalæ (B. C. 197), and his supremacy was destroyed. Flaminius proclaimed the freedom of Greece (B. C. 196). The Ætolian league was crushed (B. C. 189). Perseus succeeded Philip (B. C. 179). War broke out, and L. Æmilius Paulus defeated Perseus at Pydna (B. C. 168), and led him to Rome to adorn his triumph. Thus ended the Macedonian empire, and Macedon became a Roman province. Sparta appealed to Rome against the Achæans, and in B. C. 147 Roman commissioners decided that Sparta, Corinth, and all the cities except those in Achaia should be independent. Riots ensued in Corinth, and the commissioners barely escaped. A second embassy was insulted, and Rome declared war. Metellus defeated the Corinthian leader, Critolaus, and Mummius overthrew his successor, Diæus, near Corinth. The inhabitants of the city were reduced to slavery, its priceless treasures of art were carried away, and the city was consigned to the flames. Greece perished B. C. 146, and henceforth was only a province of the Roman empire under the name of *Achaia*. Greece was conquered, but her civilization and culture conquered Rome.

Authorities.—For the general history of Greece the following are the most important works: Grote, Curtius, Duncker, Thirlwall, Abbott, and Duruy. For the history of the Peloponnesian war Thucydides will always be superior to any modern work. The period immediately after the Peloponnesian war is most successfully treated by Thirlwall and Freeman. For the period of Roman occupation the works of Hertzberg and Finlay are the most important.

Henry C. Cameron.
Revised by C. K. Adams.

**Greece, History of Modern**: After the Roman conquest in B. C. 146, Greece had no independent life, but continued to form a part of the Byzantine empire until the time of the fourth crusade (A. D. 1202–4). The old empire was then broken up, and its provinces divided among the Frankish princes, who interrupted the history of the Greek empire by a period of fifty-seven years of Latin rule. In 1261 the Byzantines regained the throne. The dukedom of Athens belonged successively to several different families from A. D. 1205 to 1453, when, on the fall of Constantinople, Greece came under the Moslem yoke. After the signal defeat of the Turks at Vienna (A. D. 1684) the Venetians joined the Christian league, and with a powerful fleet under the command of Francesco Morosini, invaded Greece, conquered the Peloponnesus, and took possession of Athens (A. D. 1687). It was during the bombardment of the citadel by the Venetians at this time that the Parthenon, in which the Turkish garrison had stored their powder, was shattered by an explosion. But the Venetians did not take much trouble to keep what they had won. It was scarcely a dozen years ere they abandoned Athens, and by A. D. 1718 the whole of Greece was again in the power of the Turks. For a century longer the Greeks groaned under this cruel despotism, but the latter part of this period saw the rise of new intellectual aspirations which, fostered by the earnest efforts of the great scholar Koray, sought the improvement of the race by reviving the study of the classic authors and promoting education.

*War of Independence.*—Along with this movement came the patriotic impulse to shake off the Turkish yoke. In the spring of 1821 the war of independence began with a revolt in the Danubian principalities. From the first it was badly managed, the leaders relying on the support of the czar and on the fidelity of the Roumanian peasants, the former of whom condemned the movement as a rebellion, while the latter deserted the Greeks at the critical moment. The first battle, fought on June 19, was disastrous for the Greeks. Prince Alexander Ypsilanti, the chief of the *Hetaeria*, a secret association for the purpose of winning independence for Greece, was defeated, with the loss of 400 men, most of whom were among the noblest and bravest youth of the country. In Jan., 1822, the first national assembly met at Epidaurus and framed a provisional constitution. In the same year occurred the terrible massacre in Scio (Chios) by which the population of that beautiful island was reduced between Apr. and Aug., 1822, from about 100,000 to 1,800 souls. This year was also marked by several gallant and successful exploits of the little Greek navy, especially by the burning of the flagship of the Turkish commander by the fireships of Admiral Kanaris. The slaughter of Scio was thus at least partly avenged, for the Turkish admiral, who perished in dreadful agonies in this engagement, was the same who had led the bloody expedition against that ill-fated island. The next year (1823) witnessed the bold and successful midnight attack upon the Turkish camp at Carpenesion, in which 800 Turks were slain, with a loss of only 50 on the part of the assailants. But among these 50 was the heroic Suliote chief himself, Marcos Botzares. It was in this year also that Lord Byron arrived in Greece, or rather in the Ionian islands. He reached Missolonghi on Jan. 5, 1824, and died there on the 19th of the following April. In Apr., 1826, Missolonghi, that important fortress, fell before the army of Ibrahim Pasha after a gallant defense and many instances of heroic valor worthy of Marathon and Thermopylæ. Nearly the whole of Greece was now at the mercy of the Turks. In July of this year they laid siege to Athens, which after an obstinate resistance fell into their hands in June, 1827. The cause of Greek independence seemed hopeless, unless the Christian powers of Europe should interpose in her behalf. After many unsuccessful embassies on the part of Greece, and much fruitless correspondence between the courts of Great Britain, France, and Russia, a treaty was at last signed in London on July 6, 1827, by the plenipotentiaries of these three powers, providing that an immediate armistice should be established between Turkey and Greece, and proposing to place Greece on the footing of a tributary province, with the right to choose her own governors. Greece was in no condition to reject these humiliating terms; but, happily for her, the Porte was too proud or too obstinate to accede to them. The sultan's government indignantly resented any interference, and even refused to receive a written communication from the allied powers. These last now perceived that they must either adopt more rigorous measures or else stand before the world in a very humiliating position. They at once increased their fleets in the Mediterranean, and instructed Admiral Codrington, who was chief in command, to prevent the landing of any more hostile troops upon the soil of Greece. Ibrahim Pasha, the commander of the Turco-Egyptian fleet, refused to comply with this demand. His force, consisting of 120 vessels, including 79 ships of war, and carrying more than 2,000 guns, was lying in the harbor of Navarino. On Oct. 20 the allied fleets, consisting of only 26 vessels, and carrying about 1,300 guns, entered the harbor, but without intending to make an immediate attack. This was brought on, however, by the enemy, who fired upon a boat sent with a flag of truce, and killed several persons. After a bloody action of three or four hours the allies gained a complete victory. The Turkish squadron was almost annihilated. This was a decisive blow; the freedom of Greece was now secure. But the triumph was embarrassing to the victors. It was not the policy of France and England to weaken so fatally the Ottoman power. The King of Great Britain, in his address to his Parliament, expressed his regret at "this unfortunate collision with an ancient ally." The Duke of Wellington spoke of it as an "untoward event." But Greece was exultant. It was nearly two years, however, before hostilities entirely ceased, the last battle having been fought in Bœotia on Oct. 7, 1829. In this engagement Prince Demetrius Ypsilanti, the brother of him who was so disastrously defeated in the first battle of the war, gained a brilliant victory over a Turkish force of 7,000 men.

*Period of Independence.*—At the close of the war the Government was in the hands of the Count Capodistrias, who had left the Russian service and assumed the presidency of Greece at the beginning of the year 1828. When the protecting powers had at last come to an agreement to erect Greece into an independent kingdom, Prince John of Saxony, a scholar and a poet, had the first offer of the throne. Upon his refusal, Prince Leopold of Saxe-Coburg was the

next choice of the guardians of Greece. He accepted the crown on certain conditions, but some of these conditions being unacceptable to the allies, and other difficulties arising, he soon resigned the honor. Both these princes afterward enjoyed prosperous and peaceful reigns, the former as King of Saxony (1854–73), and the latter as King of Belgium (1831–65). In October, 1831, the president, Capodistrias, was assassinated at Nauplia. This event accelerated the negotiations of the protecting powers, and their third choice fell on Otho, second son of Louis, King of Bavaria. This choice was solemnly ratified by the national assembly of the Greek people, and in Feb., 1833, the young prince, then not quite eighteen years of age, arrived at Nauplia, then the seat of government. A Bavarian regency managed the government until 1835, when Otho, then twenty years of age, assumed the reins of government and transferred the capital to Athens. For ten years Greece was governed by the house of Bavaria without a constitution. The Greeks have never been lovers of despotism, and during all the stormy period of the revolution the forms of constitutional government had been generally observed.

*Constitutional Period.*—After much discontent and several unsuccessful insurrections, the will of the people at last expressed itself in a manner not to be resisted. On the night of Sept. 14, 1843, the palace of Otho was surrounded by the entire garrison of the capital and a crowd of excited citizens. Gen. Kalerges, who commanded the military force, informed his majesty that they had come to demand a constitution, and that they should remain until their demand was granted. There was no alternative; the king promised to call a national assembly at once to frame a constitution; and thus in one night Greece became a constitutional kingdom. The national assembly met on Nov. 20; its discussions on the articles of the constitution continued until Mar. 14, 1844; and on the 16th of the same month the constitution was definitively adopted and received the royal signature. The executive power was vested in the king and his responsible ministers. The legislative power was vested in a senate and a chamber of representatives, called the *Boule*, elected by manhood suffrage. (See GREECE.) Amid frequent complaints and several conspiracies Otho administered the government under this constitution for twenty years longer. But in Oct., 1862, while the king and queen were making an excursion in their yacht on the Ægean, Greece decided to change her master; and when their majesties returned after about ten days they were met in the harbor of Salamis by a deputation, who informed them that the throne of Greece had been declared vacant, and that the provisional government would not allow them to come on shore. The royal pair were obliged to board a British man-of-war, which bore them to Venice, whence they proceeded to Bavaria. On Dec. 1 the provisional government issued a decree ordering the election, by universal suffrage, of a new constitutional king. The vote resulted in the almost unanimous choice of Prince Alfred, second son of Queen Victoria; but former treaty stipulations between the three protecting powers forbade that any member of the royal family of either should ever wear the crown of Greece. A joint protocol of the three powers, dated May 27, 1863, declared the throne of Greece still vacant, and on June 5 another similar protocol offered the crown to Prince George of Denmark, second son of King Christian IX., and younger brother of Alexandra, Princess of Wales. He accepted the offer on condition that the Ionian islands, which had been since 1814 a nominal republic under the protection of the British crown, should be annexed to the kingdom of Greece. The protecting powers assented, and the national assembly of Greece ratified the whole proceeding, and declared the prince already of age, though he yet wanted six months of having completed his eighteenth year. Near the end of Oct., 1863, King George I. arrived in Athens, and took possession of his throne. In the new constitution adopted in 1864 the senate was abolished. On Oct. 27, 1867, he was married to Her Royal Highness the Princess Olga, daughter of the Grand Duke Constantine and niece of Alexander II., Emperor of Russia. During the reign of King George Greece has been rapidly developed. Athens has once more become the seat of letters as well as of a stable and efficient constitutional government. THESSALY (*q. v.*) was added to the kingdom in 1881.

In the early part of 1897 a rising of the Christian population of Crete and a declaration by them in favor of annexation to Greece led to the landing of a Greek army in Crete. The so-called "concert of the great powers," then treating with Turkey in regard to the Armenian question, forbade the interference of Greece, blockaded the Cretan ports, and shelled the insurgents when they attacked the Turkish forts and garrisons. The autonomy promised by the powers was unsatisfactory to both Crete and Greece, and the latter prepared for war. In the hostilities which followed the Greeks were compelled to yield point after point, and Thessaly was held by a large Turkish army. In the peace negotiations Turkey demanded permanent possession of Thessaly, but this the powers would not allow, and the treaty gave Turkey a little territory and a large money indemnity.

See Finlay's 7 vols. on *Greece*; Tricoupis's *History of the Greek Revolution*; Timayenis's *History of Greece*; Field's *Greek Islands and Turkey*; and Tuckerman's *Greeks of To-day*.

C. K. ADAMS.

**Greek Church**: the Church or group of Oriental churches which adhere only to the doctrinal decrees of the first seven œcumenical councils. I. *Name and Extent.*—The full title is the *Holy Oriental* (or *Eastern*) *Orthodox Catholic Apostolic Church*. The words *Holy Catholic Apostolic* are derived from the Nicene Creed, and are also claimed by the Roman Church, but in an exclusive sense. *Oriental* or *Eastern* designates the origin and geographical territory. The greatest stress is laid on the title *Orthodox*, and a special festival is devoted to its celebration—viz. "Orthodoxy Sunday," at the beginning of Lent, when a dramatic representation of the old œcumenical councils is given in the churches, and anathemas are pronounced against heresies. The popular designation *Greek* Church, though not strictly correct, refers to the prevailing nationality and language in which most of its creeds, liturgies, and theological and ascetic literature are composed and its worship mainly conducted.* The Greek Church embraces, however, also the Russian and other Slavonic nationalities. It has its seat in Western Asia and Eastern Europe, chiefly in Turkey, Greece, Russia, and some parts of Austria. It never spread southward and westward except in a few isolated congregations of Greek merchants and colonists, or in connection with the Russian embassy (at Vienna, Trieste, Geneva, Berlin, Paris, London, New York). The numerical strength of the Greek Church is estimated at 84,000,000 (71,000,000 in Europe, mostly in Russia, 9,000,000 in Asia, 3,000,000 in Africa, 10,000 in America).

II. *Divisions.*—The Greek Church is divided into three great branches: 1. The Orthodox Church in Turkey, under the Patriarch of Constantinople, with the subordinate patriarchates of Alexandria, Jerusalem, and Antioch. Constantinople, the city of the first Christian emperor (New Rome), though since 1453 in the hands of the Turk, is still the natural center of the whole Greek Church, and may become for the Eastern world, at some future day, in Christian hands what Gregory Nazianzen eloquently described it to be in the fourth century, "the eye of the world, the strongest by sea and land, the bond of union between East and West, to which the most distant extremes from all sides come together, and to which they look up as to a common center and emporium of the faith." 2. The Orthodox Church in Russia, under the permanent Holy Synod of St. Petersburg and the czar, whose dominion now stretches in unbroken line across the two continents of Europe and Asia. The czar is the personal, as Constantinople is the local, center of the whole Greek Church. 3. The National Church of the kingdom of Greece, which since 1833 is governed likewise by a permanent holy synod, but is less dependent upon the state than the Russian Church. 4. Distinct from these, and belonging to the Roman Church, are the United Greeks, scattered through Turkey, Hungary, Galicia, Transylvania, and Russia. They acknowledge the authority of the pope, and adopt the dogma of the double procession of the Holy Spirit, but are otherwise allowed to hold to their ancient discipline, marriage to the lower clergy, *communio sub utraque*, leavened bread, their liturgy, and the use of the Greek language. 5. The Greek or rather Oriental Schismatics, Nestorians, Jacobites, Armenians, Maronites, etc., are separated from the Greek and Latin Catholic Church mostly on the dogma of Christ's person, and have independent organizations, which rise up as the broken fragments of

* Owing to the long connection with the East Roman empire of Byzantium (New Rome) the Greek language is now known in the East as "Romaic," not as "Hellenic," and for many years the Greeks distinguished themselves as "Romans" from the surrounding Turks. The term Γραικός (used by Polybius as equivalent to the Latin *Græcus*) was by the Greeks themselves always regarded as an exotic. They called themselves *Hellenes*.

ancient national churches from surrounding Mohammedanism and heathenism in Western Asia and Africa.

III. *Historical Survey.*—The Greek Church has no continuous history like the Latin or the Protestant. She has long periods of monotony and stagnation; she is isolated from the main current of progressive Christendom; her languages and literature are little known among Western scholars; she has more interest for the antiquarian and traveler than for the historian and philosopher. Yet this Church is the oldest in Christendom.* She still occupies the sacred territory of primitive Christianity, and claims most of the apostolic sees, as Jerusalem, Antioch, Ephesus, and the churches founded by Paul and John in Asia Minor and Greece. All the apostles, with the exception of Peter and Paul, labored and died in the East. From the old Greeks she inherited the language and certain national traits of character, while she incorporated into herself also much of Jewish and Oriental piety. She produced the first Christian literature, apologies of the Christian faith, refutations of heretics, commentaries of the Bible, sermons, homilies, and ascetic treatises. The great majority of the early fathers, like the apostles themselves, used the Greek language.† Polycarp, Ignatius, Clement of Alexandria, Origen, Eusebius, Athanasius, Basil, Gregory of Nazianzen, Gregory of Nyssa, Chrysostom, Cyril of Jerusalem, and Cyril of Alexandria, the first Christian emperors from Constantine the Great, together with a host of martyrs and confessors, belong to the Greek communion. She elaborated the œcumenical dogmas of the Trinity and Christology, and ruled the first seven œcumenical councils, which were all held in Constantinople or its immediate neighborhood (Nicæa, Chalcedon, Ephesus). Her palmy period during the first five centuries will ever claim the grateful respect of the whole Christian world, and her great teachers still live in their writings far beyond the confines—nay, even more outside of her communion, as the books of Moses and the prophets are more studied and better understood among Christians than among the Jews for whom they wrote. But she never materially progressed beyond the standpoint occupied in the fifth and sixth centuries. She has no proper middle age, and no Reformation, like Western Christendom.

IV. There are three periods in the history of the Greek Church.

1. The *classical* or *productive* period, embracing the first six or seven centuries, which has just been characterized. The last great divine of the East is John of Damascus (about 750), who summed up the scattered results of the labors of the preceding Fathers into a tolerably complete system of theology. But he is an isolated phenomenon. The process of degeneracy and stagnation had already set in, and the former life and vigor gave way to idle speculations, distracting controversies, dead formalism, and traditionalism.

2. The *Byzantine* period, corresponding to the Middle Ages of the Latin Church, from the rise of Mohammedanism to the fall of Constantinople (A. D. 750–1453). This includes the gradual separation from the West and from all progressive movements; dependence on the imperial court at Constantinople; continuation of a certain literary activity; philological and biblical studies in slavish dependence on the Fathers; commentaries of Œcumenius (A. D. 1000), Theophylact (d. 1107), Euthymius Zigabenus (d. about 1120); large literary collections, classical and Christian, of Photius (about 890), Balsamon, Zonaras, Suidas, and Simeon Metaphrastes; the liturgical works of Maximus, Sophronius, Simeon of Thessalonica; the Byzantine historians; the image-controversy (726–842); inroads and conquests of Mohammedanism (after 630) in Syria, Persia, Egypt, North Africa; temporary suspension of the patriarchates of Alexandria, Antioch, Jerusalem; finally, the conquest of Constantinople by the Turks and the extinction of the Greek empire (1453), which stimulated the emigration of Greek scholars (Chalcondylas, Chrysoloras, Pletho, Michael Apostolius, Theodore Gaza, George of Trebizond, etc.) to the West, the revival of letters, the study of the Greek Testament, and, aided thereby, the preparation for the Reformation. Yet during this period of decline in her original home the Greek Church made a great conquest in the conversion of the Slavonians—namely, the Bulgarians and Russians (in the ninth and tenth centuries), while the Latin Church converted the Celtic and Teutonic races.

3. The *modern* period, which may be dated from the downfall of the Greek empire (1453). It presents in Asia stagnation and slavery under the tyranny of the Turks, but with great tenacity and independence as to all internal affairs; in Europe rapid external growth through the rising power of Russia, with some reforms in manners, customs, and the introduction of Western culture: protests against Romanizing and evangelical movements; the orthodox Confession of Peter Mogilas (1642); the Synod of Jerusalem (1672); the Russian Church; the patriarchate of Moscow; the reforms of Patriarch Nicon (d. 1681), and of the czar Peter the Great (d. 1725); the reaction of the Old Believers (Raskolniki); the Holy Synod of St. Petersburg (since 1721); the New Greek Church in Hellas (since 1827); modern influences from the West.

V. *Doctrine and Theology.*—The Greek Church is in doctrine substantially agreed with the Roman, but upon the whole more simple and less developed, though in some respects more subtle and metaphysical. The only serious doctrinal difference is that on the Procession of the Holy Spirit (*q. v.*). She holds to the leading principles, but rejects many of the consequences or results, of Roman Catholicism. She adheres to the theology of the Fathers, and ignores the succeeding scholastic theology of the Schoolmen, who completed the Roman system. The Eastern theology is not properly systematized. It remains rigidly in the fragmentary state of the old councils. The resistance to the Western clause *filioque* implied a protest against all further progress both in truth and in error, and meant stagnation, as well as faithful adherence to the venerable symbol of the first and most important of the œcumenical councils. The Greek theology is most full on the doctrine of God and of Christ, but very defective on the doctrine of man and the order of salvation. The East went into all sorts of theological and Christological subtleties, especially during the long and tedious Monophysite controversies, which found little or no response in the West; but it ignored the Pelagian controversies, the development of the Augustinian and later evangelical theology. It took the most intense interest in the difference between *ousia* and *hypostasis*, the *homo-ousion*, the relations of the persons in the Trinity, the *perichoresis*, the relation of the two natures in Christ, the Nestorian, Eutychian, and Monophysite heresies, but was never seriously troubled with the questions about predestination and election, total depravity and freedom, vicarious atonement, justification and imputation, conversion and regeneration, faith and good works, merit and demerit, vital union to Christ, and cognate doctrines which absorbed the attention of Western Christendom. The cause for this difference must be sought in the prevailing metaphysical, rhetorical, and objective character of the Eastern Church, inherited partly from Asia, partly from Greece, as distinct from the practical, logical, and subjective tendency of the Western churches, which is derived from the Roman and the Teutonic nationalities. The difference is illustrated already by the Nicene Creed, with its metaphysical terms about the Son, as compared with the more simple and popular Apostles' Creed, which originated in the West and is very little used in the East.

VI. *Government.*—The Greek Church is a patriarchal oligarchy, in distinction from the papal monarchy. The episcopal hierarchy is retained, the papacy rejected. The Vatican decrees of 1870 have intensified the separation between the two churches. Centralization is unknown in the East. The patriarchs of Constantinople, Alexandria, Antioch, and Jerusalem are equal in rights, though the first has a primacy of honor. The Eastern hierarchy resembles the Jewish type. The Greek priest within the veil of the sanctuary is concealed from the eyes of the people, but in social respects he is nearer the people than the Romish priest. He is required to marry once, but forbidden to marry twice. Celibacy is confined to bishops and monks. Absolution is given only in the form of a prayer, "May the Lord absolve thee!" instead of the positive form, "I absolve thee." The confessional exists, but in a milder form, with less influence than in Romanism. The laity are more independent, and the Russian czar, like the Byzantine emperor of old, is the head of the Church in his dominion. The unction of confirma-

* The Jews were indeed converted before the Greeks (Ἕλληνες), but the Jewish Christian churches passed over into the Greek, and the majority of the original Jewish converts were Greekish Jews or Hellenists.

† Even Clement of Rome, Hermas, Irenæus, Hippolytus, and others who belong to the Western Church, wrote in Greek. The early popes were Greeks. The very name of pope is Greek, and belongs to every pastor in the East. The Roman congregation itself was originally a colony of Greek Christians, Hellenes, and Jewish Hellenists. In this sense, too, the maxim of Horace holds good: "*Græcia capta ferum victorem cepit.*"

tion is made to symbolize the royal priesthood of every believer. The monastic orders, though including many clergy, are not clerical institutions; the community of Athos is a lay corporation with chaplains.

The administration of the churches as developed in the Byzantine empire is most complicated, and involves, besides the regular clergy, an army of higher and lower ecclesiastical offices, from the first administrator of the church property (*ὁ μέγας οἰκονόμος*), the superintendent of the sacristy (*ὁ σκευοφύλαξ*), the chancellor or keeper of ecclesiastical archives (*ὁ χαρτοφύλαξ*), down to the cleaners of the lamps (*οἱ λαμπαδάριοι*), the bearer of the images of saints (*ὁ βασταγάριος*). These half-clerical officers are divided into two groups—one on the right, the other on the left; each is subdivided into three classes, and each class has again five persons. Leo Allatius and Heineccius enumerate fifteen officials of the right group, and even more of the left. But many of these offices have either ceased altogether or retain only a nominal existence.

VII. The *cultus* is much like the Roman Catholic, with the celebration of the sacrifice of the mass as its center, with an equal and even greater neglect of the sermon, and is addressed more to the senses and imagination than to the intellect and the heart. It is strongly Oriental, unintelligibly symbolical and mystical, and exeessively formalistic. The Greeks reject organs, musical instruments, and sculpture, and make less use of the fine arts in their churches than the Roman Catholics; but they have even a more complicated system of ritualism, with gorgeous displays, semi-barbaric pomp, and endless changes of sacerdotal dress, crossings, gestures, genuflexions, prostrations, washings, processions, which so absorb the attention of the senses that there is little room left for intellectual and spiritual worship.* They use the liturgy of St. Chrysostom, which is an abridgment of that of St. Basil, yet very lengthy, and contains, with many old and venerable prayers, later additions from different sources to an excess of liturgical refinement.

The most characteristic features of Greek worship, as distinct from the Roman, are—the threefold immersion in baptism, with the repudiation of any other mode as essentially invalid; the simultaneous performance of the act of confirmation and the act of baptism, which in the West have been separated: the anointing with oil in cases of dangerous illness, which Rome has changed into extreme unction of the dying; infant communion, which the Latin Church has not only abandoned, but forbidden: the communion under two kinds (*κατὰ τὰ δύο εἴδη, sub utraque*); the use of leavened instead of unleavened bread in the Eucharist; the standing and eastward posture in prayer; the stricter separation of the sexes; the use of the screen or veil before the altar, and the withdrawal of the performance of the mysteries from the eyes of the people.

The worship of saints, relics, flat images, and the cross is carried even further than in the Roman Catholic Church, but statues, bas-reliefs, and crucifixes are forbidden. In Russia, especially, the veneration for pictures is carried to the utmost extent, and takes the place of the Protestant veneration for the Bible. The picture with the lamp burning before it is found and worshiped in the corner (the sacred place) of every room, in the street, over gateways, in offices, taverns, steamers, railway and telegraph stations, in the knapsack of every soldier—not as a work of art, but as an emblem, a lesson of instruction, an aid to devotion. The vernacular languages are used in worship—the Greek in Turkey and Greece, the Slavonic in Russia—but they have to a considerable extent become unintelligible to the people. The Oriental sects hold to their native dialects, the Syriac, Armenian, etc. The old Greek calendar is eleven days behind the new style introduced by Gregory XIII.

VIII. The Greeks and Russians are very religious in outward observances and devotions. They are liberal in unmeaning compliments. The Greek Christians surpass their Mohammedan neighbors in chastity, but are behind them in honesty. In Russia there is the same divorce between religion and morality. The towns are adorned with churches and convents; every public event is celebrated by the building of a church; every house has an altar and sacred pictures; every child his guardian angel and baptismal cross; a Russian fasts every Wednesday and Friday, prays early and late, regularly attends mass, confesses his sins, pays devout respect to sacred places and things, makes pilgrimages to the tombs and shrines of saints, and has the phrase *Slava Boga* (Glory to God) continually on his lips. And yet many of the priests are grossly intemperate.

IX. *The Greek Church and the Bible.*—Concerning the extent of the canon of the Scriptures the Eastern Church is not quite consistent, and stands midway between the Roman and the Protestant view concerning the Jewish Apocrypha. The Orthodox Confession repeatedly quotes the Apocrypha as authority, and the Synod of Jerusalem mentions several apocryphal books (The Wisdom of Solomon, Judith, Tobit, the History of Bel and the Dragon, the History of Susannah, The Maccabees, and The Wisdom of Sirach) as parts of the Holy Scriptures. On the other hand, Metrophanes enumerates only twenty-two books of the Old Testament (according to the division of Josephus, who counts the twelve minor prophets as one, and combines several historical books), and eleven books of the New Testament (counting fourteen Epistles of Paul as one book, and so the two Epistles of Peter and the three of John), and then speaks of the Jewish Apocrypha as not being received by the Church among the canonical and authentic books, and hence not to be used in proof of dogmas. The Longer Catechism of Philaret likewise enumerates (with Josephus, St. Cyril, and St. Athanasius) only twenty-two books of the Old Testament and twenty-seven books of the New, and says that "the Wisdom of the Son of Sirach and certain other books" are ignored in the list of the books of the Old Testament "because they do not exist in the Hebrew." The use of the Apocryphal books is founded in this, that "they have been appointed by the Fathers to be read by proselytes who are preparing for admission into the Church."

As to the *circulation* of the Scriptures among the laity, it is not encouraged, and certain portions, especially of the Old Testament, are declared to be unfit for general use. But the Greek Church has never expressly prohibited the reading of the Bible to the people; and the Orthodox Church of Russia has always had a popular version of the Bible, first in the old Slavic, and now in modern. Alexander I., by a ukase of Jan. 14, 1813, allowed even the British and Foreign Bible Society to establish a branch in St. Petersburg. Through the labors of this society nearly 500,000 copies of the New Testament and the Psalms were scattered in thirty-two languages all over the empire. But it should be remembered that not more than one out of ten Russians can read at all. In 1825 Nicholas, under the influence of the monks, or the black clergy, placed the book under arrest, and replaced it by an official Book of Saints. But his successor, Alexander II., the emancipator of the serfs, also emancipated the Bible, and restored in part, at least, the liberty of the Bible Society, but restricted it to the Protestant population. The printing and circulating of the Bible in the Russian language and within the Orthodox Greek Church is under the exclusive control of the Holy Synod of St. Petersburg.

LITERATURE.—The chief sources are the acts of the first seven œcumenical synods (from the first of Nicæa, 325, to the second of Nicæa, 787); above all, the creeds and canons of the Council of Nicæa, 325, and the Council of Chalcedon, 451. The writings of the Greek Fathers, especially Athanasius, Chrysostom, and John of Damascus. The Confession of Gennadius, Patriarch of Constantinople (delivered to the Turkish sultan, Mahomet II., 1453); the Orthodox Confession of Peter Mogilas, Metropolitan of Kiev (1643); the eighteen decrees of the Synod of Jerusalem and the Confession of Dositheus (1672, mainly directed against the patriarch Cyril Lucar and his attempt to Protestantize the Greek Church); the Russian catechisms of Platon, and especially of Philaret (Metropolitan of Moscow, d. 1867). The Longer Catechism of Philaret, issued by authority of the Holy Synod of St. Petersburg, 1839, is used in all the churches and schools of the Russian empire, and is by far the best modern exposition of the orthodox doctrine of the Eastern Church. It contains in questions and answers a commentary of the Nicene Creed, the Lord's Prayer, the Nine Beatitudes, and the Ten Commandments. See Leo Allatius on the consent of the Greek and Latin Churches (Col., 1648); Le Quien, *Oriens Christianus* (1740); Jac. Goar, *Euchologium, s. Rituale Græcum* (1667); John King, *Rites and Ceremonies of the Greek Church in Russia* (London, 1772); John Mason Neale, *History of the Holy Eastern Church* (London, 1850); Dean Stanley, *Lectures on the Eastern Church* (London and New York, 1861; 3d ed. 1866); Gass, *Symbolik der Griech. Kirche* (1872). On the Russo-Greek Church, see also the works of Strahl, Moura-

* Stanley (*Eastern Church*, p. 32) characterizes the Greek worship as "a union of barbaric rudeness and elaborate ceremonialism."

vieff, Pinkerton, Blackmore, *The Doctrine of the Russian Church* (1865); Haxthausen, Philaret, *Geschichte Russlands* (1872); Basaroff, Boissard, *L'église de Russie* (1867, 2 vols.). PHILIP SCHAFF.

**Greek Empire**: See BYZANTINE EMPIRE.

**Greek Fire**: a highly inflammable compound, probably made of naphtha, saltpeter, and sulphur, and much used by the Byzantine Greeks in defensive and offensive warfare; but there is much doubt as to its composition. It was thrown upon the enemy by means of a copper tube, or pledgets of tow were dipped in it and attached to arrows, which were discharged at hostile ships or towns. This material was also used in Western Europe and in Asia to some extent in the Middle Ages. Its invention was ascribed to Callinicus of Heliopolis, in Egypt, in 668 A. D.; and it was first used by Constantine Pogonatus against the fleet of the caliph Moawia at the siege of Constantinople in 673, with the most complete success. It is, however, generally considered an Arabian or an East Indian invention. The use of similar compounds called by the name has been attempted in modern times without much success, the new plan being to throw them in shells or grenades.

**Greek History**: See GREECE, HISTORY OF ANCIENT.

**Greek Language**: the vernacular of the inhabitants of Greece. It belongs to the Indo-European family of languages. Its chief characteristics are copiousness of inflection and vocabulary, and consequent capacity for fine distinctions, wonderful power of self-development, great vivacity, flexibility of expression, and freedom from arbitrary rules.

The Greek language may be divided into two main divisions, *Ancient Greek* and *Modern Greek*, the latter beginning with the end of the eighth century. The history of ancient Greek may be subdivided into two chief periods: (1) the classic period, from the earliest times to 330 B. C.; (2) the post-classic period, from this date to about 800 A. D.

### ANCIENT GREEK.

*Dialects.*—In the classic period the Greek language was by no means uniform. Though all Greeks felt their community of speech, and seemed to have understood one another without difficulty, yet the dialectic variations were considerable. Most of these dialects were little cultivated by literary use. Only two, Ionic and Attic, do we know through literary remains of any extent; of all the others, our knowledge depends chiefly on inscriptions. The number of dialectic inscriptions has greatly increased, and discoveries are constantly bringing more to light the astonishing multiformity of the Greek tongue. The traditional division of the dialects into Ionic, Doric, and Æolic, which has come down to us from the ancients, has been found inadequate. It is impossible to unite in a single group the six or more dialects which are neither Ionic nor Doric; it is evident that two or three such groups must be recognized, and the term Æolic can not be extended over all of these. It will be convenient for the present to divide the Greek dialects into four groups: Ionic, Doric, Æolic, and other dialects. The following are the chief individual dialects, with some characteristics of each:

A. IONIC, including Attic, which is but a branch of Ionic. Characteristic of the Ionic is the change of original long *α* into *η*, the particle *ἄν* = *κα*, *κε*, and the loss of digamma.

1. *Attic*, the chief literary dialect. It retains long *α* in certain positions (*πράσσω*, *σοφία*), verging in this respect toward the Doric. It was by holding this middle position the better fitted to become the universal Greek language. Unlike the other Ionians, the Athenians contracted contiguous vowels freely; indeed, some contractions, as that of *φιλέομεν* to *φιλοῦμεν*, are found only in Attic.

2. *Ionic of the Asiatic coast and islands*, often called simply Ionic, distinguished by avoidance of contraction and tolerance of successive vowel-sounds (*δηϊόφεν*), including—

(*a*) *Old Ionic* of the Homeric poems and all later epics, a partly conventional and artificial language, containing much that is extremely ancient (genitive in *οιο*, futures and aorists with *σσ*, traces of digamma), side by side with forms of a later stage.

(*b*) The so-called *New Ionic*, the spoken language of the Asiatic Ionians; its local variations are no longer traceable. It is known by the writings of Herodotus and Hippocrates. It has *κ* for *π* in interrogatives, as *κοῦ*, where.

B. DORIC.—All Doric dialects have *μες* for *μεν* in 1st pers. pl.; *ντι* in 3d pers. pl. (*λέγοντι* for *λέγουσι*); future in *σιω* or *σεω* for *σω*; infinitive in *μεν* for *ναι* (*δόμεν* = *δοῦναι*); *κά* for *ἄν*; gen. pl. 1st decl. in *ᾶν*, gen. sg. masc. in *ᾱ* (*πολίτα πολιτᾶν* = *πολίτου*, *πολιτῶν*). The W-sound (digamma) was, as a rule, retained. Many of the Doric dialects have *η* and *ω* for Attic *ει* and *ου* in certain situations, as *μῶσα*, *δάμω*, *τιθῆσα*, *ἦχον* = *μοῦσα*, *δήμου*, *τιθεῖσα*, *εἶχον*; others agree with the Attic.

1. The *Doric* of Crete, known chiefly from the laws of Gortyn. Samples: *ϜἹσϜος* = *ἴσος*, *ὁπόττος* = *ὁπόσος*, *δικάδδω* = *δικάζω*, *Ϝειπάθθω* = *εἰπάσθω*.

2. The *Doric* of Laconia, Messene, and the colony Heraclea in Italy. The Laconian changed *σ* between two vowels to *h*: *πᾶά* = *πᾶσα*.

3. *Doric* was also spoken in Rhodes, Melos, Thera, and some other islands, in Megara, Argos, Corinth, Cyrene, Corcyra, and Sicily. The Megarian had *χρῄδδω* = *χρῄζω*, etc. The Argive preserved *νς* like the Cretan. The Rhodian had a peculiar infinitive in *-μεν*: *θέμεν* = *θεῖναι*.

4. A special group is the *Northern Doric* of Phocis, Locris, etc. Peculiar is the use of *ἐν* for *εἰς* with accus., of *-οις* in dat. pl. 3d decl., as *Ϝετέοις* = *ἔτεσι*. The Locrian has *ἐ* = *ἐκ*, *στ* for *σθ* in verbal forms (*χρήστω* = *χρήσθω*), *πατάρα*, *ἁμάρα* for *πατέρα*, *ἡμέρα*.

C. ÆOLIC.—Three dialects may be here included:

1. The language of *Lesbos* and the neighboring coast. *Ἀπύ* = *ἀπό*, *κρέτος* = *κράτος*: *αις οις* from *ανς ονς*, thus accus. *μοίσαις* = *μούσας*, *λόγοις* = *λόγους* (the Lesbian datives being *μοίσαισι*, *λόγοισι*); doubled consonants, *βόλλα* = *βουλή*, *ἔνεμμα* = *ἔνειμα*; general retraction of the accent, and disappearance of the rough breathing, *ὔμμες* = *ὑμεῖς*. This is the language of Alcæus and Sappho, often called simply Æolic.

2. *Thessalian.*—Peculiar is *ου* for *ω* (*τοῦν πολιτάουν* = *τῶν πολιτῶν*); genitive of 2d decl. in *οι* (*λόγοι* = *λόγου*), and dative in *ου* (*τοῦ κοινοῦ* = *τῷ κοινῷ*); *μά* = *δέ*; pronoun *ὄνε* = *ὅδε*; 3d pers. plur. in *-εν* for *-ν* (*ἐδώκαεν* = *ἔδωκαν*).

3. *Bœotian.*—*βανά*, *βανῆκος* = *γυνή*, *γυναικός*; *δ* for *ζ*, as *δυγόν*, *γραμματίδδω* = *ζυγόν*, *γραμματίζω*; 3d pers. pl. in *νθι* (*ἔχωνθι* = *ἔχωσι*); a very peculiar vowel-system by which many of the long vowels and diphthongs are replaced by others, *ει* standing for *η* and *η*, *η* for *αι* and *ᾳ*, *ι* for *ει*; in the later stage *υ* stands for *οι* and *ῳ*, *ου* for long and sometimes for short *υ*; examples, *Ἠολεῖα* = *Αἰολῆα*, *Ϝελατιήυ* = *Ἐλατειαίῳ*, *τούχα* = *τύχη*, *τραγαϜυδός* = *τραγῳδός* (*-αοιδός*). The dative sg. of 1st and 2d decl. ends in earlier times in *αι* and *οι* (*ταῖ ὁδοῖ* = *τῇ ὁδῷ*), but sometimes in the Latin-like diphthongs *αε* and *οε* (*Πλαύχαε*, *Διωνύσοε*); in later times in *η* and *υ* (*τῆ ὁδῦ*). *Σαυκράτεις* stands for *Σωκράτης*.

D. OTHER DIALECTS.

1. *Arcadian.*—*Ἐs* for *ἐξ*; *ἰν*, *κατύ*, *ἀπύ* for *ἐν*, *κατά*, *ἀπό*; *δέλλω* for *βάλλω*; *κ'ἄν* = *ἄν*; genit. of 1st decl. in *-αν*, *ζαμίαν* = *ζημίας*.

2. *Cyprian.*—Related to Arcadian. *σίς* = *τίς*; *αἴλος* = *ἄλλος*. Many peculiar words, as *ϝΐϜαις ζᾶν*, during life.

3. *Elean.*—Fondness for *a*-sound. *Ϝάργον*, *πάρ*, *Ϝράτρα*, *μά*, *ἔα* = *ἔργον*, *περί*, *ῥήτρα*, *μή*, *εἴη*, words in which even the Doric has *ε*, *η*.

ALPHABET.—Though not strictly a part of the language, the alphabet may receive some notice here. The Greeks received their letters from the Phœnicians, at what time is uncertain, but the earliest known inscriptions were not written before 650 B. C., and the Homeric poems make no mention of writing. The Phœnician alphabet of twenty-two signs ending with T, was increased by a new vowel-sign Υ at the end, and later by the letters Φ, Χ, Ψ, but these last two were differently employed, the western Greeks using the sign Χ for the sound *x* (so too the Latins), and Ψ for *ch*, while with the eastern Greeks the Χ was *ch* and Ψ *ps*. The letter Ξ was employed by the eastern Greeks as *x*, but dropped by the western. The Phœnician alphabet furnished two signs for *s*; after some fluctuation one of these was dropped. The forms of the letters varied much at different times and places, but became fixed in the fourth century B. C. The letters at first were turned (Ǝ, Ч), and the writing proceeded from right to left; this, however, was early reversed. Ε and Ο stood originally for the long as well as the short *e* and *o* sounds; Η in earlier times generally represents the rough breathing *h*. The Ionians first began regularly to use Η for the long *ē*, and they also invented the sign Ω for the long *ō*. This mode of writing, and with it the complete Ionic alphabet, became general about 400 B. C., superseding the older alphabets. Breathings and accents were unused till long afterward. Capitals only were known to the ancients; the cursive letters were developed in the mediæval period.

PRONUNCIATION.—The vowels in the classical period were sounded as in Italian or German, except that *υ* early assumed in many dialects the sound of the French *u*. The

diphthongs αι, ει, οι, αυ, ευ, υι sounded as in *ay*, re*i*n, boi*l*, h*ow*, f*ew*, *we*; the ι in ᾳ, ῃ, ῳ was distinctly heard; ου assumed early a simple sound, as in *y**ou**th* = Roman *u*. The guttural nasal (*n* in *ink*) was expressed by ν or γ indifferently. The aspirates φ, ϑ, χ were at first tenues with following breathing, as in ha*p*hazard, po*t*hook, blo*ckh*ead; later they came to be merely spirants (*f*, Eng. *th*; Germ. *ch*). Ϝ sounded like Eng. *w*, ζ like *dz*, but in some parts of Greece like *zd*.

Phonetic Relations to Parent Language.—The vowels α, ε, η, ο, ω, ι, υ correspond in general to the sounds *a*, *e*, *o*, *i*, *u* of the original Indo-European tongue. But short ᾰ, standing before or after ρ and λ, has, in many words, grown out of the liquid consonant; as ἔτραπον for ἔ-τρπ-ον. Similarly ᾰ with μ and ν, sometimes even replacing those consonants; βατός for older βν-τός. In Ionic two kinds of η have to be distinguished—the original Greek η (θήρ, μή, μήδομαι) and that which has arisen from ᾱ (ἵστημι, ἡδύς = Doric ἵστᾱμι ἁδύς). The diphthongs αι, ει, οι, αυ, ευ, ου often correspond to similar diphthongs of the parent language—thus Ϝοῖδα, εἶμι (origin. *voida*, *eimi*, Sans. *vēda*, *ēmi*). Elsewhere diphthongs have arisen from the accidental concurrence of two vowels, as γένει from γενε(σ)ι, by the dropping of σ. From the above rule of correspondence must be excepted the spurious diphthongs ει and ου, to be spoken of below. The so-called *improper* diphthongs ᾳ, ῃ, ῳ, ηυ, ωυ are specifically Greek and of secondary origin, the result of contraction. Noteworthy is the interchange of ε, ο, α (τρέπω, τρόπος, ἔτραπον), ει, οι, ι (λείπω, λέλοιπα, ἔλιπον), and ευ, υ (φεύγω, ἔφυγον), in the process of inflection and word-formation. Analogous in English is *sing*, *sang*, *sung*; *ride*, *rode*, *ridden*. Of consonants, σ, κ, γ, τ, δ, π, β answer in general to the same sounds in the parent language; the aspirate χ, ϑ, φ to original *gh*, *dh*, *bh*; compare ἐ-λαχύς, τίϑημι, φημί with Sans. *laghus*, *dadhāmi*, *bhāmi*. The nasals μ, ν = Indo-European *m*, *n*, but ν final often represents an *m*; ζυγό-ν = Lat. *jugu-m*. Greek ρ = original *r*; λ responds to either *l* or *r* of cognate languages. Greek Ϝ answers to the semi-vowel *v* (*w*) of the cognate tongues. The double sounds ξ, ψ arose in various ways too complicated to be here detailed. Ζ is in most cases the product of a union of δ or γ with following ι; when initial it responds to *y* of other languages; ζυγόν = Lat. *jugum*. The Greek rough breathing is (except where of secondary origin) a remnant of a lost consonant (oftenest σ or σϜ), and never corresponds to Latin or Sanskrit *h*.

Principal Phonetic Tendencies.—1. *Disappearance of consonants* was the most prolific cause of changes of form in Greek. Ϝ disappeared entirely in the Ionic branch, and to a great extent in the others. Σ falls out between two vowels and at the beginning of a word; γένεος from γενεσ-ος (Lat. *gener-is* for *genes-is*), ῥόος from σροϜος. Many words have lost initial σϜ, as ἡδύς from σϜαδυς (Lat. *sva(d)vis*, Eng. *sweet*). Difficult combinations of consonants may be lightened; τ, δ, ϑ regularly disappear before σ. The combination νσ is especially disliked, and is avoided by nearly all dialects, oftenest by dropping the ν. 2. *Changes of Consonants.*—Ι often turns a preceding τ to σ, though not in all dialects: εἴκοσι, πλούσιος (from πλοῦτος), φησί; but Doric Ϝίκατι, πλούτιος, φατί. Τ, δ, ϑ before μ become σ, but not universally; Ionic ἴδμεν, Doric ϑεϑμός or τεϑμός for Attic ἴσμεν, ϑεσμός. Assimilation, either total, as ὄμμα (Æol. ὄππα) for ὄπ-μα, or partial, as ἐμβαλεῖν, γέγραπται for ἐν-βαλεῖν, γέγραφται, is frequent. Metathesis (transposition of a vowel and consonant) occurs in root-syllables, chiefly affecting liquids and nasals: ἔ-ϑαν-ον, ϑνή-ισκω. Noteworthy is the spontaneous generation of β between μρ, μλ, and δ between νρ, νλ; ἀνδρός for ἀν(ε)ρός, μέμβλωκα for μέμλωκα; so French *chambre*, *cendres* from *cam(e)ra*, *cin(e)res*; when initial the μ, ν are dropped: (μ)βλώσκω, (μ)βροτός for μλω-σκω, μρο-τος, roots μολ, μορ. Change of organ in mutes is seen in many words: ποῦ, Ionic κοῦ; βάλλω, Arc. δέλλω; πέσσω (i. e. πεκ-jω) Lat. *coqu-o*; πέντε, Æol. πέμπε, Lat. *quinque*; τίς, Lat. *quis*, etc. In such cases the original is believed to have been a peculiar *q* or *g* sound. The vowel ι or its consonant form j unites with preceding δ or γ to form ζ, with κ, τ, χ, ϑ to form σσ or ττ. This is regularly the origin of σσ (= ττ) and ζ in Greek; πεζός = πεδ-ιος, ἐλάσσων = ἐλαχιων; so Æol. κόρζα, ζά for καρδία, διά. The process is the same as in Italian *mezzo* (*medius*), French *face* (*facies*). 3. *Contraction of vowels*, which are brought together mostly by the loss of intervening consonants. The rules for Attic can be found in any Greek grammar, but the usage of the dialects differed much; thus αε gave in Doric η, ἐνίκη = Att. ἐνίκα; εε, οο gave in some dialects η and ω; ἀγῆται, ἵππω; in others, as in Att., ει and ου, ἡγεῖται, ἵππου. The epic dialect shows certain uncontracted verbal forms with a peculiar modification, as ὁρόω, αἰτιάασϑε, from ὁράω, αἰτιάεσϑε. 4. *Loss of Vowels.*—The Greek often drops the close vowels ι, υ between other vowels, changing them first into the semi-vowels Ϝ, j: Ἀθηναία, Ἀθηνάα; βασιληυ-ος, βασιληϜ-ος, βασιλῆος. 5. *Vicarious lengthening of a vowel* in compensation for an omitted consonant. When μ, ν, ρ, λ are dropped *before a continuant consonant*, the preceding vowel is often lengthened to compensate for its loss of position. The commonest case is (ν)σ. The dialects differ widely in respect of this process. The Lesbian often avoids it, contenting itself with assimilation of the consonants. Otherwise it replaces omitted ν by ι. Examples are—ἐσ-μι, Lesb. ἔμμι, other dialects ἠμί and εἰμί; aorist ἐμεν-σα, Lesb. ἔμεννα, other dialects ἔμηνα and ἔμεινα; ξεν-Ϝος, Lesb. ξέννος, Ionic ξεῖνος, Attic and other dialects ξένος; παν-σα, Lesb. παῖσα, other dialects πᾶσα; ϑεν-σα, strict Dor. ϑῆσα, other dialects ϑεῖσα; μον-σα, Lesb. μοῖσα, strict Dor. μῶσα, other dialects μοῦσα; τόνς retained by Cretans and Argives, other Dorians τώς τός and τούς, Ionic τούς, Lesb. τοίς. The Ionic, Attic, and some Doric dialects lengthen ε and ο to the false diphthongs ει, ου, which must be distinguished from the genuine ει and ου, as they were originally neither written nor sounded as diphthongs. The same is true of the ει and ου which arise from the contraction of εε, οε, οο, εο (see above). 6. *Transposition of Iota.*—Ι (or j) sometimes appears to spring over a consonant and intrude itself into the previous syllable: τείν-ω for τεν-ιω. 7. *Prothesis* of vowel at beginning of a word, to assist in the enunciation of a difficult consonant or combination; so in Italian, *i-scrivere*; French, *e-sprit* (*spiritus*); χϑές or ἔχϑες; often before Ϝ, where it remains after the latter's disappearance: ἄϝλον, ἐϝικοσι for ἀ-Ϝϝλον, ἑ-Ϝικοσι; even before a simple liquid ἐ-ρυϑρός = *ruber*. 8. *At the end of a word* no consonant but ν, ρ, σ can stand. Others drop off: γάλα for γαλακτ. Α ν, sometimes fixed, sometimes movable, attaches itself to some final syllables: 1st pers. pl. -με-ν, Dor. -μες, Lat. -*mus*; dat. pl. -σι or -σι-ν. In other words an adventitious ς is seen, πολλάκι-ς.

Inflection.—1. *Of Nouns.*—The eight cases of the Indo-European language are in Greek reduced to five (nominative, accusative, genitive, dative, vocative). The lost cases, ablative, locative, and instrumental, are preserved only in adverbial forms, though some forms of the Greek dative sing. and dative plur. are original locative forms. Other locatives are οἴκοι, χαμαί (*humi*); instrumentals are κρυφῇ, ἅμα. The ablative is preserved in the common adverbs in -ω or -ως; οὔτω, οὕτως, originally οὔτωτ, like Latin *bonō(d)*. The stems of Greek nouns end in long α (1st declension), ο (2d declension), and in close vowels, diphthongs, and consonants (3d declension). The case-endings, added to these stems, are in the oldest authenticated Greek forms: For ο and α stems; nom. sg. -ς (but fem. α-stems have no case-ending), gen. (σ)ιο or ς, dat. ι with long vowel preceding, acc. ν, nom. plur. ι, gen. ων or (σ)ων, dat. ισι or ις, acc. νς. For consonant and close-vowel stems; nom. sg. ς, gen. ος, dat. ι, acc. ν or α, nom. pl. ες, gen. ων, dat. σι, acc. νς or ας. Neuters in nom. acc. pl. have the ending α; in nom. acc. sg. they have in the consonant declension no ending, but the ο-stems take the accusative ending ν. The Greek has retained the dual number more fully than most of the related languages, though only in two case forms; its endings are ε, οιν. Vocative cases proper have no ending. The union of stems and endings gives rise to many phonetic changes in accordance with principles explained above. 2. *Of Pronouns.*—The flexion of pronouns differs in many points from that of nouns, and is too complicated to be discussed here. The Greek ὁ, ἡ, τό = Sanskr. *sa*, *sā*, *tat*; τοῖο = *tasya*, τόν = *tam*, τήν (Dor. τάν) = *tām*, etc. The Dorians and most Æolians had τοί, ταί in the nom. pl., not οἱ, αἱ. The relative pronoun ὅς, ἥ, ὅ = Sans. *ya-s*, *yā*, *ya-t*. The interrogative τίς is Sans. *ki-s*, Lat. *quis*. 3. *Of Verbs.*—The structure of the Greek verb is in several ways remarkable. First, in the number of significant variations of form; the Greek finite verb (excluding infinitives, participles, and all periphrastic forms) has about 250 different forms, in contrast with 94 of the Latin. Second, the Greek alone of all Indo-European languages has preserved intact the original distinction of the tenses. It never allows the perfect to become a mere preterite, and it has, in its use of present and aorist, carefully kept up the distinction between continued and momentary action, which enables it, for example, to express directly such differences as "be ill" and "fall ill," "weep" and "burst into tears," which we accomplish only by circumlocutions. The Greek

finite verb has three voices; besides the active and the passive, the *middle* voice, representing the subject as acting upon, for, or with himself: this is made the means of many fine distinctions. The middle and passive are distinguished in form only in future and aorist, and here the distinction is not very old, and not uniformly kept up. Besides the indicative and imperative moods, there are two oblique moods —subjunctive (conjunctive) and optative. The tenses fall into three groups, representing continued, momentary, and completed action. The distinction of time belongs to the indicative only; its seven tenses being thus classified:

| | *Continued.* | *Momentary.* | *Completed.* |
|---|---|---|---|
| *Present*, | Present, | ..... | Perfect. |
| *Past*, | Imperfect, | Aorist, | Pluperfect. |
| *Future*, | Future, | ..... | Future Perfect. |

The oblique moods do not distinguish time, and have three tenses only, the present for continued, the aorist for momentary, the perfect for completed action. The structure of most of these tenses is inherited from the parent language. The present and imperfect are often distinguished by some amplification of the stem of the verb; this is of several sorts, and furnishes the best ground for a classification of verbs. The so-called second aorist lacks this, and is thus distinguished from the present. The perfect and pluperfect have for their characteristic the reduplication, primarily a repetition of the initial syllable. All these tenses exist in two forms (called respectively the ω-conjugation and the μι-conjugation), as they are with or without a certain vowel (thematic or connecting vowel) appended to the stem; most verbs follow the former. The future and the so-called first aorist are formed (in the first person sing.) by adding to the stem the suffixes σιω (Attic σω) and -σα. The future perfect is peculiarly a Greek formation; the same is true of the passive aorist and future. The Greek has preserved dual forms of the verb in the 2d and 3d persons. The personal endings of the verb vary for the different moods and tenses. The following may be considered the oldest authenticated Greek forms: 1. For pres., perf., fut., and subj.; active sing. μι (or none), σι, τι; plur. μες, τε, (α)ντι; dual τον; passive sing. μαι, σαι, ται; plur. μεσθα, στε, (α)νται; dual στον. 2. For past tenses and optative, active sg. ν, ς, τ; plur. μες, τε, ν; dual τον, ταν; passive sing. μαν, σο, το; plur. μεσθα, στε, (α)ντο; dual στον, σταν. The imperative has separate endings. Participles and infinitives are formed from present, aorist, perfect, and future. There is also a rare future optative, a special Greek development.

Formation of Words.—The suffixes by which nominal stems are formed from roots are part of the inheritance from the parent language. Some of these are—α, ο, ι, υ; κο, το, μο, νο, ρο, λο, Fο, ιο (and the corresponding feminines, κα, etc.), εσ, ασ, εν, ον, τηρ, τορ, and various compounds of these. Nouns derived from verb-stems are called primary; those derived from other noun-stems are called secondary; thus δό-σι-ς, κρι-τή-ς, πρεσβευ-τή-ς are primary, but δίκα-ιο-ς, πρεσβύ-τη-ς are secondary, derived from δίκη, πρέσβυ-ς. The commonest secondary suffix is ιο (ια): before it ο is dropped; ἵππ-ιος from ἵππο-ς. Another is Fεντ (χαρι-Fεντ, nom. χαρί-εις), signifying 'abounding in.' The comparative suffixes ιον or ιοσ, τερο, and the superlative ιστο, τατο, deserve mention. To few of these suffixes can a uniform meaning be attached, as that of the *doer* to τηρ. In compound words two stems are united; the latter only is inflected, ἱππο-κόμο-ς. The Greek is rich in compounds, but they rarely contain more than two members. Verbs (called denominative) are freely formed from nouns; most of these end in αω, εω, οω, αζω, and ιζω, the first vowel belonging to the noun-stem; φιλέ-ω from φίλο-ς, with ο changed to ε. From the stems of denominative verbs other nouns may be formed in the same manner as from roots.

Accent.—The accent of the Greeks was not, like ours, a stress on a particular syllable, but is an elevation in pitch. It is confined to the last three syllables of words. The ordinary tone of accented syllables is called *acute* (marked ´), and when it falls on long vowels extends to the end of the same. But long vowels in either of the two final syllables have sometimes the high tone restricted to the first half, the voice descending on the last half; this kind of accent is called *circumflex* (marked ^). If the final syllable of a word be long, the tone can in no case stand further back than the end of the penultimate vowel; that is, the circumflex can not stand on the penult nor the acute on the antepenult; thus ἀνθρώποις, not ἄνθρωποις or ἀνθρῶποις. The accent of most words is *recessive*, going as far back as this rule will allow: but in some words it adheres to the ultimate or penult. An acute at the end of a word is lowered in pitch if other words follow in close connection; so arises a third variety of tone, called *grave* and marked `. Some short words (enclitics and proclitics) have no accent of their own, but lean, as it were, on the preceding or following word.

Syntax.—The structure of Greek sentences is natural and unfettered, giving rise to many colloquial idioms, and admitting many slight inconsistencies which are not looked upon as blemishes. The rules are singularly flexible, the variety of possible constructions very great. As peculiarities of Greek syntax might be named the frequency of *attraction* of case in connection with relative clauses, the wide development of the *inner* accusative ("live a *life*," "run a *race*") in its different varieties, the particle ἄν which plays an important part in the syntax of the verb. The genitive and dative cases have a complex office, the former having taken on itself, in addition to its own, most of the functions of the lost ablative; the dative in like manner those of the old locative and instrumental cases. To explain the Greek uses of these cases from a single fundamental notion is impossible. The Greek is the only language of the Indo-European family which, retaining both the subjunctive and optative formations, has kept them distinct, and made them the basis of different shades of modality. They have each two uses—a primary use, in which they have the force of a modified future (opt. of wishing, subj. of request, and in protasis and apodosis of future conditions); and a secondary use, in which they refer to indefinite frequency in present and past time respectively, the idea of futurity being given up: ἐὰν τοῦτο ποιῇ, εἰ τοῦτο ποιοίη = if he (ever) does (or did) this. The optative has yet another use in indirect quotations.

Later History of the Language.—From the time of Alexander (330 B. C.) on, literary and political influences gave the Attic dialect ascendency over all others; it became the language of the whole Greek world. The other dialects gradually disappeared, first in public life and educated circles, last of all among the masses. The new universal speech took the name of *common* (κοινή) *dialect*. It was a slightly modified Attic; thus for οἶσθα, ἴσμεν, δείκνυμι were said οἶδας, οἴδαμεν, δεικνύω. Outside of Greece, in Syria, Macedonia, Alexandria, the language was spoken with less purity, and many corruptions crept in, the mistakes of foreigners using the Greek language, Ἑλληνισταί. The language of the New Testament and the Septuagint is tinctured with such peculiarities. The pronunciation altered even more than the form of words. Among the earliest changes was that of ει to that of simple ι, and of ζ from *dz* or *zd* to simple *z*. In the first centuries of the Christian era the same influences were yet more actively at work. Β is softened to our *v*, and η yields to the prevailing *itacism*, and takes the sound of ι. The diphthong οι came to coincide in sound with υ; much later both were attenuated to ι. Αι took the simple sound of ε. The diphthongs with υ modify or lose their second vowel. Δ and γ are softened in sound. Some of these phonetic corruptions had taken place in the Bœotian language long before. The quantity of vowels is confused. Inscriptions of the fifth century A. D. and later periods abound in singular misspellings—ἤτος (ἔτος), Εἶσις (Ἶσις), ἐπύησεν (ἐποίησεν), πρεσβοίτεροι (πρεσβύτεροι), κῖτε (κεῖται), καταδουλιζμός (-ισμός), ἀτός (αὐτός), ἐπισκεάζειν (-σκευάζειν). The process of decay went rapidly on after Byzantium was made the head of the Hellenic world. The cleft between the vulgar tongue and the language of the *literati* widens. Roman words are largely adopted—ὀσπίτιον, πρίνκιψ, παλάτιον. The written language, though clinging stoutly to ancient models, can not hold its own, and the spoken tongue verges gradually toward the Romaic or modern Greek. The use of diminutives for primitives, of the accusative for the dative, of ἵνα and subjunctive for infinitive, of εἰς for ἐν, of auxiliary verbs θέλω, ἔχω, are among the characteristics of this transitional stage. Long and short vowels are no longer distinguished, and word-accent is made the basis of versification. Inscriptions of the ninth century show the wildest confusion in orthography, as παναγήα Θεοτώκε = παναγία Θεοτόκε, ἐπὴ τὸν ὐκιακῦν = ἐπὶ τῶν οἰκειακῶν.

The completest Greek grammar is that of Kühner (*Ausführliche Grammatik*, 2 vols.; 3d edition revised by Blass, 1891 ff.). The works of Krüger, Madvig, and Goodwin are important for the syntax. On dialects the standard work is Meister's *Die Griechischen Dialekte* (2 vols., 1882–89, uncompleted). An outline of Greek historical grammar is G. Meyer's *Griechische Grammatik* (2d ed. Leipzig, 1886). The best defining lexicon is Liddell and Scott's (7th edition, Oxford, 1889).

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### Modern Greek.

Modern Greek is the language of modern Greece, and to a large extent the language of commercial intercourse, as well as the common speech, of large masses of the population along the entire coast of the Eastern Mediterranean and on the islands, in Constantinople, Thrace, and Macedonia, in large districts of Asia Minor, and in parts of Southern Italy. The spoken language abounds in variety of dialects, as might be expected from the mutual isolation of most of the districts where it is spoken. These dialects have been classified by Hatzidakis (Kuhn's *Zeitschrift*, xxx., 387 ff.) into two main groups, a northern and a southern. The thirty-eighth parallel of latitude—i. e. the parallel of Athens—forms an approximate boundary, and the tendency to drop the unaccented vowels *i* and *u* and reduce unaccented *o* and *e* to *u* and *i* is the characteristic which distinguishes the northern group from the southern; thus northern *μνῶν* to southern *μηνῶν*, so *θμός* to *θυμός*, *ἀλφή* to *ἀλοιφή*, *γυναῖκες* to *γναῖκες* or *ναῖκες*, *κιρός* to *καιρός*, *ἄγγιλους* to *ἄγγελος*, *ἰγώ* to *ἐγώ*, *πουλίτκα* to *πολίτικα*, etc. North-Greek comprises the dialects of Thrace, Macedonia, Thessaly, Epirus, Locris, Ætolia and Acarnania, Eubœa, and the Northern Sporades; South-Greek those of the other Ægean islands, including Crete and Cyprus, of Attica and Megara, of the Peloponnesus, of the Ionian islands, and of Southern Italy. The dialects of Asia Minor (Pontus, Cappadocia, Cicilia) probably are to be classified on a like basis. The earlier school of modern Greek philologists (down to about 1880) sought to find in the peculiarities of these dialects traces of the ancient dialectal divisions, Æolic, Doric, etc. Individual sounds, inflectional forms, and words were freely identified as Æolic, Ionic, etc. The language was even accredited with the marvelous power of embalming isolated forms of an earlier type even than the records of ancient Greek. Thus as late as 1879 Georg Curtius (*Griech. Etymologie*, 5th edit., p. 391), in deriving the mod. Gr. *αὐγό*, egg, from anc. Gr. *ᾠόν* (Lat. *ōvum*), claims that *α* is the original Indo-European *a*-sound older than the *ω* of *ᾠόν*, and that *υ* is the digamma which had disappeared in *ᾠόν*. The mod. Gr. plur. *γλῶσσες*, tongues (for anc. *γλῶσσαι*), was commonly written *γλώσσαις*, and explained as the Æolic accusative ending (*-αις* < *-ανς*), though the termination is really borrowed from the consonant stems as *γυναῖκες*; cf. G. Meyer, *Bezzenb. Beitr.*, i., 230. The 2d sing. midd. *λέγεσαι* was explained as older than Homeric *-εαι*, Attic *-ῃ*. Femin. forms like *ἄσπρη* were called Ionic, and those like *κεφάλα* Doric. Abundant illustration of this method of treatment can be found for example in Mullach's *Grammatik der griech. Vulgärsprache* (1856); Maurophrydis, Kuhn's *Zeitschr.*, vii., 137 ff. (1858); Chalkiopulos, *Curtius's Studien*, v., 339 ff. (1872); Deffner, *Archiv für mittel- und neugriech. philologie* (1880). Since 1880, however, the application of strict scientific method particularly in the hands of Hatzidakis, G. Meyer, Foy, Krumbacher, Psichari, W. Meyer, and Thumb has demonstrated beyond a question that, with the sole exception of the Zakonian, a descendant of the Laconian dialect, all the present known dialects are natural successors of the "Common Greek," or **Κοινή**. (See in particular the admirable summary of the evidence in Hatzidakis, *Einleitung in die neugriech. Grammatik*, pp. 10–171, 1892.)

The *Common Greek*, or **Κοινή**, was peculiarly the language of that Greek cosmopolitanism which arose out of the ruin of the old city-states after the campaigns of Alexander. It was the Attic Greek readapted from a provincial idiom to become the universal medium of intercourse for the newly organized civilization and life of Alexander's empire. It took its shape chiefly in non-Greek countries under the demands of trade, intercourse, and diplomacy, and had many types, according to the people adopting it. In Greece proper, the local dialects yielded to it more slowly, but the influence of the schools, of literature, and finally of the Church was added to that of usage in the greater world of commerce and intercourse, and gradually they sank back into the position of *patois*, and after the second Christian century disappeared from view. Individual words, like proper names, etc., survived, but that within the period from 300 B. C. to 600 A. D. the old dialects as types of speech became entirely swallowed up in the Attic Common Greek is amply proven by the absolutely new lines of distribution which the later dialects follow. Only the old Doric speech of Sparta has left itself a witness in the Zakonian, which is still spoken on the eastern slopes of Parnon in Northeastern Laconia. (Cf. Deffner, *Zakonische Grammatik*, 1881.) The Doric characteristics of this dialect include such points as: (1) The retention of the old *ā*—e. g. in *μάτη(ρ)*, *φωνά*; (2) the retention of the old *u* for *ü*—e. g. in *γουναῖκα*, *σοῦκο* (*σῦκον*); (3) sigma for theta—e. g. *κρίσα* (*κριθή*), *σέρι* (*θέρος*); (4) loss of intervocalic sigma—e. g. in *χαλάω* (*χαλάσω*); (5) final rho for sigma—e. g. in *καλὲρ ἔνι* (*καλὸς ἐστι*), *καοῦρ* (*καλῶς*); (6) retention of digamma—e. g. in *βάννε* (*Fαρνός*), *δαβελέ* (*δαFελός* > *δαλός*); (7) iota for epsilon before *e*, *o*, *u*—e. g. in *χρίε* (*χρέος*), *ἐλία* (*ἐλαία*). The characteristics of modern Greek which distinguish it from the ancient classical language are largely present in the **Κοινή**, and are indeed essentially due to the conditions under which the **Κοινή** developed. (For a characterization of the **Κοινή**, see Steinthal, *Geschichte der Sprachwissenschaft bei den Griechen und Römern*, ²ii., 25.) Dislodgments in the habitat or in the constituency of a language involve the commonest occasion for decisive alterations in its materials and structure. The Attic Greek of the fourth century B. C., with its fineness of structure, its marvelous adaptation to both variety and clearness of expression, its firmly organized inflectional system, its established norms of syntactical usage, its moderate vocabulary, and its fullness and clearness of articulation, reflected the life of a comparatively small, well-defined, permanent community possessed of a high degree of culture. The rapid extension of the language which followed the campaigns of Alexander carried it to peoples of various speech—Egyptians, Macedonians, Syrians, Jews, etc., as well as to non-Attic Greeks. Tradesmen and soldiers, not scholars, were its missionaries. The practical necessities of communication rather than the purposes of moral and artistic effect determined form and usage. The inflectional system becomes simplified. Irregular forms are dropped. Finer syntactical distinctions become confused. New words are formed on old analogies, and new types of formation appear. The language tends toward an analytic structure. The puristic reaction toward Attic standards, introduced by the "Atticists" of the second century A. D., was little more than a hopeless protest of pedantry, and while it shows its effects in the diction of Dion Chrysostomos, Ælius Aristides, Lucian, and others of the time, it offered no real check upon the natural development of the language. (Cf. Schmid, W., *Der Atticismus in seinen Hauptvertretern*.)

*Changes in Pronunciation.*—It is a well-recognized fact that the most of those changes in pronunciation which distinguish the modern from the ancient Greek had already taken place before 600 A. D. Thus *ει* had become *ī* by 100 B. C., *αι* had become *ē* by the second century A. D., and by about the same time *αυ*, *ευ* had become *av*, *ev*. A pronunciation of gamma as spirant appears as early as 300 B. C., and of beta in the first century A. D.; phi changed to *f* by the second century A. D. The distinction between *o* and *ω* had become obscured by the beginning of our era, and between that time and 400 A. D. the predominance of stress over pitch in the accent asserted itself. That the folk-dialects of modern Greece are direct successors of the common Greek, of which the Byzantine Greek represents the mediæval type, there can therefore remain not the slightest doubt. Only concerning the question of race-descent can doubt exist. This question was vigorously opened in the well-known works of Fallmerayer, especially in his *Geschichte der Halbinsel Morea* (1830), who denied the existence of any pure Greek blood among the present population of Greece. It is now generally recognized as historical fact that Slavic immigrations have occurred at different times, especially in the eighth century, and that large tracts in the Peloponnesus were permanently occupied by them. The original population remained large enough, however, to absorb the intruders and impress its language upon them. Other districts were also, though to a less extent, invaded by them. Many were later expelled. The rest were absorbed. Their language has left traces only in occasional place-names and loan-words. The cities, Attica, and the islands remained free from intermixture. The greater part of the population of the Peloponnesus is, however, probably of mixed blood. Large masses of Albanians also entered the country in the fourteenth and again in the eighteenth century. Twelve per cent. of the present population of the Peloponnesus and 11 per cent. of the population of entire Greece are Albanian. Many of these, in isolated districts, still preserve their own language, but the most have become entirely assimilated, both in language and in national feeling. Despite, then, the undoubted fact that large portions of the modern population are of mixed race, it is reasonably sure that the Greek blood as well as the Greek influence has always predominated, and it is cer-

tain that the modern Greek tongue represents a continuous existence on Greek soil, and not, as has been often claimed, a reimportation from Byzantium. Valuable investigations on this subject are contained in the articles of Philippson, *Zur Ethnographie des Peloponnes*, Petermann's *Mittheilungen* (1890); and *Reise durch Mittel- und Nordgriechenland*, *Zeitschr. der Gesellsch. für Erdkunde zu Berlin*, vol. xxv. (1890); see also Hertzberg, *Geschichte Griechenlands seit dem Absterben des antiken Lebens*. The intimate connection of the Greeks with so many peoples, and their successive subjection to Romans—the Roman empire of Byzantium—Venetians (1204–1456), and Turks (1456–1830), have left traces in the language, notably in the form of loan-words; thus Latin πριγκιπᾶτον, σπίτι (*hospitium*); Italian ἅτζιο (*agio*), μπαγκιέρης (*banchiere*), βαπόρι (*vapore*), σοῦπα (*zuppa*); Turkish ἀσκέρι (army), κουμπούρι (pistol); Slavic ζαπόνι (sail), σαμψῆς (officer), πίβα (beer); Albanian κουρύτα (boat), βάλτη (swamp), etc. The loan-element never became at any time, however, so extensive as to give the language the character of a mixed language, nor was its specifically Greek character ever endangered. There is now a strong tendency to replace loan-words with native words.

*Modern Standard.*—With the re-emergence of Greek nationality after 1830, the need of a standard language as a medium of national intercourse and an expression of the national life became strongly felt. There existed only the local dialects of the spoken language. These were little more than *patois*. No one was pre-eminent. Athens was a petty village of 300 houses, and its population chiefly Albanian. There was therefore no dialect which could claim to be that of the capital city. In this juncture recourse was naturally had to the ancient language. This was made to furnish the means of raising the local *patois* to the position of a standard literary language. Respect for the ancient classical speech as a standard of correctness had in the whole history of the Greeks never failed. The use for literary purposes of a mediæval form of κοινή had, thanks to the influence of the Church, never been entirely discontinued. The respect for the ancient models had preserved through all periods of Greek literary history down through the Byzantine period the ancient orthography. The Church had preserved in its service, even in its preaching, the ancient standard of form throughout. The step was an easy and natural one to take. The leader in the work of establishing a standard speech was the patriotic scholar Adamantios Koraës, commonly known as Koray. (Cf. Thereianos, D., Ἀδαμάντιος Κοραῆς, 3 vols., 1889–90.) The question of the extent to which ancient standards shall be used in establishing the norm for modern usage is still actively discussed among the Greeks, often with polemical bitterness. Historical grammar is brought to bear here on a serious practical question. It is not the only time that philology has been "in politics." Though the principle of making the ancient language in general the basis for the standard literary language seems to be universally recognized, the tendency is, on the whole, toward a freer recognition of the popular speech. (Cf. Hatzidakis, Περὶ τοῦ γλωσσικοῦ ζητήματος ἐν Ἑλλάδι (1890), and the various writings of Kontos, Psichari, and Bernardakis.) With this question is closely connected in the Greek mind the defense of the present pronunciation as essentially identical with the ancient, and this defense is conducted with genuine patriotic zeal and no slight exhibition of acrimony toward the scholars of other countries who persist in pronouncing ancient Greek either according to the analogies of their own languages or on the "Erasmian" basis of a scientific reconstruction of the ancient sounds. (Cf. Rangabé, A. R., *Die Aussprache des griechischen*, 2d ed. 1882; Papadimitrakopulos, Βάσανος τῶν περὶ τῆς ἑλληνικῆς προφορᾶς ἐρασμικῶν ἀποδείξεων, 1889; Radis, Ὁ ἐν Γαλλίᾳ περὶ τῆς ἑλληνικῆς γλώσσης ἀγών, 1890.) To what an extent patriotism can blind itself to scientific conclusions may be judged by comparing these works with Blass, *Pronunciation of Ancient Greek* (English transl. of 3d ed. 1890).

The pronunciation is in substance as follows: α as *a* in *father*; ε, αι, and ι as *e* in *met*; ο, ω generally as open Ital. *o*; η, ι, υ, ει, οι, υι as *i* in *pique*; ου as *oo* in *boot*; αυ as *av* before voiced and *af* before voiceless sounds; ευ as *ev*, *ef*; β as *v*; γ before *e* and *i* vowels as a voiced palatal spirant—i. e. the voiced form of Germ. *ch* in *ich*, and nearly the same as *g* in Centr. Germ. *liege*; before other sounds it is the voiced guttural spirant—i. e. the voiced form of Germ. *ch* in *ach*, and nearly the same as in Centr. Germ. *tage*; γγ as *ng* in *sing*; δ as *th* in *then*; θ as *th* in *thin*; ζ as *z* in *zeal*; ξ as *ks*; π as *p* in *pen*, but μπ as *b* in *bed*; σ as *s* in *sit* (always voiceless); τ as *t* in *ten*, but ντ as *d* in *den*; φ as *f* in *fed*; χ before *e* and *i* vowels as a voiceless palatal spirant, like Germ. *ch* in *ich*: before other sounds it is the voiceless guttural spirant, like Germ. *ch* in *ach*; ψ as *ps* in *tipsy*. A strong stress accent rests upon the syllable bearing the written accent. This syllable is prolonged and pronounced with a force and distinctness that tend to belittle and obscure the other syllables. The rough breathing is rarely distinguished from the smooth. For the inflections and syntax, reference must be made to the text-books enumerated below.

Bibliography.—1. Text-books for learners: Vincent and Dickson, *Handbook to Modern Greek* (2d ed. 1887), an excellently arranged book, following, however, somewhat too closely the literary language; Mitsodakis, *Praktische Grammatik der neugriech. Sprache* (1891), offers the best available introduction to the spoken language; Gardner (Mrs.), *A Modern Greek Grammar* (1892, a transl. of Wied.); Jannaris, *Wie spricht man in Athen?* (1891), based on the spoken language; Stedman, *Modern Greek Mastery* (1896).

2. Dictionaries: Kontopulos, *Greek-English and English-Greek Lexicon* (4th ed. 1889); Jannarakis, *Deutsch-griechisch Handwörterbuch* (1883); Legrand, Λεξικὸν νεοελληνικὸν καὶ γαλλικὸν; Sophocles, *Greek Lexicon of the Roman and Byzantine Periods* (new ed. 1888); Ducange, *Glossarium ad Scriptores mediæ et infimæ græcitatis* (2 vols., reprint 1891); Jannaris, *Dict. of English and Mod. Greek* (1895).

3. Grammatical treatises: Hatzidakis, *Einleitung in die neugriechische Grammatik* (1892); this work serves to clear the ground and lay the foundations for a scientific treatment of mediæval and modern Greek; Psichari, *Essais de Grammaire Historique Néo-grecque* (2 vols., 1886–89); Meyer, W., *Portius's Grammatica linguæ græcæ vulgaris* (1889); a new edition of the oldest modern Greek grammar, that of Simon Portius (1638), accompanied by a valuable commentary; Muller, *Historische Grammatik der hellenischen Sprache* (1890); Foy, *Lautsystem der griech. Vulgärsprache* (1879); Mullach, *Grammatik der griech. Vulgärsprache* (1856), usefulness past; Thumb, *Die neugriech. Sprache—eine Skizze* (1892): an address delivered on entering professorship at Freiburg, accompanied by valuable notes; and *Handbuch der neugriech. Volkssprache* (1895); Boltz, *Die hellenische oder neugriech. Sprache* (1881); Krumbacher, *Ein irrationaler Spirans im Griech.* (1886). Benj. Ide Wheeler.

**Greek Literature, Ancient**: The literature of the Greeks is distinguished above all for freshness, originality, and perfection of form. Itself a spontaneous national outgrowth, independent of outside influences, it furnished an intellectual impulse which spread to other people, the force of which has never spent itself, and of which modern European literature is the result. There are four periods: (1) The ancient or classical literature, ending with Aristotle at the time of Alexander the Great; (2) the Alexandrian period, till the subjection of Egypt to Rome, 30 B. C.; (3) the Roman period, till the division of the empire, 330 A. D.; (4) the Byzantine period, till the capture of Constantinople, 1453. The last three are of subordinate importance.

I. The National Classical Literature.—1. *Epic Poetry.*—Before Homer, the Greeks must have had popular poetry and poets, for in the *Iliad* and *Odyssey* the bard and his art are no strangers. The hymn, the epic song, the dirge, the bridal song must have all existed in these early days. In this pre-Homeric period the oldest national poetical measure, the dactylic hexameter, gradually formed itself out of a ruder meter, and multitudes of epithets and poetical phrases fixed themselves in use as part of the stock of the professional bard. But of this period there is no direct knowledge; even the names (Orpheus, etc.) referred to it are certainly mythical. Greek literature begins with the Homeric poems, the *Iliad* and *Odyssey*, in which are found the vividest word-painting, most musical flow of language, great wealth of expression, with an inimitable child-like simplicity. The *Iliad*, Achilles its central figure, describes portions of the siege of Troy; the *Odyssey*, the adventures of Odysseus on his return home from the siege. The origin of these poems has been in recent times the subject of much controversy. In 1795 appeared Wolf's *Prolegomena ad Homerum*, in which, maintaining that the poems were not reduced to writing before 600 B. C., he denied the possibility that compositions of such length, composed for oral recitation, could have previously existed as a whole, and thus opened the way for disbelief in the personality of any Homer. Since then much investigation has been directed to the subject. Wolf's line of argument was carried further

by Lachmann and others. According to their doctrine, the poems are aggregations of ballads which came into form in the hands of a guild of professional singers (*Homeridæ*), to whom Homer was a mythical *heros eponymos*, and were thus handed down from generation to generation; the present form of the poems, with the unity of plan which they show, was given them at the time of Pisistratus (about 550 B. C.) by men employed by him to collect the scattered portions, and they were first reduced to writing then or shortly before that time. There is a tendency to modify this extreme view, and rather to divide the *Iliad* (and similarly the *Odyssey*) into two or three poems of considerable extent—a nucleus and continuations. Few, if any, scholars hold to the old view of absolute unity of authorship. The question of Homer's personality is as far from settled as ever, but this question is, after all, of minor importance. The poems have in any case passed through different phases, and the personal Homer, if there was one, is only one of several factors. The traditions of the ancients respecting the person of the poet are in every respect contradictory, and rest apparently on nothing but conjecture. Nor is it apparent when the poems were first committed to writing. We know, however, that they were for a long time propagated by a class of men called *rhapsodes*, professional declaimers who recited epic poetry at public festivals. Their activity was at its greatest height about 550–500 B. C., and this period probably marks the final stage in the growth of the *Iliad* and *Odyssey*. The beginnings must be placed at least three centuries further back. As to the place of origin, it is evident, from their language, that the poems came directly from the Ionians of the Asiatic coast. A recent theory, yet on its probation, asserts, however, Æolic origin for the oldest parts. It should not be overlooked that doubts respecting the Homeric poetry existed even in antiquity; some of the Alexandrines referred the *Iliad* and *Odyssey* to different authors. The hymns and epigrams which have been handed down under the name of Homer are certainly of later origin. The *Batrachomyomachia*, or Battle of the Frogs and Mice, a burlesque, is the product of an uncertain but very late age. Besides the *Iliad* and *Odyssey* there were several other ancient epic poems, treating of the Trojan war and other subjects. Though these works are lost, they were only inferior to the *Iliad* and *Odyssey* in merit and popularity, and exercised great influence on subsequent literature, furnishing materials for the dramatists, Vergil, etc. The *Cypria* formed an introduction to the *Iliad*, while the *Æthiopis*, the *Sack of Troy*, and the *Little Iliad* continued it; the *Nosti* and *Telegonia* were connected with the *Odyssey*. Besides these there were the *Œdipodea*, *Thebais*, and others. The name Epic Cyclus was afterward given to this group. All these were in the earlier times ascribed to Homer. The later ancients assign them in part to other authors.

2. Hesiod, author of *Works and Days*, a didactic poem on husbandry and the calendar, is a less indistinct personality; he is said to have lived at Ascra in Bœotia, at what time is uncertain. The tone, subdued and of sententious brevity, differs greatly from the Homeric; the dialect is substantially the same. The *Theogony* ascribed to Hesiod is probably of different authorship, though of the same school.

3. *Elegiac and Iambic Poetry.*—These two forms of verse took their rise among the Ionians. From about 680 to 500 B. C. is their flourishing period. The elegy is of a serious, reflective, but by no means always mournful tone, the didactic and moralizing element prevailing; its range of subjects was great; its meter is a modification of the epic hexameter. It stands in connection with the spirit of the times, the age of the "Seven Wise Men," and of the first beginnings of philosophic thought. The iambic verse, at first the medium of personal invective, is lively and epigrammatic. Of all these poems only scanty fragments have been preserved. Archilochus of Paros (about 650) was at once the inventor and the most famous author of iambi; some represent him as the earliest elegiac poet, while others assign that honor to Callinus the Ephesian. Distinguished as author of elegies were Tyrtæus the Athenian and adopted Spartan (the lame schoolmaster of the popular fable), Mimnermus of Colophon, the famous Solon, and Theognis the Megarian. Of the last there has come down a collection of extracts, in all some 1,700 verses. As iambic poets, besides Archilochus, Simonides of Amorgus and Hipponax were prominent. The latter was the inventor of the choliamb or *limping* iambic verse, in which a humorous effect was produced by an unexpected rhythmic turn at the end.

4. *The Single-voice Lyric*—Hitherto every fresh impulse in literature had come from the Ionians of Asia Minor. Now the Æolians of Lesbos took the initiative in the cultivation of the *melos*, or song expressly composed for and inseparable from music. The former styles of poetry, though perhaps originally chanted in musical tones, had early freed themselves from such connection. The lyric poem, on the other hand, was always essentially musical. In Alcæus and the poetess Sappho, both Lesbians (about 600), the expression of individual thought and passion is predominant. The song is for a single voice with cithara accompaniment; the form, that of the short stanza, mostly of four lines; the subjects, erotic, convivial, even political; the dialect, their native Lesbian. The Rhegian Ibycus and Anacreon of Teos later continued this style of composition; the latter, known as an erotic poet, had a playful vein unknown to the earlier lyric poets; he lived in Samos and Athens in the sixth century. Little besides fragments of these has survived; the extant ditties bearing the name of Anacreon are spurious compositions of many centuries later.

5. *The Choral Lyric* was first developed among the Dorians, who hitherto had taken no creative share in literature. Hence the dialect of choral poetry was always Doric. The first impulses came even here from Æolians—Terpander, who came to Sparta about 680, and Arion, who flourished at Corinth somewhat later. Both were Lesbian musicians and poets. Choral poetry existed in a great variety of forms, most of which combined voices with instrumental music and orchestic action, and were often exceedingly complicated in their metrical and melodic structure. Important among the many forms was the dithyramb, a feature of Bacchic worship, performed by fifty singers round an altar, and containing a mimetic element which was the germ of the future tragedy. Arion is named as the perfecter of this style. Other sorts were pæans, hyporchemata or ballets, various marching songs for religious and military occasions, marriage songs, dirges, and the like. Most of these took the character of a public spectacle. The subject-matter was varied: they were often narrative, sometimes responsive or in dialogue form. The earliest names of importance are Alcman and Stesichorus; the former was an adoptive Spartan of the seventh century; the latter, of Sicilian birth, flourished about 600. Stesichorus was especially fond of mythical subjects, as the titles of his compositions show. Later (556–468) Simonides of Ceos attained the highest distinction in choral composition; his life was passed mainly in Athens. Outside the limits of choral poetry he became famous for elegies and epigrams. Passing over names of less note, the list of famous choral poets closes with Pindar, the only one from whom any complete poems have come down. He was about thirty-five years younger than Simonides, and a native of Thebes. Forty-five *epinicia*, or poems celebrating victors at the four national festivals, have come down entire. Loftiness of diction is Pindar's chief characteristic; he is deeply religious, always of a dignified earnestness; often obscure, yet abounding in poetical beauties. His compositions embraced other species, but nothing of them is preserved but fragments.

6. *Tragedy.*—The dithyramb contained, as has been seen, a mimetic trait, and this was little by little developed, first by introducing a disguised personage apart from the chorus, who personated a character (at first doubtless Dionysus himself), and sustained a dialogue with the chorus; then by introducing this action at intervals in the performances (episodes), by extending the representations to other than Bacchic myths, by erecting at first a platform, and then a regular theater for the spectacles, and improving the costumes and masks; lastly, by increasing the number of actors to two, and then to three, so that more than one character could appear at once. The chorus was, in consequence, diminished in numbers (to twelve or fifteen) and importance. This took place at Athens, and Athens remained the home of the tragedy; it was exotic elsewhere. Tragedy remained essentially a Bacchic solemnity, and was performed only at the Dionysiac festivals; it was sustained at the public expense, and partook of the nature of a contest, three poets contending together (each with four pieces) for the prize. The theater was of great size and uncovered; it consisted of a circular dancing-place (*orchestra*) and semicircular tiers of seats. Behind the orchestra a scene wall was erected. Chorus and actors moved in the orchestra. There was, in the classical period, no stage; at most, only a low platform. Machinery and scenery, at first rude, had by the end of the fifth century reached a certain degree of perfection.

The chorus was an essential part, though its office became less and less important. The lyrical parts were sung with instrumental accompaniment and orchestic action, the dialogue partly recited and partly intoned or chanted. The materials of plays were taken almost without exception from the national myths. The fifth century B. C. is the flourishing period of tragedy, marked by the three great names of Æschylus, Sophocles, and Euripides. Æschylus (525–456), after his predecessors, Thespis, Phrynichus, and others had made many advances, first gave the tragedy its complete form. A man of stern and serious nature, thoroughly penetrated with religious feeling, his plays abound in lofty ethical conceptions and powerful but sometimes turgid diction. Seven of them are preserved, the *Prometheus* and *Agamemnon* the best. Sophocles (496–406) has finer feeling for human nature, more dramatic life, greater versatility and power of affecting the sympathies. Modern critics rank him highest of the three. Seven of his plays are extant, of which the most powerful are the *Antigone*, *Œdipus Tyrannus*, and *Electra*. A decline from this high standard is seen in Euripides (484–406), who, though a poet of great talent, has grave faults—too little ideality, want of symmetry and unity in plot, a reliance on single passages of brilliancy for effect. The sophistical tendencies of the age were unfavorable to poetry, and a falling off in poetic taste begins from this time. Euripides was very popular in subsequent ages, and eighteen plays of his have been preserved, besides many fragments; a nineteenth, *Rhesus*, is spurious. No plays of the lesser tragedians exist.

7. *Comedy* arose, like tragedy, from the Bacchic festivities; not, however, from the dithyramb, but from the *comus* or procession of licensed revelers at the country Dionysia, which mingled invocations of the deity with gibes at the bystanders. Its early history is obscure. At Athens it was adopted by the state, as part of the public Dionysiac festival, about 460. Three phases of the Attic comedy are commonly distinguished, the Old, Middle, and New Comedy. Old Comedy flourished from 450 to 400; the chief poets were Cratinus, Crates, Eupolis, and Aristophanes. Eleven plays of Aristophanes have been preserved. Farcical extravagance and the utmost license in personal satire are the characteristics of the Old Comedy; with this the most brilliant though often the coarsest wit. In the *Parabasis*, a part where the action stopped and the chorus addressed the audience directly, the Old Comedy preserved the image of the original *comus*. With the end of the Peloponnesian war the spirit of comedy changes; its farcical merriment is given up; political satire is now less its motive than the delineation of types of character and scenes of daily life. The Middle Comedy (400–338) was a transitional stage. The latest piece of Aristophanes, *Plutus*, properly belongs to it. The chief poet was Antiphanes. The New Comedy belongs chronologically in the next period. It had no chorus, its characters were types of everyday society; it stood very near the modern comedy. Menander (342–290) had the first place among the sixty-four authors of New Comedy; his works must have been masterpieces of their class. Others were Philemon, Diphilus, Posidippus. Literature has suffered a great loss in that no plays of these have been preserved. Some judgment of their merit can be formed from the imitations of the Roman poets Plautus and Terence. Separate from the Athenian comedy was the Sicilian, which attained some eminence in the hands of Epicharmus about 475, and Sophron somewhat later.

8. *History.*—Among the Greeks prose began long after poetry. The crude beginnings of historical composition were made by the Asiatic Ionians—attempts merely at preserving current reminiscences, without as yet any idea of investigation or criticism. They were confined at first to local traditions, then took a wider range. The language had still a poetical coloring, and much fable was mixed with facts. Such early prose-writers were Hecatæus of Miletus, Pherecydes of Leros, and others. All used the Ionic dialect. The chief of these Ionic historians, and the only one whose works have come down, is Herodotus of Halicarnassus (b. 484), who undertook extensive journeys, and embodied the results of his inquiries in nine books of history, our chief source of information of the Persian wars and preceding periods, treating of almost all the known nations of the earth, and giving geographical and ethnological information, as well as historical. The style is of charming simplicity and the utmost vividness. Respecting Herodotus's credibility, it must be conceded that, although he sincerely aims at truth and exercises more criticism than any of his predecessors, his superstition and love of the marvelous have influenced his work in many ways. Especially is he untrustworthy in the past history of foreign nations. An unaffected piety pervades his work; his conception of the Persian invasions and their causes is a religious and ethical one. Thucydides, the greatest historian of Greece, was an Athenian (d. about 400), and, discarding the traditional use of Ionic, wrote in his native dialect. His work in eight books, treating of the Peloponnesian war down to 410, is a model of impartiality and conscientious research. He aims at the utmost brevity, and writes in a style obscure and crabbed, but full of a singular force. Speeches, partly imaginary, form an important part of the work, serving to set forth motives and the inner connection of events. The military career of Thucydides was unfortunate, and his work was written in banishment. A continuation of Thucydides's history is furnished by Xenophon of Athens (about 434–355), whose seven books of Grecian history (*Hellenica*) extend to 362 B. C. Superior to this work in interest is his *Anabasis*, a simple and graphic account of the adventures of the body of Greek mercenaries who joined the ill-fated expedition of the younger Cyrus against Artaxerxes—adventures in which Xenophon himself had an important share. Xenophon was a soldierly and straightforward man, fond of the practical, but lacking in the intellectual grasp needful for a historian. Much of his life was spent abroad, partly in banishment. His literary labors were not confined to history, as is shown by the *Cyropædia* (a life of the elder Cyrus, a sort of historical romance) and the *Memorabilia* of Socrates, a collection of personal reminiscences of the great teacher, besides several smaller works, some of doubtful genuineness. Historians of this time whose works are lost are Ctesias, a Cnidian physician long employed at the Persian court, and the author of Persian annals, and Philistus, the historian of Sicily, both contemporary with Xenophon. Later were Ephorus and Theopompus, pupils of Isocrates, the former the first writer of general history.

9. *Philosophy.*—No philosophical writings before Plato have been preserved, though the two preceding centuries had produced many such. The first beginnings of philosophy are contemporary with those of history, and the Ionians, as in history, took the initiative. The Ionic philosophers occupied themselves with speculations on the physical universe; Thales, Anaximander, Anaximenes were the earliest of these. A little apart from these stood Heraclitus (500), and later Anaxagoras of Clazomenæ (450), the most advanced philosophic thinker before Socrates, long a resident of Athens, and exercising a powerful influence on the great men of that day. Special schools, offshoots of the Ionic, were formed by Pythagoras, a Samian who emigrated to Croton in Italy, and Xenophanes of Colophon, the founder of the Eleatic school in Elea; both of the sixth century. Pythagoras himself wrote nothing, but his followers, Philolaus, Archytas, and others, expounded his doctrines in books. The Eleatics reverted to the poetical form in their writings; so Xenophanes, Parmenides, and Empedocles. Entirely new ground for philosophic thought was obtained by the fearless thinker and uncompromising moralist Socrates (d. 399), who, though he wrote nothing, gave a direction to speculation which resulted in the establishment of several schools. The first of these, the Academy, was founded by the celebrated Plato (429–347) of Athens, an enthusiastic, imaginative, almost visionary nature, educated by extensive travel. His works are in the dialogue form, with Socrates as chief speaker. As works of art they are unsurpassed; though ranging over the whole field of ethics, politics, and metaphysics, they possess a dramatic vivacity which never flags and a constant freshness of thought. Probably all are preserved; besides the longer works, *Republic* (10 books) and *Laws* (12 books), there are some forty shorter compositions, many of doubtful genuineness. The numerous works of Heraclides Ponticus, the scholar of Plato, are lost. The founders of the other Socratic schools, Euclid (Megarian school), Aristippus (Cyrenian school), and Antisthenes (Cynic school), wrote but little. Aristotle (384–322), the founder of the Peripatetic school in the Lyceum, was a pupil of Plato, but very unlike him. He was pre-eminently a man of facts; his eagerness for knowledge extended into every part of the physical and metaphysical universe. Recognition of the importance of inductive research, as opposed to mere speculation, exactness of method and completeness of system, the introduction of accurate technical terms, are among his merits. About half of his numerous writings are preserved, com-

posed in a clear, pragmatic style, devoid of all ornament, often bald and compendious. Among the completest of these are the *Nicomachean Ethics*, the *Politics*, the *Logic*; besides these, his extant writings extend over literature, rhetoric, psychology, zoölogy, botany, mathematics, physics, and other departments. The greater part of his *Athenian Republic*, supposed to be lost, was discovered in 1891 in an Egyptian papyrus. It may be said of Aristotle that he embraced in himself all the science of his age. Though contemporary with Demosthenes, he stands on the border of two periods, and in spirit belongs rather to the latter.

10. *Rhetoric and Oratory.*—The nursery of Grecian eloquence was Athens, and its flourishing period the fourth century, though the study of rhetoric as an art had been previously pursued during the period of the Peloponnesian war, especially under the influence of the class of men called Sophists. The Sophists were a peculiar product of that age, rhetoricians rather than philosophers, loose thinkers, though professedly teachers of philosophy and morals. Athens was their chief field, though most of them were from abroad. The principal Sophists were Gorgias, a Sicilian, Hippias of Elis, Protagoras of Abdera, Polus of Agrigentum, and Prodicus of Ceos. Under the instructions of these men the art of oratory grew to maturity. The famous Attic orators are ten in number. The first department cultivated was the judicial; in this field Antiphon (d. 411) and Andoeides distinguished themselves. Of the former fifteen orations have been preserved, of the latter four, many of these written for others to speak. To a somewhat later period belong Lysias and Isocrates; their style shows more freedom and elegance. The latter brought to perfection the epideictic style, or speech of display. Of the one thirty-four speeches have been preserved, of the other twenty-one. A little later flourished Isæus, eleven of whose orations are extant. With Demosthenes (384–322) is reached the highest point in oratory. This consummate orator attained his eminence, without great natural endowments, by the most unremitting diligence. His style is extremely forcible, and, though bearing marks of the utmost elaboration, is free from rhetorical artifice. Sixty orations bearing his name are preserved. His contemporaries, Lycurgus, Æschines, Hyperides, and Dinarchus, though able orators, are his inferiors in power. Speeches of all of these have been preserved. The famous contest on the Crown between Æschines and Demosthenes (330 B. C.) gave occasion for the masterpieces of the two orators.

11. *Medicine.*—The only works of a technical professional nature which have come down from this period are the writings of Hippocrates of Cos (b. 460), the founder of the science of medicine. They are in the Ionic dialect, brief and plain in language; parts are of doubtful authenticity.

II. Alexandrian Period (330–30 B. C.).—Its characteristics are great diminution of originality, the cultivation of science at the expense of literature, the study and dissemination of previous works. The boundaries of the Hellenic world were greatly enlarged, and foreign influences made themselves felt. The two centers of literary activity were Alexandria and Athens.

1. *Poetry* became secondary to prose. Besides the New Comedy, already described, the only new type produced is the bucolic, the germ of which existed among the Sicilian peasantry; it was artistically developed by Theocritus, a Syracusan, about 270. These poems, called *idyls* (a word of uncertain meaning), were primarily pictures of rural life. Most of them are in dialogue form, in Doric dialect and in dactylic verse; their prevailing tone is humorous, and a feeling for nature not very common among the ancients pervades them. We have, besides thirty pieces of Theocritus, several by Bion and Moschus of a similar sort. Not unlike these, though in iambic meter, are the *mimiambi* of Herondas, brief dramatic sketches from common life, published in 1891 from a papyrus. The remaining poetry of this period is artificial in the extreme. The epic compositions are labored imitations of Homer; the *Argonautica* of Apollonius, a grammarian of Alexandria (220), is preserved, but has little merit. Still less interesting are the didactic poems on astronomy and medicine of Aratus and Nicander; the latter wrote *Georgics* and *Metamorphoses* (now lost), imitated afterward by Vergil and Ovid. The epigram is cultivated with more success; the *Anthology* contains many of this period. Callimachus, the first Alexandrine librarian, distinguished himself in this style and wrote also hymns of some little merit. Both the elegy and the tragedy received some attention, but all productions are lost. The *sillos*, or satiric poem, also came into vogue.

2. *Philosophy* was chiefly pursued at Athens, where, besides the Academy and the Lyceum, the Epicurean and Stoic schools (outgrowths of the Cyrenian and Cynic schools respectively) flourished, attracting pupils from all parts of the civilized world. Of the teachers the most important in a literary point of view are Theophrastus, pupil and successor of Aristotle, a man of most varied learning, from among whose many works a book on botany and an essay on types of character have come down, and Chrysippus and Panætius the Stoics, both prolific writers on ethics.

3. *Grammar*, in its widest sense, including the study of literature, was ardently pursued, especially at Alexandria under the Ptolemies. The famous libraries there collected, and the Museum, a kind of academy of sciences, were important means. The collection, cataloguing, criticism, and annotation of the literary relics of the classical period was the chief task; later came the systematic treatment of grammar. Scanty as are the remnants of these grammarians' works, whatever of the classic literature has been saved has passed through their hands, and modern philology is greatly indebted to them. The greatest of these critics were Aristophanes of Byzantium (200) and Aristarchus (150); the former busied himself chiefly with the drama, the latter with Homer. A small grammatical text-book of Dionysius Thrax (110) has come down to us, also a short treatise on mythology by Apollodorus. A rival of the Alexandrine school was the Pergamenian, its representative scholar Crates.

4. *Other Sciences.*—The advances made, especially at Alexandria, in astronomy, mathematics, and geography were remarkable. In mathematics were distinguished Euclid, whose *Elements of Geometry* hold their place even yet, and who lived in Alexandria about 300 B. C.; and later Archimedes of Syracuse, and Apollonius. Of others, Eratosthenes, a man of universal learning, the first scientific geographer (d. 194), and Hipparchus, the astronomer, may be mentioned. In Athens the Peripatetics and other philosophers also cultivated the sciences.

5. *History* is singularly neglected in this period; the only name of importance is Polybius (204–122), of whose history of Roman conquests only five books (out of forty) are preserved complete.

III. Roman Period (30 B. C.–330 A. D.).—Literature centers at Rome, the ancient seats of learning losing their importance. The scientific spirit decreases, but there is returning taste for rhetoric and regard for form and style in composition, which had been generally neglected in the preceding period; so results a remarkable revival of Attic prose, especially history. To the first century of this period belong Diodorus Siculus, only a small portion of whose *Universal History* is preserved, Plutarch the biographer and essayist, Flavius Josephus the Jewish historian, and Strabo the descriptive geographer. From Dionysius of Halicarnassus a history of early Rome has reached us, as well as works on rhetoric and literature. Later were Arrian, Appian, Herodian, and Dio Cassius (the last three writers of Roman history), and Pausanias, whose *Description of Greece* is invaluable. Of rhetoricians, Dio Chrysostom, and later Longinus, deserve mention, but especially the witty satirist Lucian, whose works are of the most varied character. Less valuable are the writings of the two Philostrati and those of Ælian, the latter a collection of anecdotes. The *Deipnosophistæ* of Athenæus consists of table conversation; though a tasteless *mélange*, it contains important material. The writing of imaginary letters ascribed to noted personages came into vogue, and was cultivated by Alciphron and others. The grammarians of this time are divided into Technicists and Atticists. Of the former were the Alexandrian Apollonius Dyscolus and his son Herodian, the last of the great ancient grammarians; of the latter, mere Attic purists, Phrynichus and Julius Pollux. The astronomer and geographer Ptolemy and the physician Galen are the chief names in physical science. The study of philosophy languished, and the Athenian schools died out; Epictetus the Stoic is the most eminent teacher. Philosophy degenerated on the one hand into the fantastic superstition of Neo-Platonism, whose chief apostle was Plotinus, on the other into the skepticism of Sextus Empiricus (about 200 A. D.). A history of philosophy from Diogenes Laertius (about 200) has been preserved. In poetry this period is utterly barren; Babrius, the author of Æsopian fables in choliambs, is the only name worth mentioning.

IV. Byzantine Period (330–1453 A. D.).—The literary cen-

ter is Constantinople. A brief renaissance of poetry and rhetoric is followed by a long decline, in which all originality dies out. Learning grows less and less; many works of antiquity are forgotten and lost; careless compilations and excerpts replace original works. The writers of this period have, for the most part, scant literary merit. It will suffice to mention a few: Nonnus (about 400), author of the voluminous *Dionysiaca*, not without originality, and Quintus Smyrnæus, are the best of a number of poets. Anthologies, or collections of epigrams of various ages, are compiled. Rhetoric flourished under Julian, and the works of Libanius are no mean specimens of eloquence. The romance was cultivated by Heliodorus and others. Stobæus's *Florilegium* and *Eclogæ*, collections of choice extracts, contain much that is valuable. In grammar and erudition, Chœroboscus, Eustathius, the commentator of Homer (Bishop of Thessalonica, 1160), Photius, and the lexicographers Hesychius and Suidas may be mentioned. Zosimus, Procopius, Zonaras are among the historians. Of ecclesiastical writers, the most eminent are Justin Martyr, Clement of Alexandria, Origen, Eusebius, Gregory, John Chrysostom; the first three belong chronologically to the preceding period.

The study of Greek literature was revived in the West during the fifteenth century, chiefly through the influence of the learned Greeks who fled in considerable numbers to Italy, and labored there, favored by such men as Lorenzo de' Medici; among these were Theodore Gaza, Constantine and Janus Lascaris, and Marcus Musurus. Since then these literary relics have been studied with ever-increasing zeal. Prominent among the many modern scholars whose labors in this field have been fruitful are Reuchlin, Casaubon (sixteenth century), and later (eighteenth century) Hemsterhuys and Valckenaer in Holland; in England, Bentley (d. 1742), and afterward Porson and Elmsley; in Germany during the present century, Heyne, Wolf, Hermann, Böckh, Bekker, Dindorf, and Welcker. The principal histories of Greek literature are, in English, Mahaffy's and Müller's (completed by Donaldson); in German, Bernhardy's, Bergk's, and Christ's; in French, Croiset's.

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**Greek Literature, Modern**: To date its beginning from the fall of Constantinople (1453), when the last vestige of political independence distinctively Grecian was obliterated by the Ottoman conquest, conveniently separates modern Greek from Byzantine literature. But the date is arbitrary. For several centuries beyond it many writers, including the defenders of orthodoxy against the Latin heresy, were continuators of Byzantine literature; and the Church even now, in its ceremonial and official language, clings more or less closely to the same tradition. On the other hand, the earliest monuments of modern Greek literature belong to a period three or four centuries prior to 1453. Koray was the first to call attention to these monuments by the publication of the vernacular poems of Ptochoprodromos (Στίχοι Θεοδώρου τοῦ Πτωχοπροδρόμου, see Ἄτακτα, vol. i., Paris, 1828), which date from the twelfth century. Numerous collections of mediæval Greek poems have since been published, examples of which are Maurophridis's Ἐκλογὴ Μνημείων τῆς νεωτέρας ἑλληνικῆς γλώσσης, (Athens, 1866); W. Wagner's *Mediæval Greek Texts* (printed for the Philological Society of London, 1870); *Carmina Græca Medii Ævi* (1874); Ἀλφάβητος τῆς ἀγάπης, a collection of Rhodian love songs (1879); *Trois poèmes Grecs du Moyen Âge inédits* (1881); and S. Lambros's *Collection de Romans Grecs en langue vulgaire et en vers* (1880). E. Legrand has included a number of like poems, together with many of more recent date, in his *Collection des Monuments pour servir à l'étude de la langue néo-hellénique*, and in his *Bibliothèque Grecque vulgaire*. Many of these poems derive a special interest from their resemblance to congeneric Western poetry of the time. To what degree in the interaction of the East and the West, brought about by the crusades, the Western poets lent inspiration to the Greeks remains an unsettled question. Apart from its importance as the earliest monument (tenth century) of modern Greek literature, the *Exploits of Digenis Acritas* (unknown until its publication by C. Sathas and E. Legrand) is interesting because of the use of its incidents in many later poems, which form what might be called the Acritic cycle. The popular songs of Greece were first made known by Fauriel (*Chants populaires de la Grèce moderne*, Paris, 1824–25). Transmitted orally for many generations, the earlier of these songs are rare. The greater number celebrate the strife of the Klephts with the Turks in the eighteenth century; while others are legendary, historic, or amatory in character. Their beauty is undeniable.

They are, however, not the sole literary product of the time preceding the renaissance of Greece. From the fifteenth to the middle of the eighteenth century there was an unbroken line of Greek authors, but they were more numerous than brilliant. The Greeks were crushed beneath the foreign yoke. Learning was limited to the Church or to the few who had studied medicine in Italy. Medicine, the only liberal profession he was allowed to exercise, was to the Greek often the way to political preferment under the Turk. Up to the end of the eighteenth century nearly all Greek books were printed in Venice, where flourished a large and important Greek colony. Venice, indeed Italy in general, was long the intellectual refuge of the Greeks. The few Greek regions not yet enslaved by the Turks were ruled by the Venetians. The Morea was alternately lost and won by them up to the beginning of the eighteenth century. Crete was conquered only in 1669, and the Venetians held the Ionian islands until the annihilation of the republic by Napoleon I. They were not gentle masters, but their Greek subjects were far happier than their countrymen under the Turk. They could breathe; they could write other things than lamentations (Θρῆνοι), of which many specimens by their less fortunate compatriots exist. Most, if not all, of the poets of that time were natives of countries not yet subjugated by the Turk. Loukanos (sixteenth century), who made a popular version of the *Iliad*, was a Zantiote. Kornaros (seventeenth century), the author of the *Erotocritos*, a chivalric poem in the Italian style, but Hellenic in spirit, as its wide popularity attests; Chortakis, whose dramatic poem *Erophile* is hardly less esteemed than the *Erotocritos*; and Drimyticos (seventeenth century), the author of ἡ εὐμόρφη Βοσκοπούλα, were Cretans. The humble efforts of these earlier writers have their interest. They show the continuity of Greek life, both in their reverence for national traditions and in their dim reflection of the literary movements of civilized Europe, with whose peoples the Greeks have never ceased to claim solidarity.

Literary Renascence.—The real literary renascence of Greece began in the latter half of the eighteenth century. The revival of commerce enabled the Greeks to establish schools. Closer relations with Italy, Germany, and Hungary brought them into immediate contact with the West. Some Greek merchants were men of letters, who labored to acquaint their countrymen with the results of Western culture, and many books, scientific, historic, and even fictive, were translated by them. From the end of the eighteenth century the Greek press of Vienna rivaled that of Venice. Literary periodicals were issued, the most notable and influential of which was ὁ Λόγιος Ἑρμῆς. Of the men of letters who served as a medium between the East and the West the most brilliant was the Thessalian Rigas (b. 1760). Chiefly known as a writer of patriotic songs, he had no other aim than the political regeneration of Greece. Having failed in an attempt to organize a rising, he was delivered by the Austrians to the Turks, by whom he was murdered at Belgrade in 1798. Among the foremost writers of the eighteenth century were Eugenios Boulgaris (1716–1806) and Nicephoros Theotokis (1736–1800), whose sermons (Κυριακοδρόμια) are the best of earlier attempts to raise modern Greek to the dignity of a literary language.

The most significant symptom of the revival, however, was the cultivation of *belles-lettres* by the Phanariots in Constantinople at the beginning of the nineteenth century. To their standard flocked the flower of the nation. The presence of families enriched by office under the Porte, of the patriarch, and of the great bankers contributed to make the Phanar the seat of a real aristocracy, which, true to its racial instincts, found solace from oppression in the pursuit of intellectual culture. In that congenial atmosphere sprang up a literature, the growth of which was checked in but one direction. No songs of liberty were composed, and those of Rigas were sung with closed doors. Athanasius Christopoulos (1772–1847) wrote in the simple and elegant language of cultivated society songs of love and wine as perfect in form as charming in fancy. The masterpieces of the French theater were translated by Rizo Rangabé. Rizo Neroulos, besides two tragedies, wrote humorous poems not yet forgotten. The influence of the Phanariots extended to the courts of the Greek princes of Wallachia and Moldavia. Nor were letters neglected elsewhere. At Janina, in Epirus, flourished John Bilaras (1771–1823), a lyrical poet at once humorous and tender; and in Zante, Gouzelis, a writer of

comic and satiric verse and the translator of the *Jerusalem Delivered*. Of authors whose aim was the diffusion of knowledge it will suffice to mention Anthimos Gazis, Bardalachos, Koumas, the priests Bamvas and Konstantine Œconomos, and Moustoxidis of Corfù.

A greater name than any of these is that of Adamantios Coray (1748–1833), whose influence was due not only to his learning and patriotism, but also to the fact that, residing for fifty years in France, he addressed his countrymen from that distant home of letters and of civilization. Already influenced by translations of the masterpieces of French literature of the seventeenth century, and of the philosophic works of the eighteenth, the Greeks were easily attracted by the intellectual movement in France. They were electrified by the outbreak of the French Revolution, The expedition to Egypt, in which they saw but a conflict between Christian and Moslem, brought the Revolution nearer, and raised hopes which reached their highest point when the French in taking possession of the Ionian islands, promised by proclamation the emancipation of Greece. It was natural, then, that the Greeks should listen with redoubled attention to the voice of their learned countryman in Paris. The intellectual and moral advancement of the Greeks was the dream that Koray sought to realize; and to that end were published, at the cost of rich compatriots, his editions of many Greek classics, which established his reputation as a scholar throughout Europe, and enabled him by means of introductions to take the part of a national inspirer. Collected and separately printed in 1819, these *Prolegomena*, together with Koray's letters, were of powerful assistance in the regeneration of Greece. A complete edition of the letters was printed at Athens in 1885–86. The list of his publications is long, and besides works in Greek includes translations into French of Theophrastus, Strabo, Hippocrates, etc. To give a definite character to modern Greek by purging it of foreign elements and checking the pedantic efforts of classical reactionists was another aim of Koray; and to his lexicographic essays (contained in the Ἄτακτα, Paris, 1818–25) and to his own constant example is largely due the present state of literary Greek.

From the time of Koray, literary activity centers in Athens. Learning continues to be cultivated outside of the kingdom, but its manifestations take place mostly within it. The tranquil conditions favorable to the development of literature have thus far been in the main wanting in Greece, but her energetic advance in all its branches, as illustrated by the creditable and sometimes brilliant efforts of her poets and prose-writers, is full of promise.

*Lyrical Poets.*—The poets of the period beginning with the emancipation of Greece were chiefly lyrical. Madame Juliette Lamber was the first to classify them on historic and geographic lines. The most eminent representatives of the group formed in Constantinople and continued in Athens were Alexander Rangabé (1810–90) and the brothers Alexander (1803–63) and Panagiotis Soutsos (d. 1868). From these poets, whose works were its models, the Athenian school immediately derives, though its members, leading the life of Western Europe, were not unaffected thereby. Spiridion Basiliadis (1845–74), Angelos Blachos (b. 1838), Demetrios Paparrigopoulos (1843–73), John Karasoutsas (1824–73), and Achilles Paraschos (b. 1838) best express the tendencies both of their school and time.

The characteristics of the Ionian group were due to the failure of the Turks to secure a footing in the seven islands, which, governed in turn by Venice, France, Russia, and England, maintained closer and more permanent relations with Western Europe than did any other portion of Greece. Solomos (1798–1857), whose famous hymn to liberty is the national anthem of the Greeks, Andreas Kalbos (1796–1869), Julius Tupaldos (1814–83), Tertsetis (1806–74), and Gerasimos Markoras are the chief ornaments of this school.

Another group, called by Madame Lamber the Epirotic, drew inspiration from the popular national songs, of which it adopted the rhythm, and in a measure the language. To this school belonged Bilaras, and also Zalocostas (1805–57), at least in his lyrics, which are his real glory. Its most illustrious name, however, is that of Aristotelis Balaoritis (1824–79), by birth an Ionian, whose reputation is second only to that of Solomos, the greatest of modern Greek poets. His complete works have been translated into French by J. Blanchard (Paris, 1883–86). Demetrios Bikélas, as poet, should be included in this group, which has exerted, chiefly through Balaoritis, a strong influence over the younger generation of poets. Indeed, most Greek poets have renounced the traditions of the Athenian school, write in the vernacular, and employ forms more or less popular.

*Modern Poets.*—The modern Greek poets were first stirred by the love of country, and for a time the main chord of their lyre was the patriotic. In the strains of Solomos, the Soutsos, Spiridion Tricoupis, Zalokostas, Rangabé, and Balaoritis, what was then the deepest feeling of the Greeks found voice. To the patriotic succeeded the consciously literary mood, when the verse of Basiliadis, Karasoutsas, Paparrigopoulos, and Parasehos felt the influence of the romanticists. The younger poets have sought and found inspiration in the daily life around them, and their verse is often the drapery of some philosophic thought. An annual poetic contest, instituted by rich and patriotic citizens, has largely increased the number of versifiers. Among modern poets, Aristomenes Probelegios (b. 1850), George Bizyénos (b. 1853), George Drosinis (b. 1859), Kostis Palamas (b. 1859), John Polemis, and Ephtaliotis are the most brilliant; but the most popular is the satirist George Souris (b. 1853). Other poets, Alexander Soutsos (in his warfare with Kapodistrias), Theodore Orphanidis (in his Τιρι-Λίρι), and Laskaratos of Cephalonia, have excelled in satiric verse, but Souris has surpassed them all. He is the editor of a weekly newspaper which from title to colophon is written wholly in verse. In this unique journal are passed in review the leading events, social and political. Narrative poetry has been written by Alexander Soutsos, Rangabé, Orphanidis, and by Zalokostas, whose poems dealing with Klephtic strifes or episodes of the war of independence are much in favor.

*Dramatic Literature.*—Though Greece can not yet boast a national theater, there is no lack of original plays. The Zantiotes Gouzelis and Matesis have written comedies. Twelve tragedies by the Ionian John Zambellios, ranging in subject from Greek antiquity to the war of independence, have been published. Panagiotis Soutsos's tragedies show more lyrical than dramatic talent; his brother Alexander has been more fortunate in comedy. Rangabé, too, has written for the stage, and his *Marriage of Coutroulis*, which wittily ridicules modern Greek politics, is also remarkable for the introduction of the chorus. A clever comedy, one of the motives of which is the confusion of Greek dialects, is ἡ Βαβυλωνία, by D. K. Byzantios. Conspicuous among recent dramatic writers are Kleon Rangabé, Angelos Blachos, Antoniades, Aristomenes Probelegios, Demetrios Koromilas, a prolific author, Basiliadis (whose *Galatea* has been translated into French by the Baron d'Estournelles), and Demetrios Bernardakis, the best known of whose plays are *Maria Doxapatri*, *Euphrosyne*, and *Fausta*. The Greek repertory has been further enriched by translations. Alexander Rangabé, whose father's versions of French masterpieces have been mentioned, has translated from the German Goethe's *Iphigenia*, Schiller's *Wilhelm Tell*, and Lessing's *Nathan der Weise*. A metrical translation of the first part of *Faust* has been made by Probelegios. Some attempts to translate Shakspeare had been made (*Hamlet* in verse by Perbanoglos, and *The Tempest* in prose by Polylas), when Bikélas undertook to popularize the great poet in Greece by metrically translating *Romeo and Juliet*, *Othello*, *King Lear*, *Hamlet*, *Macbeth*, and *The Merchant of Venice*. Both for intellectual quality and artistic execution his translations have won commendation from the highest critical authorities. The example of Bikélas was imitated. Two versions of *Hamlet* have been produced—one in verse by Polylas and another in prose by Damiralis, the latter of whom has also made prose translations of *Coriolanus*, *Antony and Cleopatra*, and *Julius Cæsar*. A translation of the latter play in the verse of Alexander Rangabé also exists.

*Prose Fiction.*—Prose fiction has been much cultivated by the Greeks since 1830, and before its liberation from foreign influence it had passed through as many phases as had their lyric poetry. The brothers Soutsos and Alexander Rangabé were the first to enter the field. The tales of the Soutsos display talent, but as regards plot or study of character are without interest. Those of Rangabé are better, but too many of them have foreign subjects, and describe foreign manners. *The Notary*, the scene of which is laid in the Ionian islands, is perhaps the best of his novels, if not so widely known as *The Lord of the Morea*, a tale of the crusades, which has been translated into both French and German. Spiridion Zampelios's Κρητικοὶ Γάμοι, which deals with the Venetian occupation of Crete, owes a special interest to the author's acquaintance with historic minutiæ. The tales of C. Ramphos contain some spirited dia-

logue. Kalligas, a jurist of great eminence, is the author of *Thanos Blechas*, in which the manners of the mountaineers are well described. Two novels by Paleologos (published in 1839 and 1842) are quite forgotten. Stephen Xenos, whose *Devil in Turkey* was published in English by himself, is also the author of *The Heroine of the Greek Revolution*. *Pope Joan*, an historical novel by the brilliant critic and publicist Roidis, has been translated into French. The first essay in fiction of Demetrios Bikélas (b. 1835) marks a new departure in that branch of literary art. Drawn wholly from Greek sources, his story of *Loukis Laras* owes little or nothing to foreign models. Immediately after its appearance in 1879 it was translated into French by the Marquis de Queux de Saint-Hilaire, and it has since been translated into ten other languages, including the English version by John Gennadius, former Greek envoy at the court of St. James. A collection of short stories of contemporaneous Grecian life by Bikélas was published in 1885, and at once turned into French by the same translator. Though the Zantiote Gregory Xenopoulos, who inclines to naturalism, still writes novels, the short story is now the favorite form of fiction, and has been adopted by George Drosinis, the poet (a few of whose tales have been translated into English and German), Palamas, Probelegios, Bizyénos, Polylas, Karkabitza, Ephtaliotis, Psicharis, etc.

Some of these tales are written in the vernacular of which previously only poetic use had been made. The fight between the purists who would have literary Greek conform to ancient, at least in the choice of words and the connection of grammatical forms, and the vulgarists, who contend for its assimilation to the language as traditionally formed and spoken by the people, has been a long one, and it is not yet over. The present leader of the vulgarists is M. John Psichari, a Frenchman by naturalization, whose position as a professor in Paris and whose rank as a linguist have enabled him to put new life into the controversy. To whatever extreme partisanship may lead either school, both are working out the problem of literary Greek. Whether the vulgarists will surmount all the obstacles to the establishment of the popular language, in so far at least as grammar and phonetics go, or will only succeed in neutralizing the efforts of the classical extremists, is a question for time to resolve. At any rate, there is a current literary language, which is employed in the administration of public affairs of every description, and is the instrument not only of the press and pulpit, but of all prose-writers outside of the domain of fiction.

Before passing to the historians, a word of commendation should be given to the jurists Peter Paparrigopoulos, Paul Kalligas, and N. Saripolos; the philosophers Braïlas-Armeni and John Skalzuni (an opponent of the Darwinian theory); and the theologians Kontogonis, Diomedes Kyriakos, and the Archbishops Nikephoros Kalogeras and Dionysius Latas.

*History.*—Even before the Revolution the Greeks had given much attention to history. Koumas, the author of a universal history, has been mentioned. Dionysius Photinos, a Danubian dignitary, has written a *History of Ancient Dacia and of the Actual Transylvania, Wallachia, and Moldavia* (Vienna, 1819), which is especially valuable for the later period. The histories of Souli and of Parga (Venice, 1815), by Christopher Perraibos are much prized. The Greek revolution, though even yet too near for philosophic treatment, has naturally been attractive to many writers, the most noteworthy of whom is Spiridion Trikoupis, whose history of that period (London, 1857) is by far the best, though John Philemon's *Essay toward a History of the Greek Revolution* is worthy of mention, as are also the *Memoirs* of N. Dragoumis and the interesting *Recollections* of Theodore Kolokotronis dictated to his secretary, the poet Terzetis (recently translated into English by Mrs. Edmonds). *A History of the Hellenic Nation*, from the earliest times to the accession of King Otho, by Constantine Paparrigopoulos, is the most successful attempt yet made to show the historic continuity of the Greek nation. The mediæval and modern portions are particularly well done, and indicate much original research. A similar history by Spiridion Lambros, a prolific writer on history and philology, has reached the third volume. Karolides is publishing a *General History of the Nineteenth Century*, of which the portion touching Greece is praiseworthy. Maurogianni's *History of the Ionian Islands* in modern times, and a history of the same islands under the Venetians by the Zantiote Lunzi, may also be mentioned. Spiridion Zambellios is the author of Βυζαντιναὶ Μελέται; Alexander Paspati has written a *History of the Capture of Constantinople* and several works on the topography of the Byzantine capital. Besides various valuable historical works, Constantine Sathas has published *Monuments*, to serve for a history of Greece from the Middle Ages to our own time. Of the numerous historical contributions to periodical literature of Demetrios Bikélas, several have been collected by the Marquis of Bute, and translated by him into English under the title of *Seven Essays on Christian Greece* (London, 1890).

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H. A. Huntington.

**Greeley**: city (founded in 1870); capital of Weld co., Col. (for location of county, see map of Colorado, ref. 1–E); on the Cache la Poudre river, 5 miles above its junction with the Platte, and on the U. P. Railway; 30 miles E. of the Rocky Mountains, 52 miles N. by E. of Denver, 54 miles S. S. E. of Cheyenne. It is in an agricultural and stock-raising region, with rich coal-fields near by. It contains the State Normal School, located here in 1889, building cost $300,000; high school, building cost $30,000; and 4 ward schools; water-works system that cost $80,000; electric-light plant; manufactures of vacuum pumps, elevators, brick and tile, etc.; and 3 weekly newspapers. Pop. (1880) 1,297; (1890) 2,395; (1900) 3,023.

Editor of "Sun."

**Greeley**, Horace, LL. D.: journalist; b. at Amherst, N. H., Feb. 3, 1811. His father was a farmer in humble circumstances, and while yet a child Horace took an active part in the labors of the farm. He early learnt to read, and before he was ten he had devoured every book that he could borrow. His third winter was spent at the house of his maternal grandfather in Londonderry, where he attended a district school for the first time. When he was about ten years old his father removed with the family to Westhaven, Vt., where for about five years he was assisted by Horace in clearing up wild land and other severe manual labor. At the end of that time, in the spring of 1826, he became an apprentice to the printer of a weekly newspaper in East Poultney, Vt. This was a position which he had long coveted. He soon learned the art of setting type, and even before the first week was over his skill was superior to that of many an apprentice who had been in practice a month. After remaining in this situation about four years he had become master of the trade, and rendered valuable assistance in conducting the newspaper. In June, 1830, the paper was discontinued, and young Greeley joined his parents, who had removed to Erie co., Pa. He obtained employment in some of the printing-offices in the vicinity of the town of Erie, but the work was hard and the pay poor, and he at length made up his mind to seek his fortune in New York. He arrived in that city on Aug. 17, 1831, with only ten dollars in his pocket, and a scanty stock of clothing in his bundle. After much difficulty he found employment as a journeyman printer. In this capacity he worked in different offices until Jan. 1, 1833, when he entered into a partnership with Francis Story, and began the publication of *The Morning Post*, the first daily penny paper ever printed. The paper failed in about three weeks, and the enterprise was succeeded by the establishment of *The New Yorker*, a weekly journal devoted to literature, politics, and news. Though this was regarded as an excellent newspaper, it never gained financial success, and Mr. Greeley was obliged to engage in other labors. While editing *The New Yorker* he wrote leading articles for *The Daily Whig*, *The Jeffersonian*, and *The Log Cabin*. In the autumn of 1841 *The New Yorker* and *The Log Cabin* were merged in *The Tribune*, with which Mr. Greeley's name was henceforth identified.

The first number of this journal was issued on Apr. 10, 1841. It was a small sheet, retailing for one cent. The paper had no presses, no capital, and only 500 subscribers. For the first week the expenses exceeded the income, but in the course of six months it was established on a sound financial basis, when Mr. Thomas McElrath became a partner and undertook the sole charge of the business of publication, leaving Mr. Greeley the exclusive care of the editorial department. In 1848 Mr. Greeley was elected to fill a vacancy as a member of the House of Representatives in the national Congress, and served in that body from Dec. 1 of that year to Mar. 4, 1849. He took an active part against the abuses of the mileage system and in favor of the establishment of homesteads in the public lands. In 1851 he visited Europe, and served as one of the jurors of the World's Fair in the Crystal Palace in London. He also appeared before the parliamentary committee on newspaper taxes, and gave full and important details concerning the newspaper press of the U. S. His letters during his absence are among his most interesting productions. In 1855 he made a second visit to Europe, chiefly for the purpose of attending the French exhibition, and remained abroad about three months. In 1859 he made a journey across the plains to California, and was honored with a public reception at Sacramento and San Francisco. After having exerted himself for the prevention of civil war between the South and the North at the national Republican convention which met in Chicago in May, 1860, he took a decided stand in favor of its vigorous prosecution subsequent to the actual commencement of hostilities. In 1864 he made an attempt at reconciliation on a plan of adjustment proposed to President Lincoln, which proved unsuccessful. In the same year Mr. Greeley was a presidential elector for the State of New York, and a delegate to the Loyalist convention at Philadelphia.

Upon the close of the war in the spring of 1865, Mr. Greeley became a strenuous advocate of complete pacification based on the conditions of impartial suffrage and universal amnesty. In pursuance of this end he consented to be one of the bondsmen for Mr. Jefferson Davis, the President of the Confederacy, who was imprisoned by the Federal Government on the charge of treason.

The Liberal convention for the nomination of a candidate for the presidency, which met in Cincinnati on May 1, 1872, after the fifth ballot gave a majority of votes for Mr. Greeley. He accepted the nomination, and in the month of July following was nominated for the same office by the Democratic convention at Baltimore. He was thus presented to the country as the candidate of two great parties for the highest office in the Government, and an impassioned contest ensued. He lost the election by a large majority. During the canvass Mr. Greeley performed an incredible amount of mental and physical labor. He spoke constantly, and in all parts of the country, to numerous and eager audiences, frankly discussing the great question at issue, and expressing his convictions with equal boldness and candor. His strong constitution at length became impaired by excessive toil and intense excitement. The loss of his wife, who had been a hopeless invalid for many years, served to complete the fatal work. He was attacked with inflammation of the brain, and died on Nov. 29, 1872, at the residence of his physician, 2 or 3 miles from his home at Chappaqua, N. Y.

In addition to his labors as a journalist and public speaker, Mr. Greeley was the author of several works, the principal of which are *Hints toward Reforms* (1850); *Glances at Europe* (1851); *History of the Struggle for Slavery Extension* (1856); *Overland Journey to San Francisco* (1860); *The American Conflict* (1864); *Recollections of a Busy Life* (1869).

Revised by C. K. ADAMS.

**Greely,** ADOLPHUS WASHINGTON: explorer; b. at Newburyport, Mass., Mar. 27, 1844; fitted for college in the public schools, graduating from the Brown High School in 1860; enlisted in Company B, Nineteenth Massachusetts Infantry, July 26, 1861; served through the civil war first as second lieutenant and afterward as captain of a regiment of colored infantry; was honorably mustered out Mar. 22, 1867; was appointed second lieutenant of Thirty-sixth U. S. Infantry Mar. 7, 1867; assigned to Fifth Cavalry July 14, 1869; became first lieutenant of Fifth U. S. Cavalry May 27, 1873; captain June 11, 1886. Soon after the civil war he was detailed for duty in U. S. Signal Service. He commanded the expedition sent into the Arctic regions by the U. S. Government, in accordance with the plan of the International Geographical Congress held at Hamburg in 1879, to establish a series of circumpolar stations for scientific observations. He landed with his party, twenty-five in all, at Discovery Harbor, lat. 81° 44′ N., lon. 64° 45′ W., Aug. 12, 1881 (see POLAR RESEARCH), and was rescued June 22, 1884, at Cape Sabine with six of his party by the officers of the relief ships under Commander Schley. Two of Greely's party, Lieut. Lockwood and Sergt. Brainard, had reached 83° 24′ N. lat. (44° 5′ W. lon.), the highest northerly point yet attained. Greely abandoned Fort Conger Aug. 9, 1883, and reached Baird Inlet Sept. 29, with entire party well; abandoned all his boats, and was adrift thirty days on a floe of ice in Smith's Sound. His permanent camp was established Oct. 21, 1883, at Cape Sabine, the point where he was found. Here eighteen perished. Had the relief ships been delayed forty-eight hours, not one of the party would have been found alive. (See *The Rescue of Greely*, 1885; *Report on United States Expedition to Lady Franklin Bay*, 2 vols., 1888; and Greely's *Three Years of Arctic Service*, 1886.) He was captain of Fifth U. S. Cavalry June 11, 1886. On Dec. 11, 1887, he was detailed as acting chief signal officer of the army, and thus served until he was regularly commissioned as chief signal officer, with the rank of brigadier-general, Mar. 3, 1887. This placed him *ex officio* in charge of the meteorological work of the U. S., and he retained charge of this work until July 1, 1892, when the civilian duties of the Signal Office were transferred to the new Weather Bureau under the Department of Agriculture. In 1888 he published a work entitled *American Weather*. Massachusetts, through legislative action, extended to him its formal thanks for his service in war, in science, and in exploration. He received the thanks of the Government of Great Britain for returning a British ensign, official dispatches, and Arctic mail; also gold medals from the Royal Geographical Society of London and the Society of Geography of Paris.

**Green,** ANDREW H.: See the Appendix.

**Green,** ANNA KATHARINE: See ROHLFS, ANNA KATHARINE.

**Green,** ASHBEL, D. D., LL. D.: author and educator; b. at Hanover, Morris co., N. J., July 6, 1762; entered the Revolutionary army 1778; graduated from New Jersey College in 1783 with the highest honors; was soon after appointed tutor, and held office for two years; was chosen Professor of Mathematics and Natural Philosophy in New Jersey College in 1785; began preaching in 1786; was elected a member of the American Philosophical Society in 1787; pastor of the Second Presbyterian church, Philadelphia, 1787–1812; became president of Princeton College in 1812, and soon after in the same year received the degree of LL. D. from the University of North Carolina. His degree of D. D. came from the University of Pennsylvania 1792. He held the presidency of Princeton College for ten years 1812–22. Author of *A History of Presbyterian Missions, Lectures on the Shorter Catechism, Discourse Delivered in the College of New Jersey, with a History of the College* (Boston, 1822), and other works. Edited and largely wrote *The Christian Advocate* (1822–34); was an able orator, and one of the leaders of Old School Presbyterianism for many years. D. in Philadelphia, May 19, 1848. See his *Life* by J. H. Jones (New York, 1849).

**Green,** JOHN RICHARD, LL. D.: historian; b. in Oxford, England, in 1837; studied at Magdalen College School, and at the age of eighteen obtained a scholarship in Jesus College, Oxford. He took holy orders in 1860, and was made curate of St. Barnabas's, London, where in addition to his parochial work he devoted much time to historical studies in the British Museum. Two years later he became vicar of St. Stephen's, Stepney. He resigned his living in 1869, and became librarian at Lambeth, where he wrote his famous *Short History of the English People* (1870). This was followed by a *History of the English People* (1877–80); *The Making of England* (1882); and *The Conquest of England* (posthumous, 1883). His health was always delicate, and for many years he spent his winters in southern lands. D. at Mentone, France, Mar. 9, 1883.

**Green,** JOSEPH F.: See the Appendix.

**Green,** RUFUS SMITH, D. D.: Presbyterian minister; b. in Sidney, N. Y., Apr. 1, 1848; educated at Gilbertsville Academy, Hamilton College (1867), the University of Berlin, Germany, and the Auburn Theological Seminary (1873). Pastor of Presbyterian churches in Westfield, N. Y., 1873–77; in Morristown, N. J., 1877–81; in Buffalo, N. Y., 1881–90; in Orange, N. J., 1890–93; president of the Elmira

(N. Y.) College for Women 1893. In Morristown he edited *The Record*, 1879–81; published *The History of Morristown, New Jersey*, a part of the *History of Morris County* (1881); in Buffalo he published *Our Church at Work* (1882–90); *Both Sides, or Jonathan and Absalom* (Philadelphia, 1887). From 1891 he has been chairman of the General Assembly's committee on systematic beneficence, and has published *The Christian Steward*. WILLIS J. BEECHER.

**Green**, SETH: pisciculturist; b. in Rochester, N. Y., Mar. 19, 1817. He devoted his life to methods of improving the yield of fish from spawn, and in increasing the product of fisheries in the U. S. In 1868 he was appointed one of the fish commissioners of New York, but, shortly afterward resigning, was made superintendent of fisheries. The introduction of shad on the Pacific coast was due to his efforts. He was decorated with two gold medals by the Société d'Acclimatation of Paris. He published *Trout Culture* (Rochester, 1870) and *Fish-hatching and Fish-catching* (1879). D. in Rochester, N. Y., Aug. 20, 1888.

**Green**, THOMAS HILL, LL. D.: philosopher; b. at Birkin, Yorkshire, England, Apr. 7, 1836; son of Rev. Valentine Green, rector of Birkin. He was educated at Rugby and at Balliol College, Oxford, which he entered in 1855. In 1859 he took a first class in the school of *litteræ humaniores*, and later a third class in law and modern history. In Nov., 1860, he was elected a fellow of Balliol, and in 1862 gained the chancellor's prize for an essay on morals. On taking the degree of M. A. he subscribed to the Thirty-nine Articles, although changes in belief made him unwilling to take orders. In 1866 he was appointed to a vacancy in the teaching staff of Balliol, in 1870 became master of the college, and in 1872 was re-elected fellow. In 1878 he became Whyte Professor of Moral Philosophy. Meanwhile he had taken an active part in furthering popular education, temperance, and, as a Liberal, reforms in local politics. In 1871 he married a sister of John Addington Symonds. He died at Oxford, Mar. 15, 1882. His principal works are *Introduction to Hume* in Hume's *Treatise on Human Nature* (1874–75; new ed. 2 vols., 1886); posthumous works, *Collected Writings*, edited by Nettleship (3 vols., London and New York, 1885–88); *Prolegomena to Ethics* (London and New York, 1883). He was joint translator of Lotze's *Metaphysics* (Oxford, 1884). Green was the leading representative of the so-called Neo-Hegelian movement. His influence was the chief one in English idealistic thought until his work came to be supplemented and recast in the writings of Principal Edward Caird. The University of Oxford is still dominated in its philosophical instruction by Green's works. His character and personal qualities gave his opinions great weight with young men. He was the original of "Mr. Gray" in the romance *Robert Elsmere*. J. MARK BALDWIN.

**Green**, TRAILL: See the Appendix.

**Green**, WILLIAM HENRY, D. D., LL. D.: scholar and clergyman; b. at Groveville, Burlington co., N. J., Jan. 27, 1825; graduated at Lafayette College 1840; studied at the Princeton Theological Seminary; became teacher of Hebrew there 1846; was ordained Presbyterian minister 1848; became pastor of the Central Presbyterian church, Philadelphia, 1849; held the professorship of Hebrew and Old Testament Literature in Princeton Seminary from 1851; took part in the work of revising the Authorized Version of the Bible, being chairman of the Old Testament Company, one of the two sections of the American committee of revision; was moderator of General Assembly in 1891. He published a *Hebrew Grammar* in 1861, which has passed through several editions; a *Chrestomathy* in 1863; an elementary Hebrew grammar in 1866; *The Pentateuch Vindicated from the Aspersions of Bishop Colenso* (1863); *The Argument of the Book of Job Unfolded* (1874); *Moses and the Prophets* (1883); *The Hebrew Feasts in their Relation to Recent Critical Hypotheses* (1885); and many articles theological and controversial. D. Feb. 10, 1900. Revised by WILLIS J. BEECHER.

**Green**, WILLIAM MERCER, D. D., LL. D.: bishop; b. in Wilmington, N. C., May 2, 1798; graduated at the university of that State June 3, 1818; was ordained deacon in the Protestant Episcopal Church in 1820, and priest in 1821, by the Rt. Rev. Richard Channing Moore, of Virginia. He was the first pastor of St. John's church, Williamsborough, N. C., 1821, and of St. Matthew's church, Hillsborough, 1825. In 1837 he was called to the chair of English Literature in his *alma mater*, and in 1849 was elected the first Bishop of Mississippi. He was one of the founders of the University of the South at Sewanee, Tenn. His published works comprise little more than a brief *Memoir of Bishop Ravenscroft* (New York, 1870), a *Life of the Right Rev. Bishop Otey* (1885), and a few sermons, chiefly on the subject of ministerial authority and baptismal regeneration. D. in Sewanee, Tenn., Feb. 13, 1887.

**Greenbacks**: the name applied during the U. S. civil war (1861–65) to notes, bonds, and forms of paper currency issued by the Government, and printed in green ink. Since then, however, the term has been limited in meaning to U. S. legal-tender notes, especially those issued in 1862 and 1863. Their issue was due to the exigencies of the war, and to the expectation that relief would be thus afforded to the business of the country. It has been defended on grounds of necessity, although criticised by some financial writers as premature. Issues of $150,000,000 each were authorized by the laws of Feb. 25, 1862, July 11, 1862, and Mar. 3, 1863, respectively, with the result of inflating the currency to such an extent that gold rose to 285 in 1864, and did not touch par till Dec. 17, 1878, the date of the first gold sale at par in the U. S. for sixteen years. On Mar. 31, 1866, the amount of legal-tender notes outstanding was $422,424,007, which by Dec. 31, 1868, had been reduced to $356,000,000. The constitutionality of the legal-tender laws was called in question, but appeals to the courts finally established their validity. After many fluctuations in value the act of Jan. 14, 1875, enacted that on and after Jan. 1, 1879, all legal-tender notes should be redeemed in coin upon presentation at the office of the assistant treasurer in New York city. (See CURRENCY.) There had in the meantime arisen a strong opposition to the resumption of specie payments, and in 1874 it became a distinct party issue, on which the so-called Greenbackers went into the campaign of 1876, nominating Peter Cooper for President. They opposed the fixing of an arbitrary date for the resumption of specie payments as a measure destined to rob debtors, and advocated the retirement of all bank-notes and the issue by Government of greenbacks which should be exchangeable for interconvertible bonds, bearing interest sufficiently high to keep them at par with gold. In the election of 1876 their candidate received only 81,737 votes, but in the two succeeding campaigns they were somewhat better supported. In 1888 and 1892 they had no separate candidate and platform, but voted with the United Labor and People's parties. See POLITICAL PARTIES. F. M. COLBY.

**Green Bay**: an extension of the northwestern part of Lake Michigan, extending 140 miles from N. N. E. to S. S. W., and nearly 30 miles in average breadth. Its waters are about 500 feet deep, and of a green color. To the N. E. the Great and Little Bays de Noquet are its continuations.

**Green Bay**: city (first white settlement made by the French in 1639, permanently settled by them in 1745, incorporated in 1839, chartered in 1854); capital of Brown co., Wis. (for location of county, see map of Wisconsin, ref. 5–F); on the Fox river, at the head of Green Bay, and on the Chi. and N. W., the Chi., Mil. and St. P., and the G. B., Min. and St. P. Railways; 65 miles N. N. E. of Fond du Lac, 113 miles N. of Milwaukee. It is at the terminus of the projected navigable connection between Lake Michigan and the Mississippi river by means of the Fox and Wisconsin rivers and a canal to be 119 feet wide at the bottom and 19 feet deep. This work is being carried on by the U. S. Government under contracts aggregating more than $10,000,000. The city has an excellent harbor, accessible by the largest lake steamers, and is principally engaged in the lumber and fishery industries, shipping annually about 80,000,000 feet of lumber, 200,000,000 shingles, and 6,000,000 staves, and having a large trade in whitefish and trout. Its location and valuable mineral springs have made it a popular summer resort. Pop. (1880) 7,464; (1890) 9,069; (1900) 18,684 (Fort Howard annexed since 1890). EDITOR OF "STATE GAZETTE."

**Greenbrier**: a river in West Virginia; rises in lat. 38° 40′, and flows S. W. parallel to the main ridge of the Alleghanies, on the western slope of which its valley lies between that ridge and the secondary ridge of the Greenbrier Mountains. In about lat. 37° 40′ it unites with New river, which, running nearly northward, unites with the Gauley and forms the Great Kanawha. These rivers and their valleys constitute the trans-Alleghany portion of the James river and Kanawha Canal route of a proposed connection between tide-water and the great valley of the Mississippi.

**Green Brier Mountains**: a ridge in West Virginia parallel to the main Alleghanies, and lying N. W. of them, con-

tinuous southward with the Great Flat Top, and northward with Shaver Mountains.

**Greenbush**: village; Rensselaer co., N. Y. (for location of county, see map of New York, ref. 5–J); on the Hudson river, and on the Boston and Albany and the N. Y. C. and H. R. Railroads; opposite Albany, with which it has bridge connection. It has a large railway station, machine and car shops and freight-yards, 7 churches, Roman Catholic convent, sawmills, tannery, cigar-factory, pork-packing establishments, and 2 weekly newspapers. Greenbush is sometimes called East Albany. Pop. (1880) 3,295; (1890) 7,301; not separately returned in 1900.

**Greencastle**: city; capital of Putnam co., Ind. (for location of county, see map of Indiana, ref. 7–C); near Big Walnut, a branch of Eel river; on the Cl., Cin., Chi. and St. L., the Louisv., New Alb. and Chi., and the Vandalia Railways; 39 miles W. of Indianapolis. It is within 8 miles of the celebrated block coal region of Indiana, and near by are valuable tracts of timber and beds of sandstone, limestone, and iron ore. It is the seat of DE PAUW UNIVERSITY (*q. v.*), and has important manufactures and five weekly newspapers. Pop. (1880) 3,644; (1890) 4,390; (1900) 3,661.

EDITOR OF "BANNER AND TIMES."

**Greencastle**: borough; Franklin co., Pa. (for location of county, see map of Pennsylvania, ref. 6–E); on the Cumberland Valley Railroad; 63 miles S. of Harrisburg. It is in an agricultural region, manufactures agricultural implements and woolen goods, and has two weekly newspapers. Pop. (1880) 1,735; (1890) 1,525; (1900) 1,463.

**Green Cove Springs**: town; capital of Clay co., Fla. (for location of county, see map of Florida, ref. 3–J); on the St. Johns river and the Jack., Tampa and K. W. and the Southwestern Railways; 30 miles S. of Jacksonville, 45 miles N. of Palatka. It has a celebrated sulphur spring, much resorted to for the cure of rheumatic troubles, and believed by many to be the "fountain of youth" vainly sought by Ponce de Leon. Principal business, lumbering, fruit and vegetable shipping, brick and woodwork manufacturing, and railway-car building and repairing. It has two weekly newspapers. Pop. (1890) 1,106; (1900) 929.

**Greene**, CHARLES EZRA: civil engineer; b. in Cambridge, Mass., Feb. 12, 1842; graduated at the Massachusetts Institute of Technology in 1868. Since 1872 he has been Professor of Civil Engineering in the University of Michigan. He is the author of *Graphical Analysis of Roof Trusses* (1874); *Graphical Method for Bridge Trusses* (1875); *Trusses and Arches Analyzed by Graphical Methods* (1879); and *Notes on Rankine's Civil Engineering* (1891).

**Greene**, CHARLES GORDON: journalist; b. at Boscawen, N. H., July 1, 1804. At the age of nine he was assigned to the care of his brother Nathaniel, then manager of *The Patriot* at Haverhill, Mass., who sent him to the Bradford Academy near by, of which Benjamin Greenleaf was then the principal; subsequently he was apprenticed in his brother's printing-office, and continued his apprenticeship in Exeter, N. H.; in 1822 he removed to Boston, and entered the office of the Boston *Statesman*; in 1825 he undertook the management for a year of *The Free Press* at Taunton, and was for a portion of the time its editor. Returning to Boston, he published *The Spectator*, a literary journal, which, however, he soon abandoned, and resumed his place in *The Statesman* office; in 1827 he removed to Philadelphia and published *The National Palladium*, which advocated the election of Andrew Jackson to the presidency. In 1828 he went to Washington and was engaged upon *The United States Telegraph* until after Jackson was elected, when he returned to Boston and acquired a joint ownership in *The Statesman*, of which he became sole owner in a few years. In Nov., 1831, he established the Boston *Post*. He was a member of the Legislature, and Democratic candidate for various public offices. He became aide to Gov. Morton in 1840, and thus gained his title of colonel. President Pierce appointed him naval officer of Boston in 1853, and he was reappointed by Buchanan in 1857. He sold his interest in *The Post* in 1875. D. in Boston, Sept. 27, 1886.

**Greene**, CHARLES WARREN, A. M., M. D.: journalist and author; b. at Belchertown, Mass., Aug. 17, 1840; educated at Phillips Academy, Andover, Waterville College (Maine), and Brown University; studied medicine at Harvard Medical School, Berkshire Medical College, Pittsfield, and the medical department of Dartmouth College, where he graduated M. D. in 1867; entered the U. S. volunteer service by enlistment July 19, 1862, and served in the army three years, attaining the rank of captain of volunteers, which he held one year; practiced his profession in Massachusetts 1868–72; in 1872 devoted himself to literary pursuits; edited editions of Lippincott's *Gazetteer*, and wrote *Animals, their Homes and Habits* (1886); *Birds, their Homes and Habits* (1886).

**Greene**, EDWARD LEE, Ph. B.: botanist; b. at Hopkinton, in Rhode Island, Aug. 20, 1843; educated at Albion, Wis.; entered the ministry in 1871; lecturer on botany (1883), and now Associate Professor of Botany in the University of California. He is editor of *Pittonia* (1887–), and has published *Illustrations of West American Oaks* (1889–90), *Flora Franciscana* (1891–), besides many papers on the botany of the western coast. CHARLES E. BESSEY.

**Greene**, FRANCIS VINTON: son of Gen. George Sears Greene; b. in Providence, R. I., June 27, 1850; graduated at West Point first in his class 1870; appointed second lieutenant of artillery; transferred to corps of engineers as second lieutenant June 10, 1872, first lieutenant Jan., 1874, captain Feb. 20, 1883; resigned Dec. 31, 1886; served in garrison 1870–72; as assistant astronomer on Northwest boundary survey 1872–76; on special duty in office of Secretary of War 1876–77; as military *attaché* to the U. S. legation in Russia 1877–78, being attached to the headquarters of the Russian army in the Russo-Turkish war; was present at the battles of Shipka Pass, Plevna, Philippopolis, passage of the Balkans, and various combats; received the Order of St. Anne (third class) and of St. Vladmir (fourth class) for bravery at Shipka Pass and Philippopolis. Author of *The Russian Army and its Campaigns in Turkey* (1879); *Army Life in Russia* (1880); *The Mississippi* (Campaign Series, Civil War, 1882); *Life of Nathanael Greene* (1893); and various military and scientific papers. He served in the war with Spain in 1898, first as a colonel, then in the Philippine islands as a brigadier-general, and was afterward made a major-general.

**Greene**, GEORGE SEARS: soldier; b. in Warwick, R. I., May 6, 1801; graduated at the U. S. Military Academy second in his class, and entered the army as second lieutenant of artillery in 1823: from this date he was on duty at West Point, as Professor of Mathematics, in garrison, and on ordnance duty till 1836, when he resigned from the army and adopted the profession of civil engineer. As such he was employed on various public works in different parts of the U. S. till 1857, when he was appointed engineer of Croton water-works and of Croton reservoir. He resumed his sword on the outbreak of civil war; was appointed colonel Sixtieth New York Volunteers, and brigadier-general of volunteers in Apr., 1862, participating in the battles of Cedar Mountain and Antietam, the defense of Harper's Ferry, and the battles of Chancellorsville and Gettysburg; transferred to the Army of the Cumberland in 1863, he was severely wounded at Wauhatchie, and disabled from duty in the field till 1865, when he joined the army of Gen. Sherman. In Apr., 1866, he was mustered out of volunteer service; resumed charge of Croton water-works, and became engaged on other important public works; from 1875 till 1877 president of the American Society of Civil Engineers. D. Jan. 28, 1899.

**Greene**, GEORGE WASHINGTON: historian; b. in East Greenwich, R. I., Apr. 8, 1811; a grandson of Gen. Nathanael Greene; was educated at Brown University; lived in Europe 1827–47; U. S. consul at Rome 1837–45; was instructor in Modern Languages in Brown University from 1848 to 1852; became in 1872 Professor of History (non-resident) at Cornell University. Author of *Historical Studies* (1850); *Historical View of the American Revolution* (1865); *Biographical Studies* (1860); *Life of Nathanael Greene* (1867–71); and other works. D. in East Greenwich, Feb. 2, 1883.

**Greene**, HARRY PLUNKET: See the Appendix.

**Greene**, NATHANAEL: soldier; b. at Warwick, R. I., of Quaker parents, July 27, 1742 (O. S.). In early youth, chiefly by his own perseverance, he acquired a more than ordinary knowledge of many branches of education, the perusal of military history occupying much of his attention. In 1770 he was chosen a member of the Assembly of Rhode Island, and from this date took an active part in the affairs of his country till the close of the war. The battle of Lexington excited his military ardor, and on receiving (in May, 1775) the appointment of brigadier-general and the command of the Rhode Island contingent army, he led them to Cambridge; for this he was formally excommunicated from the religious body of which he was a member. On the arrival

of Washington at Cambridge, Greene expressed to his commander his satisfaction in his appointment, and soon won his confidence and esteem. In Aug., 1776, he was appointed a major-general by Congress. In the battle of Trenton he led a division, and bore an equally important part in the following battle of Princeton. At the Brandywine, where he commanded a division, he distinguished himself, and contributed largely toward saving the army from destruction by a rapid march and the firm stand he made against the enemy. At the battle of Germantown he commanded the left wing of the army. In Mar., 1778, he was appointed quartermaster-general, and accepted the office at the urgent solicitation of Washington, on condition that his rank in the army should not be affected and that in time of action he should retain his command. This right he exercised at Monmouth, where he commanded the right wing, as also at the battle of Tiverton Heights. During Gen. Washington's visit to Hartford in 1780 Greene was in command of the army; was president of the court of inquiry upon Maj. André. After the disasters to the American arms in South Carolina he was assigned to the command of the Southern department, to supersede Gen. Gates. He found the army reduced by defeat and desertion, and greatly disorganized and in want. Having recruited his army and repaired its wants, he sent out a detachment under Gen. Morgan, which resulted in the victory of the Cowpens, Jan. 17, 1781. Greene effected a junction with Morgan Feb. 7, but finding his numbers altogether greatly inferior to the army of Cornwallis, he retreated with great skill to Virginia, where, being re-enforced, he returned to North Carolina, and the battle of Guilford was fought, in which, though Greene was defeated, the loss of the British was the greater, and in a few days Cornwallis began a retreat toward Wilmington, followed by Greene; but changing his plan, Greene marched directly to South Carolina, where on Apr. 28 he engaged Lord Rawdon at Camden, and was defeated, but again with the results of success; on May 22 he commenced the siege of Fort Ninety-six, which was raised by the approach of Lord Rawdon. To the suggestion now made, that he had better retire to Virginia, Greene replied, "I will recover South Carolina or die in the attempt." Awaiting a favorable opportunity, he in turn pursued the forces of Lord Rawdon, resulting in the battle of Eutaw Springs, the hardest fought battle of the war, and the advance upon Dorchester. For his conduct at Eutaw Springs Congress presented him with a gold medal and a British standard. During the remainder of his command he struggled successfully against the greatest difficulties in suppressing mutiny among his troops, who were insufficiently fed and clothed. North and South Carolina and Georgia made him valuable grants of property, and after spending a year in Rhode Island upon the return of peace, he sailed with his family to his estate at Mulberry Grove, near Savannah, where he died June 19, 1786, from inflammation of the brain, occasioned by sunstroke. See the *Life* by George W. Greene (3 vols., New York, 1867–71) and that by Francis V. Greene (1893).

Revised by F. V. Greene.

**Greene**, Nathaniel: journalist; b. at Boscawen, N. H., May 20, 1797. He edited various newspapers at Concord and Portsmouth, N. H., and Haverhill, Mass., and in 1821 established the Boston *Statesman*, at first a semi-weekly, but finally the leading Democratic daily in the State; in 1829 he was appointed postmaster of Boston, and held office until 1840, and again from 1845 to 1849. In 1836 he published a translation of Sforzosi's *History of Italy*, *Tales from the German* in 1837, and *Tales and Sketches from the German, Italian, and French* in 1843. D. in Boston, Nov. 29, 1877.

Revised by Henry A. Beers.

**Greene**, Robert: poet and dramatist; b. at Norwich, England, about 1560; studied at Cambridge, where he took his degree in 1578; traveled abroad several years, visiting France, Germany, Poland, and Denmark, and seems to have taken holy orders on his return in 1583. Soon after, however, he settled in London, engaged in literary pursuits, and entirely abandoned himself to licentiousness and debauchery. He left thirty-five prose tracts and four dramas. The former are often of a polemical or satirical description, sometimes "love-pamphlets" or "vaine fantaisyes." They are generally written in the euphuistic style, but they interest by their materials, and form a not unworthy beginning of the English novel. Of greater interest, however, to our time are those tracts which more or less directly deal with the author's own life: *Never Too Late* and *Greene's Groat's Worth of Wit bought with a Million of Repentance*. Of his dramas *The History of Orlando Furioso* is the earliest. The next, a *Comical History of Alphonsus, King of Aragon*, was written in rivalry with Marlowe's *Tamburlaine*. The *Honorable History of Friar Bacon and Friar Bungay*, written in rivalry with Marlowe's *Dr. Faustus*, gives a charming dramatic picture of English life, and *The Scottish Historie of James IV.* contains some outbursts of genuine pathos. See Dyce, *The Dramatic and Poetical Works of Robert Greene* (1861); and Ingleby, *Shakespeare Allusion-books*, 1874 (Introduction). D. in London, Sept. 3, 1592.

Revised by Henry A. Beers.

**Greene**, Samuel Dana: commander U. S. navy; b. in Cumberland, Md., Feb. 11, 1840: graduated at the Naval Academy in 1859; served as midshipman on the Hartford of the China squadron; became a lieutenant in 1861; in Jan., 1862, volunteered to serve as the executive officer of the Monitor (the first of an untried type of vessels), which the majority of seamen, not without reason, as was afterward proved, believed to be utterly unseaworthy. On Mar. 9 the Monitor attacked the Confederate ram Merrimac in Hampton Roads, and in consequence of an accident to Capt. Worden was commanded by Lieut. Greene throughout the engagement. Lieut. Greene remained on the Monitor until she foundered in Dec., 1862; then served as executive officer of the Florida, the Iroquois, and other vessels 1863–69; became lieutenant-commander in 1866, and commander in 1872; commanded the Juniata in 1875, the Monongahela in 1876–77, and the Dispatch in 1882–84. He was Assistant Professor of Mathematics at the Naval Academy in 1865–68, of Astronomy in 1871–75, and assistant to the superintendent in 1878–82. D. in Portsmouth, N. H., Dec. 11, 1884.

**Green Ebony**: a South American tree (*Jacaranda mimosifolia*) of the family *Bignoniaceæ*. Its wood is quite hard and is olive green in color. It is used by dyers, and gives yellows, browns, and greenish tints. It is also used in turnery and joiner-work to some extent. Other species of the genus yield medicinal agents.

**Greenfield**: city; Greene co., Ill. (for location of county, see map of Illinois, ref. 7–C); on the Chi., Bur. and Q. and the Jacksonville Southeastern Railways; 12 miles E. of Carrollton, 55 miles N. of St. Louis. It is in an agricultural and stock-raising region; contains 4 churches, a seminary, steam flour-mill, and 2 weekly newspapers, and exports cattle, swine, horses, grain, and other produce. Pop. (1880) 985; (1890) 1,131; (1900) 1,085. Editor of "Argus."

**Greenfield**: city; capital of Hancock co., Ind. (for location of county, see map of Indiana, ref. 6–F); on the Pitts., Cin., Chi. and St. L. Railway; 21 miles E. of Indianapolis. It is in an agricultural region and also in the natural gas-belt of Indiana, and has a supply of gas sufficient for its own needs and for those of Shelbyville, Ind., with which it is connected by a pipe line. There are 5 churches, high school (building cost $45,000), and 3 grammar schools, electric-light plant, manufactures of glass, school furniture, ice, stoves, nails, flour, butter and cheese, and rolling-mill, planing-mill, and machine-shop products; also 3 weekly and 2 monthly periodicals. Pop. (1880) 2,013; (1890) 3,100; (1900) 4,489. Editor of "Hancock Democrat."

**Greenfield**: town; capital of Adair co., Ia. (for location of county, see map of Iowa, ref. 6–F); on the Chi., Bur. and Q. Railroad; 65 miles S. W. of Des Moines. It is in the rich corn-belt of the State, and has a large trade in agricultural produce. There are 1 daily and 3 weekly newspapers. Pop. (1880) 684; (1890) 1,048; (1900) 1,300.

**Greenfield**: town; capital of Franklin co., Mass. (for location of county, see map of Massachusetts, ref. 2–E); on the Connecticut river, and the Connecticut River and the Fitchburg Railroads; 36 miles N. of Springfield. It derives its principal prosperity from the agricultural and dairy interests which surround it, and from its manufactures, being the main market for butter, cattle, sheep, etc., in the northwest section of the State, and having manufactures of cutlery, sterling and plated silverware, boots and shoes, children's carriages, bolt-cutting machines, machinists' and blacksmiths' tools, leather goods, wooden rakes and shovels. There are 3 national and 2 savings banks, high school, young ladies' seminary, public library, soldiers' monument, and a weekly newspaper. Pop. (1880) 3,903; (1890) 5,252; (1900) 7,927.

Editor of "Gazette and Courier."

**Greenfield**: village; Highland co., O. (for location of county, see map of Ohio, ref. 7–D); on Paint creek, and the

Balt. and O. Southwestern and Ohio S. Railroads; 75 miles N. by E. of Cincinnati. It is in an agricultural region, and has considerable general trade and a weekly and a semi-monthly newspaper. Pop. (1880) 2,104; (1890) 2,460; (1900) 3,979.

**Green Finch**, or **Green Linnet**: a bird (*Coccothraustes chloris*) of the family *Fringillidæ*, found throughout a large part of the eastern hemisphere. It is often kept as a cage-bird, but is a poor songster. It is also called the green grosbeak. It feeds on both seeds and insects.

**Greenheart**: a tree (*Nectandra rodiæi*; family *Lauraceæ*) and its very valuable timber. It is the same tree which yields the bebeeru bark, a valuable medicine. Its seeds also yield starch, which is used as food by the natives. The timber is exported from Guiana. It is very heavy and durable, takes a high polish, and is used in turnery, and is also largely used for ship-building purposes.

**Greenhouse**: a glass structure designed to afford an artificial climate in which tender plants may be grown in countries or seasons too cold for their unprotected growth. The simplest structures of this kind are the cold-frames or hotbeds, used by market-gardeners for forcing the early maturity of vegetables. Cold graperies, conservatories, orchard-houses, bark-stoves, forcing-houses, etc., are among the varieties. Originally the name *greenhouse* was applied more especially to those whose winter temperature is just high enough to keep tender plants alive, or perhaps to produce from the flowering kinds some blossoms, but not enough to stimulate growth; but the term is usually applied indiscriminately to glass plant-houses, especially in the U. S. When a greater heat than this is kept up in winter the structure is called a stove or hothouse. The glass serves for the imprisonment of a portion of the solar heat, and currents of cold air are excluded; but in order equably to maintain this temperature, it is necessary to employ artificial heat in some form. For the ruder cold-frames the fermentation of horse-dung mixed with dead leaves or other suitable organic matter is sufficient; and in the old-fashioned stove very delicate plants may be forced by the fermentation of ground tan-bark and horse-dung, which affords not only a suitable heat, but a copious supply of moisture, which is another very favorable condition for plant-growth. In the best constructed greenhouses heat is supplied from iron pipes, through which steam or hot water is conducted. Wrought-iron or gas pipes are generally used, and the riser or flow-pipe is often carried through the top of the house, the returns coming back under the benches. Less piping is required for steam than for hot water. For ordinary conditions, a house 20 by 100 feet can be sufficiently heated by steam by one 2-inch pipe passing overhead the length of the house, and supplying from six to twelve 1-inch or 1¼-inch returns. Hot water demands about a half more pipe. There is much discussion as to the comparative merits of steam and hot water for greenhouse heating, but each has its special merits. For carrying long distances in runs with little fall and containing many angles, it is probable that steam will give the best results in most cases. The character of the heat from the two systems is the same, and plants will thrive equally under either method. One system is as easily manipulated as the other, with the improved automatic heaters now in use.

The modern tendency in greenhouse building is toward simplicity of construction. This is particularly true in the U. S., where the glass house has been the most simplified, and has produced the greatest results in the way of forcing vegetables and flowers. The framework of modern houses is either wood or iron; in either case, it is essential that the frame be very light, and that large glass be used. The details of building must be gleaned from the horticultural periodicals and a few books which contain chapters on greenhouse construction. Revised by L. H. Bailey.

**Green Island**: village; Albany co., N. Y. (for location of county, see map of New York, ref. 5–J); on an island of the same name in the Hudson river, between Troy and Watervliet, with which it is connected by bridges; also connected with Troy and Cohoes by street railway. It contains car-shops of the Del. and Hudson Canal Company's Railway, iron-foundries, iron-works, machine-shops, stove-works, sash and blind factory, and large trade in marble and lumber. Pop. (1880) 4,160; (1890) 4,463; (1900) 4,770.

**Greenland** (transl. of Dan. *Grönland*): a continental island, and the largest island in the known world; area about 500,000 sq. miles. Its insularity was established (July, 1892) by R. E. Peary, C. E., U. S. navy, who discovered that a strait, believed to be Nordenskiold Inlet, stretches from Lincoln Sea on the W., to the Arctic Ocean on the northeast coast of Greenland. The northern limit of the mainland extends only a little N. of the 82d parallel. North of the mainland is an archipelago of unknown extent. The greatest length of the island from Cape Farewell in the south to Nordenskiold Inlet in the north is about 1,400 miles. The broadest part, in North Greenland, is about 700 miles wide. The island is entirely under Arctic conditions. The only parts of its coast line still wholly unknown are the northeast coast, between Independence Bay (81° 37′ N. lat., 34° W. long.) and Cape Bismarck; the southeast coast, between the 67th and the 69th parallels; and the northwest coast along the shores of Melville Bay.

*General Topography.*—The interior is covered by the most enormous ice-cap known to exist, spreading over the whole island except along a narrow coast fringe. Deep fiords, some of them the outlets of great glaciers, fed by the ice masses of the interior, characterize most of the coasts. Cliffs and mountains of impressive aspect, from 1,500 to 7,000 feet in height, almost everywhere skirt the coasts. There are no rivers, but the greater part of the drainage reaches the sea through the melting of ice and snow, the muddy brooks and torrents thus formed flowing down and under the glaciers. A part of the precipitation also is removed by the glaciers, which, moving down the fiords, break off as icebergs at the sea-edge. Islands lie in large numbers along the west coast, but are less numerous on the east coast. The two distinctive features are the rugged and mountainous coast belt, extending from 2 or 3 to 20 miles inland, and the ice-cap, which covers all the rest of the country. The east coast is wilder and more desolate than the west, its mountains and cliffs are higher and more precipitous, and its vegetation is more scanty. The highest known summit is Mt. Petermann, at the head of Franz Josef fiord (10,725 feet). The altitude of the west coast mountains, S. of the Arctic Circle, is about 1,600 to 2,000 feet, with a few black and jagged summits that rise 5,000 feet above the sea; between the Arctic Circle and the latitude of Disco Bay the slopes are less precipitous, and the mean altitude is not so great. This is the region of the deepest fiords and the mightiest glaciers. N. of Disco Bay the mountains are again steeper and higher, some of them rising 7,000 feet. The hills and mountains N. of Melville Bay are, for the most part, less bold and impressive than along the coast of Danish Greenland, and the hill features rarely exceed 3,000 to 4,500 feet in height, though N. of Smith Sound there are some loftier summits.

*Geology.*—Gneiss, granite, and other crystalline formations form by far the greater portion of the rocks uncovered by snow and ice, and therefore accessible for study. On Disco island, and here and there along the west coast, towering masses of columnar basalt, some of them shaped into fantastic forms by wave action, are a conspicuous feature. Sandstone is also found; coal has been discovered on Disco island and on Lady Franklin Bay; the mineral cryolite is in paying quantities at Ivigtut, in Southwestern Greenland, and is extensively mined; and the mineral eudialite, near the south end of the island, is also commercially profitable. Though the island is largely the result of ancient plutonic activity, no active volcano is known to exist. The fossil flora found in sedimentary beds of the Carboniferous, Triassic, and Jurassic periods show types of vegetable life akin to some now found within the tropics. The Upper Cretaceous strata are very rich in fossil flora that must have existed under conditions of climate ranging from temperate to sub-tropical. More than 600 fossil plants afford undoubted evidence that Greenland has experienced all the various phases of climate.

*The Inland Ice.*—As late as 1885 some geologists and explorers, most notably Nordenskiold, held that the interior of Greenland was not entirely covered with snow and ice. It was left for Nansen (1888) and Peary (1892) to prove that the interior is an unbroken ice-sheet covered with snow and rising by gentle gradients from both east and west coasts to the culminating plateau or main axis, over 8,000 feet above the sea. The configuration of the land can not be studied, for mountains and valleys have completely disappeared under this tremendous ice-sheet. It is only near the outer edges that the moving mass has crept around instead of overwhelming the hill features, leaving here and there protuberances of rock known as nunataks. These rocky islands in the ice sea are more numerous in South

than in North Greenland. Peary saw a few birds from 50 to 75 miles inland, but otherwise the only signs of life in the interior are on these nunataks, where flies, butterflies, a species of poppy and mosses have been found. These little centers of animal and vegetable life amid the ice wastes are among the curiosities of Greenland. Once out of sight of the nunataks, nothing has yet been seen throughout the vast interior except the comparatively smooth and snow-covered ice-field, sloping gently from the narrow plateau of greatest elevation toward the east and west coasts. The area covered by the inland ice is over 400,000 sq. miles. The land surface on which it rests is probably diversified by lofty hills and deep valleys, but the plastic ice moves over the obstructions, and, impelled by its great weight and the law of gravitation, slowly makes its way toward the sea. The tremendous weight of the moving ice mass, which probably covers the valleys to a depth of 5,000 to 6,000 feet, must exercise a strong molding influence upon the land. An active melting process evidently goes on at the bottom of the ice, and large streams pour into the sea from under the ice in winter as well as in summer. These streams are powerful eroding agents and are turbid with the detritus they carry. In the glacial basins where the ice masses are pushed and torn by the enormous pressure that is thrusting them to the outlets, the surface is rent by wide and deep crevasses, very difficult and dangerous to cross. It was this phenomenon that gave the idea that the inland ice was impassable. When, however, these glacial basins are crossed the ice surface is unbroken, and offers not the slightest impediment to explorers who are properly equipped for snow traveling. From the upper portion of many a coast mountain it is possible to gain this safe inland highway without meeting crevasses. The summit or main axis of the ice-cap, extending N. and S., is a plateau of no great width, from 8,000 to 9,000 feet above the sea, nearly bisecting the island in its southern portion, but nearer the east coast in its northern part. At that immense elevation Peary was shrouded for two weeks in almost incessant fog and mist. The Danes, who have examined a stretch of about 1,500 sea miles of coast, have found that, measured on a line drawn through the inner extremities of the fiords, the edge of the inland ice is everywhere continuous. This edge of the ice sea is often 1,000 feet thick, and tends constantly to approach the sea, but in some parts its progress toward the coast is stopped by the mountainous barriers. As a rule the ice movement seaward is only sufficient to make good the loss caused by the thawing of the ice edge under the summer sun.

*The Glaciers.*—Hundreds of glaciers approach the sea, but comparatively few of them reach it or are of first-class magnitude. Garde counted 170 along the southeast coast, but there are perhaps less than 100 in all Greenland that reach the sea and produce icebergs, and less than fifty of them are of the first importance. The east coast glaciers are mostly of inferior size, due to the smaller drainage area of the east coast, and few of their icebergs ever reach Cape Farewell, many of them being blocked in the fiord entrances by islands at their mouths. The birthplace of most of the icebergs which drift down into the Northern Atlantic, and are met by steamers, is along the short strip of west coast between 68° 30′ and 75° N. lat. It is in some of these fiords that the marvelous phenomenon may be witnessed of ice masses, about 1,000 feet thick and 14,000 feet wide, moving seaward at the average rate of 2 feet an hour. The average rate of five of these glaciers has been found to be about 50 feet a day. The great glacier near Upernivik moves 90 feet a day. The frozen mass yearly discharged as icebergs would make a mountain 14,000 feet long, 13,000 feet broad, and about 900 feet high. The front of some glaciers has advanced in recent years. In 1889 the great glacier of Jakobshavn was nearly 2 miles beyond the point that marked its limit in 1878. In Inglefield Gulf glaciers have been discovered (Peary, 1892) that are almost as large as those of South Greenland. When a glacier front reaches the sea it is pushed out over the water until its weight causes a mass of greater or less extent to break off, and, if the sea is of sufficient depth or other impediments do not intervene, the iceberg thus created floats away.

*Climate*—Greenland is one of the coldest parts of the world. The isothermal line indicating the freezing-point crosses the island near its southern end. It is shrouded in darkness and twilight for several months in the year. The winters are of very unequal severity, and settlements not far from one another report considerable differences in average temperature in the same season. Warm and föhn winds from the south now and then raise the temperature many degrees during the last months of winter. Temperatures of −60° to −70° F. have been experienced in Northwest Greenland. The mean winter temperature at settlements in South Greenland has been recorded as varying between −7° and 20° F. At Upernivik the mean temperature for the three summer months is 38°, and further south, at Julianehaab, it is 48°. The temperature of the east coast is higher than that of the west coast. More snow falls in the south than in the north. The branch of the Gulf Stream flowing N. along the west coast increases the habitability of that region.

*Flora.*—The island has a considerable variety of mosses, herbs, and shrubs. Minute flowerless plants of the class *Algæ* are found even on the ice. In sheltered spots the summer sun shines with much intensity and vegetation develops rapidly. In fiords in the extreme southwest birches and alders attain the height of a man. Few of the shrubs are more than a foot high and their branches touch the ground. Dwarf alder and mountain-ash are found as far north as the 65th parallel, the juniper two degrees higher, and the willow and birch, often half hidden in moss, as far north as the 72d parallel. The flora embraces about 400 flowering plants and several hundred varieties of lichens. Botanists find the flora more like that of Europe than America, and Hooker and Brown say its character is that of the mountains and lake regions of Northern Europe. The fauna also is nearly allied with that of North Europe, and these facts have led to the conclusion that at one time Greenland was connected by land with the Old World. Some vegetables are cultivated, not with much success, in the Danish settlements.

*Fauna.*—The musk ox is the only animal of distinctly American origin, and it is now found only in the extreme north beyond the reach of the natives. The reindeer, white bear, wolf, fox, hare, weasel, and lemming are European mammals. Most of these animals have been practically exterminated in Danish Greenland. Reindeer, once found in great herds in the south, are now met with in numbers only in the northern and eastern parts of the island. The Danes have introduced cattle, sheep, goats, and swine in very small numbers. Among the 125 varieties of birds the eider duck, ptarmigan, and auk are the most useful. There are few species of butterflies or of terrestrial mollusks. The neighboring seas swarm with life. Seven species of seals, sixteen of the whale family, many fishes and mollusks, and numerous lesser organisms people the waters. The Greenland seas were once among the best whaling-grounds, but the right whale and less valuable species were long ago exterminated, and for years whalers have passed north only to reach other whaling-grounds through Lancaster Sound, which they have nearly exhausted. The seal is the great food reliance of the natives, the walrus coming next, while the reindeer, still numerous in the Smith Sound region, is little hunted. The ivory of the walrus and narwhal is of important service to the natives, and the Danes export large quantities of seal oil and skins.

*Inhabitants.*—The Danish census of 1888 showed a population of 10,221, of whom 300 were Danes. This did not include the east coast Eskimos, who were found (Holm, 1885) to number about 500 souls, nor the northwest coast natives, who number (Peary, 1892) 243 persons. The East Greenland Eskimos are gradually emigrating to the west coast, where they may have the benefit of trade with white men. The natives are grouped in about 200 settlements, many of them containing only one or two huts. Their most northern settlement is Peteravik in Robinson Bay, under 78° N. lat., about 40 miles S. of their most northern habitat when Kane and Hayes met them. There is evidence that they formerly hunted and lived much farther N. The only pure Eskimos are those of the Smith Sound and east coast regions. All the others have a large admixture of European blood, are nominally Christians, and live chiefly by collecting skins and oil for the Danish trade. They have schools, a newspaper and books in their own language; missionary teachers are devoted to their welfare, and the Danish Government protects them in large measure from vices introduced by white men. Their settlements, built in the shelter of bays and fiords, communicate with one another only by sea. Isolated as these native communities are, their habits and dialects are almost identical. The Smith Sound Eskimos and those of South Greenland are separated by the impassable barrier of the Melville Bay ice, and have been brought into con-

tact only to a limited extent by the whites, and yet their language shows only slight dialectic differences. The east coast dialect, however, differs considerably from that of the west coast, chiefly because the words applied to persons as proper names are not spoken after the death of the person and other words are invented to convey the idea. The language is therefore in a state of gradual transition. The Danes are all in the Government service, and a number of them with their wives and children have lived in Greenland for many years. Their most northern settlement is Tessuisak (73° 24′), and this place, where a Danish trading-agent and his family reside, is the most northern abode of civilized man.

*Government.*—The southwest coast is divided into the inspectorates of North and South Greenland, each having its own governor, and each divided into districts in charge of lesser officials. The governors and agents are responsible to a Government board at Copenhagen, which is charged with the control of all Greenland affairs. The policy is to pay the natives small prices for their skins and oil, and to sell them commodities at a small advance on prices in Denmark, and some articles are sold to them at first cost.

*History.*—The island was first seen by the Norman rover Gunnbjorn, and afterward (about 982 A. D.) Erik the Red, a banished Icelander, landed there and called it Greenland, with the idea that an attractive name would draw colonists. (See ERIK THE RED.) Over 600 years later Baffin called it, more appropriately, the Land of Desolation. A century after Erik landed a considerable population from Iceland had settled on the west coast, forming the communities of Westerbygd and Oesterbygd, both undoubtedly lying on some of the western fiords. For four centuries these people had intercourse with Europe, and they also discovered and visited America. European wars distracted attention from them, and meanwhile they were almost annihilated by Eskimos and finally were nearly forgotten. They perished, leaving some monuments in the shape of stones covered with Runic inscriptions, and the ruins of a church and houses. They had become nominally Christians, and maintained a republican form of government, but shortly before the troubles that blotted them out they swore allegiance to the King of Norway. The history of Greenland is then a blank for 200 years, until Davis, Hudson, and Baffin (1585–1616) began their explorations. Davis discovered the great strait that bears his name, Hudson saw the east coast at 73° N. lat., and Baffin (1616) skirted the west coast to Smith Sound, making, in a little sailing vessel, one of the most successful voyages ever made to that region. The country has been under Danish control for two centuries, but it was not till the missionary Hans Egede (1721) debarked on the west coast that permanent settlements were established. Egede founded Godthaab (Good Hope), and sought in vain for evidence that descendants of the Norsemen were still living there.

*Exploration.*—The exploration of Greenland is the work of the nineteenth century. Graah, one of the most tireless of explorers, surveyed the west coast between Cape Farewell and Upernivik (1821–23). Undaunted by difficulty he forced his way through the ice along the east coast (1828–30) to 65° 18′ N. lat. Discovery on the southeast coast was renewed (1883–85), when Holm remapped the coast and found at Sermalik (65° N. lat.) the most northern natives known to exist on that coast. Farther north the whaler Scoresby (1822) skirted the coast for 400 miles, and added many facts to the maps. His detail of the coast line was altered in some respects by the studies of Clavering (1823) and Koldeway (1869–70). Denmark's explorers have systematically studied the west coast as far north as Upernivik since 1876. The explorers who have helped to outline the northwest shore line are Inglefield (1852), Kane (1853–55), Hayes (1860–61), Hall (1871–73), Nares (1875–76), and Greely (1881–83), during whose expedition a point within 386 miles of the north pole was attained, about 4 miles beyond the highest latitude hitherto reached. The Danes and Germans have studied the border regions of the ice-cap and are investigating glacial phenomena. Hayes, Whymper, Nordenskiold, Jensen, and Peary made short journeys on the ice-cap before Nansen (1888) crossed it S. of the Arctic Circle, sledging 260 miles; and Peary (1892) crossed it in North Greenland, sledging 1,300 miles to and from his winter camp. See PEARY, ROBERT E.

Further information may be found in *Danish Greenland*, by Dr. H. Rink (London, 1877); in the series *Meddelelser om Grönland* (Danish Government, Copenhagen, vols. i.–xiii., 1879–90, with French paraphrases in each volume); and in the reports and books of the explorers above mentioned. See GREENLAND in the Appendix. R. E. PEARY.

**Greenleaf**, SIMON, LL. D.: jurist; b. at Newburyport, Mass., Dec. 5, 1783; studied law, and, after being admitted to the bar, began practice at Standish, Me., in 1806, removing to Gray soon after, and in 1818 to Portland. From 1820 to 1832 he was reporter of the Supreme Court in Maine, and published nine volumes of reports. In 1833 he was appointed Royall Professor of Law at Harvard University, through the influence of Judge Story, whom he succeeded as Dane Professor of Law in 1846. Having resigned in 1848 his professorship, he was made emeritus professor. He was for many years president of the Massachusetts Bible Society. His most important work was a *Treatise on the Law of Evidence*, in 3 vols. (1842–53; 14th ed., with additions by Simon Greenleaf Croswell, 1883). A volume of *Overruled, Denied, and Doubted Decisions and Dicta* was published in 1840, and subsequently expanded to three volumes. In 1849 he edited Cruise's *Digest of the Laws of England respecting Real Property*. He also published an *Examination of the Testimony of the Four Evangelists by the Rules of Evidence as administered in Courts of Justice, with an Account of the Trial of Jesus* (1846), and *Remarks on the Exclusion of Atheists as Witnesses*. D. at Cambridge, Mass., Oct. 6, 1853.

**Green Mountains**: a part of the Appalachian chain, constituting an important range in Vermont and Massachusetts, and continued southward in the hills of Western Connecticut and the Highlands of New York. The Taconic range of Massachusetts, New York, and Connecticut is an outlying western parallel range. Northeastward the Green Mountains pass into the Notre Dame Hills of Canada, and are traceable at least as far as the Gulf of St. Lawrence. The highest points are Mt. Mansfield, 4,389 feet, Camel's Hump, 4,188 feet, and Killington Peak, 4,380 feet in height. The range contains marble, iron, slate, and some copper and gold. The country is generally a rich pastoral region, with valuable water-power and abundant forests, consisting of pine, hemlock, fir, spruce, etc. The summits of the mountains are rounded and grassy. Revised by G. K. GILBERT.

**Greenock**: town of Scotland; in Renfrewshire, on the Frith of Clyde; 22½ miles by rail W. N. W. of Glasgow (see map of Scotland, ref. 11–F). It has excellent harbors and docks, extensive establishments for sugar-refining, ship-building, and the manufacture of ironwork, ropes, paper, wool and worsted, and a very brisk trade with North America and the West and East Indies. It has several parks, fine water-works, a custom-house, county buildings, several asylums, a temperance institute, and the Watt Institution. The west end of the town is handsomely built. The tonnage of vessels belonging to the port in 1888 was 229,912 tons. James Watt, the inventor of the steam-engine, was born here. Pop. (1901) 67,645.

**Greenough**, green′ō, HORATIO: sculptor; b. in Boston, Mass., Sept. 6, 1805. At the age of sixteen he entered Harvard College. At Cambridge he found in Washington Allston a stimulating and wise friend; his gratitude to Allston never diminished. His sonnets, written while an undergraduate, sketches with the pencil, plaster casts, models, and designs—particularly one for a monument on Bunker's Hill—attest a remarkable creative power. Before the day of graduation Greenough went to Italy for serious study of the ancient masterpieces, repairing at once to Rome, where Thorwaldsen was his friend and instructor. His studies impaired his health, and he spent a few months at home executing portrait-busts of J. Q. Adams, Chief Justice Marshall, and others. Already he had a reputation for talent. At Paris, whither he went for the purpose, he made the bust of La Fayette, by none admired more than by La Fayette himself. Returning to Italy, Greenough took up his residence in Florence as a sculptor. Among his first patrons was Cooper the novelist, who gave him a commission which proved to be the beginning of his larger renown. The group, nude cherubs, was sent to Boston, and excited great admiration in influential quarters just at the time when the Government was thinking of a statue to George Washington. He secured the commission, but the work was not designed for the open air, and the placing of it was a disappointment to the artist.

One of his earliest works was a statue of Abel. One of his latest, *The Rescue*, representing an American settler grappling an Indian, was executed between 1837 and 1851

on an order from the Government. The disturbed state of Italy made his home there disagreeable, and he left in the autumn of 1851 on the pretext of erecting his group of *The Rescue* in Washington. D. in Somerville, Mass., Dec. 18, 1852. Among his best-known works are the *Venus Victrix*, the *Angel Abdiel*, and the *Medora*.

Revised by RUSSELL STURGIS.

**Greenough**, RICHARD SALTONSTALL: sculptor; brother of Horatio; b. at Jamaica Plain, Mass., Apr. 27, 1819; has spent most of his life in Europe. Among his works are a portrait-bust of William H. Prescott, executed in 1843, a head of Christ, *Moses and the Daughter of Pharaoh*, *Cupid Warming an Icicle*, *The Shepherd Boy and the Eagle*, now in the Boston Athenæum, the bronze statue of Franklin in School Street, Boston, executed in 1853, the marble statue of Gov. Winthrop in the chapel at Mt. Auburn Cemetery, and a colossal statue of Gov. Winthrop, ordered by the State of Massachusetts for the Capitol at Washington.

Revised by RUSSELL STURGIS.

**Green Pigments**: those pigments which directly afford green colors, rendering unnecessary the mixture of yellow and blue pigments to obtain certain shades. Among the most prominent of the green pigments is *chrome green*, the sesquioxide of chromium, made by firing the chromate of mercury, and affording a very permanent and full-bodied opaque green paint. *Terre verte*, or green earth, a native mineral, affords a neutral green, permanent and delicate, much used by artists. *Scheele's green*, the arsenite of copper, is a cheap and good green paint. *Schweinfurth's green* is the double arsenite and acetate of copper; it affords a very handsome color. *Sap green*, prepared from buck-thorn-berries, is employed by artists. Many of the salts of copper are employed as green pigments. See PAINTS and PIGMENTS.

**Greenport**: village; Suffolk co., N. Y. (for location of county, see map of New York, ref. 8–K); on Shelter Island Sound and the Long Island Railroad; 95 miles E. by N. of Brooklyn. It has an excellent harbor, which has been improved by a breakwater, a bank, 7 churches, 2 weekly newspapers, and several summer hotels and boarding-houses, and is principally engaged in ship-building, coasting, and fishing. Pop. (1880) 2,370; (1890) estimated, 3,000; (1900) 2,366.

**Green River**: a river in Kentucky; rises in Lincoln County, and pursues a devious northwesterly course, uniting with the Ohio 6 miles above Evansville, Ind. It is navigable at high water 200 miles by means of locks and dams. The mouth of the Mammoth Cave, at an elevation of 225 feet above, is about a quarter of a mile from this river, a subterranean communication from which constitutes the famous "river" of that cave.

**Green River**: a river of Massachusetts; rises in Windham co., Vt., and joins the Deerfield river at Greenfield. It affords good water-power, and there is fine scenery on its banks.—Another Green river flows from Hancock, Mass., through Williamstown, into the Hoosac.—Still a third rises on the borders of Massachusetts and New York, flows southward through West Stockbridge, Alford, and Great Barrington, and joins the Housatonic river near the northern boundary of Sheffield. It is this which forms the theme of the poet Bryant in his lines *To Green River* (written when he was a resident of Great Barrington).

**Green River**: a river of Utah; rises in Western Wyoming, and flows in a generally southward course into Utah. With Grand river it constitutes the Rio Colorado of the West. It drains a large portion of Utah E. of the Wahsatch Mountains, and a large area in Northwestern Colorado.

**Greensand** [named from the greenish hue imparted by certain of its grains]: a sandstone or sand containing a large amount of the green mineral glauconite, a hydrous silicate of iron and potassium. The word has also been used as the proper name of several formations of Cretaceous age. In England the Upper Greensand and Lower Greensand, separated by the Gault formation, fall in separate divisions of the Cretaceous, the Cenomanian, and Neocomian. In New Jersey the upper marl beds of the Cretaceous are sometimes called the Greensand. G. K. G.

**Greensboro**: town; capital of Hale co., Ala. (for location of county, see map of Alabama, ref. 4–B); on the E. Tenn., Va. and Ga. Railway; 38 miles S. of Tuscaloosa, 50 miles W. N. W. of Selma. It is in a cotton-growing region, a few miles N. of the canebrake region, formerly famous for its productiveness; is the seat of the Southern University, founded by the Alabama Conference of the Methodist Episcopal Church in 1859; and has the Tullibody Academy and a non-sectarian female college, carriage-factory, and 1 monthly and 2 weekly periodicals. Pop. (1880) 1,833; (1890) 1,759; (1900) 2,416.

**Greensboro**: city; capital of Greene co., Ga. (for location of county, see map of Georgia, ref. 3–H); on the Ga. Railroad; 83 miles W. of Augusta, 87 miles E. by S. of Atlanta. It is in a cotton, corn, and hay region, and has several schools, the Thomas Stocks Institute, Fuller Academy, 1 bank, and 2 weekly newspapers. Pop. (1880) 1,621; (1890) 1,313; (1900) 1,511.

EDITOR OF "HERALD-JOURNAL."

**Greensboro**: city; capital of Guilford co., N. C. (for location of county, see map of North Carolina, ref. 2–F); on the Richmond and Danville and the Cape Fear and Yad. Valley Railways; 48 miles S. S. W. of Danville, 81 miles W. N. W. of Raleigh; named in honor of Gen. Greene, who commanded the Continental army in the battle of Guilford Court-house, fought 5 miles N. W. of Greensboro on Mar. 15, 1781. It is in a tobacco, wheat, corn, oats, and fruit region, with gold, copper, and iron mines; contains the only blast furnaces for the manufacture of Bessemer steel in the State, and has roller flour, planing, hosiery, and cotton mills, brick, tile, and terra-cotta works, foundries and machine-shops, etc. The educational institutions include the Greensboro Female College for white girls (Methodist Episcopal Church South); Bennett College for colored youth of both sexes; Guilford College (Friends'); and the State Agricultural and Mechanical College for colored students. Pop. (1880) 2,105; (1890), 3,317; (1900) 10,035.

LOCAL EDITOR OF "DAILY WORKMAN."

**Greensburg**: city; capital of Decatur co., Ind. (for location of county, see map of Indiana, ref. 8–F); on the Cleve., Cin., Chi. and St. L. Railway; 47 miles S. E. of Indianapolis, 68 miles W. N. W. of Cincinnati. It has natural-gas wells, a furniture-factory, a pork-packing establishment, several flouring-mills, carriage-factories, a woolen-mill, a foundry and machine-shop, fine stone quarries, and extensive shipments of stone for business purposes are made. There are three weekly newspapers. Pop. (1880) 3,138; (1890) 3,596; (1900) 5,034.

**Greensburg**: borough; capital of Westmoreland co., Pa. (for location of county, see map of Pennsylvania, ref. 5–B); on the Penn. Railroad; 31 miles E. of Pittsburg. It is an important coal and grain shipping-point, and has natural-gas wells and manufactures of steam-heating apparatus, iron, brass, steel, glass, nuts, bolts, etc. There are several churches, banks, Greensburg Seminary (Lutheran), and 2 daily and 6 weekly newspapers. Pop. (1880) 2,500; (1890) 4,202; (1900) 6,508. EDITOR OF "PRESS."

**Greenshank**: the *Totanus glottis*; a wading bird of the group known as tatlers; is remarkable for its wide geographic range, being found in Asia, Europe, and North America, but rather rare in the U. S. It is as large as a woodcock, and has a much longer bill and legs.

**Green Sickness**: See CHLOROSIS.

**Green Snake**: a name applied to several harmless serpents of the U. S. *Cyclophis vernalis* is the little green or grass snake, very common throughout a large part of the U. S. *Cyclophis æstivus* is a long, slender tree-snake, of the Southern States, golden green above, whitish yellow beneath; the genus to which these belong is rather closely related to *Coluber*.

**Greenspond**: a port of entry; on an island of the same name N. of the entrance to Bonavista Bay, on the northeast coast of Newfoundland. The island is utterly barren, and soil for gardens has been brought from the mainland. The harbor is small but safe, and the town is important as a fishing and sealing station. Pop. about 1,000.

**Greenstone**: a name at one time much used for massive rocks of intermediate composition and greenish color. This latter characteristic they owe principally to the presence of green hornblende, largely of secondary origin. Chlorite and epidote are also common constituents which add to the green color of the rock. Recent studies have shown the term greenstone to be petrographically a loose and inaccurate one, since the rocks to which it was applied are more or less altered forms of syenite, diorite, gabbro, or diabase, but it is nevertheless still a convenient field designation.

GEORGE H. WILLIAMS.

**Green Turtle**: a large sea turtle (*Chelone midas*), probably so called from the brownish-olive color of the upper parts. The head is small, the feet, as in other marine turtles, modified into flippers. It is found in the tropical or warm seas of both hemispheres, and is particularly abundant in the West Indies and at Ascension island. The green turtle attains a weight of from 300 to 500 lb., but those of this weight are not common. The females seek the shore at night in the West Indies from April to June, for the purpose of depositing their eggs in the sand above high-water, where they are left to be hatched by the sun. The animal feeds on seaweed, and the flesh, which is palatable, is the basis of the well-known turtle soup. Green turtles are brought to market in large numbers, and, as they live for a considerable time without food, are readily transported from Ascension or the West Indies to England. The Pacific green turtle has been called a distinct species (*Chelone virgata*), and two others are credited to Australasia, but it is doubtful if these are valid. See TESTUDINATA and TURTLE-FISHERY. F. A. LUCAS.

**Greenville**: city; capital of Butler co., Ala. (for location of county, see map of Alabama, ref. 6–D); on the Louisville and Nashville Railroad; 45 miles S. S. W. of Montgomery. It has a large trade in cotton and lumber; sawmills, cotton-gins, a cedar-factory, an ice-factory; South Alabama Female Institute (Baptist), public-school building, street railway, improved system of water-works, and a weekly newspaper. Pop. (1880) 2,471; (1890) 2,806; (1900) 3,162.
EDITOR OF "ADVOCATE."

**Greenville**: city; capital of Bond co., Ill. (for location of county, see map of Illinois, ref. 8–D); on the East Fork of Big Shoal creek, and on the Jackson Southeastern and the Vandalia Railways; 50 miles E. N. E. of St. Louis. It is in a corn and wheat growing region, has extensive coal mines, and contains Greenville College for ladies, several banks, and two weekly newspapers. Pop. (1880) 1,886; (1890) 1,868; (1900) 2,504. EDITOR OF "ADVOCATE."

**Greenville**: city; Montcalm co., Mich. (for location of county, see map of Michigan, ref. 6–I); on the Flat river and on the Det., Lans. and North., and the Tol., Sag. and Musk. Railways; 28 miles N. E. of Grand Rapids, 59 miles N. W. of Lansing. It has excellent water-power, Flat river being dammed at two points within the city limits, large flouring-mills, several sawmills and planing-mills, woolen-mill, machine-shops, tannery, shingle-mills, public library, and 1 daily and 3 weekly newspapers. It is surrounded by a good farming country, and is a base of supplies for the Flat river lumbering. Pop. (1880) 3,144; (1890) 3,056; (1900) 3,381.

**Greenville**: town; capital of Washington co., Miss. (for location of county, see map of Mississippi, ref. 6–E); on the Mississippi river and on the Richmond and Danville and the Yazoo and Miss. Valley Railroads; 100 miles N. N. W. of Jackson. It is the center of a large cotton-trade, and has 2 compresses and 2 oil-mills, saw and planing mills, handsome new court-house, excellent public schools, and 3 weekly newspapers. Pop. (1880) 2,191; (1890) 6,658; (1900) 7,642. EDITOR OF "TIMES."

**Greenville**: town; capital of Pitt co., N. C. (for location of county, see map of North Carolina, ref. 3–I); on the Tar river and on the Wilmington and Weldon Railroad; 90 miles E. by W. of Raleigh. It is in a region particularly adapted to cotton, tobacco, peanuts, grains of all kinds, vegetables, and fruit; contains 5 churches for white people and 4 for colored, an academy for boys, school for girls, 2 schools for both sexes, and 2 for colored children; and has 2 tobacco warehouses, machine-shops, foundries, carriage-factories, lumber-mills, and paint factory. Pop. (1880) 912; (1890) 1,937; (1900) 2,565.
EDITOR OF "EASTERN REFLECTOR."

**Greenville**: city; capital of Darke co., O. (for location of county, see map of Ohio, ref. 5–C); on Greenville creek and on the Cin., Jack. and Mack., the Dayton and Union, and the Pitts., Cin., Chi. and St. L. Railways; 35 miles N. W. of Dayton. It is in an agricultural region; has 11 churches, 2 public schools, Roman Catholic school, improved system of water-works, natural-gas plant supplied from wells in Mercer County, 18 miles N., and 1 daily, 1 monthly, and 7 weekly periodicals. Gen. Wayne built a fort on the site of Greenville in 1793, and signed a treaty with the Indians there Aug. 3, 1795. Pop. (1880) 3,535; (1890) 5,473; (1900) 5,501. EDITOR OF "TRIBUNE."

**Greenville**: borough; Mercer co., Pa. (for location of county, see map of Pennsylvania, ref. 3–A); on both sides of the Shenango river, which affords abundant water-power, and on the Erie, the Penn., and the Pitts., Shen. and L. E. Railways; 85 miles N. of Pittsburg. It is at the head of the fertile Shenango valley; has several coal mines, iron-foundries, rolling-mills, woolen-mills, and minor manufactories, and is the seat of Thiel College, organized under the auspices of the Evangelical Lutheran Church in 1870. Pop. (1880) 3,007; (1890) 3,674; (1900) 4,814.

**Greenville**: city; capital of Greenville co., S. C. (for location of county, see map of South Carolina, ref. 4–C); on the Car., Knox. and W., the Port Royal and W. Car., and the Richmond and Danville Railways; 141 miles N. W. of Columbia, 158 miles E. N. E. of Atlanta, Ga. It is the seat of Furman University and Greenville Female College, and, besides, has a good system of public schools. The U. S. court meets semi-annually in Greenville. The city is a great manufacturing center, has a large carriage and wagon manufactory, cotton-mills, etc., fine U. S. and county court-houses, opera-house, and street railway; is a popular summer resort, and handles over 20,000 bales of cotton annually. Pop. (1880) 6,160; (1890) 8,607; (1900) 11,860. EDITOR OF "BAPTIST COURIER."

**Greenville**: town; capital of Hunt co., Tex. (for location of county, see map of Texas, ref. 2–I); on the St. L., So. West., the Sher., Shrev. and So., and the Mo., Kan. and Tex. Railways; 50 miles N. E. of Dallas. It is in an agricultural region and has a large shipping-trade and several manufactures. Pop. (1890) 4,330; (1900) 6,860.

**Greenway**, THOMAS: Premier of Manitoba; b. in Cornwall, England, in 1838; removed to Canada in 1844. He represented South Huron in the Dominion Parliament 1875–78; was elected to the Manitoba Legislature in 1880, and has been returned at each successive election. In Jan., 1888, he was called upon to form an administration, which he did, and took the offices of President of the Council and Minister of Agriculture. NEIL MACDONALD.

**Greenwich**, grin'idj: parliamentary borough of England; in the counties of Kent and Surrey; on the right bank of the Thames (see map of England, ref. 12–J). It contains several establishments for the building of iron steamers and the manufacture of machinery. The two objects of greatest interest, however, are the Royal Observatory (see OBSERVATORY), in the fine park, from which the longitude is reckoned on all British charts, and the Royal Naval College, formerly known as the Greenwich Hospital, a splendid range of buildings. Behind the college is the Royal Hospital School, in which sons of petty officers and seamen are boarded. Among charitable institutions are the Norfolk or Trinity College, the Greencoat and Bluecoat schools, and the Jubilee almshouses. One member is sent to Parliament. Pop. (1901) 95,757.

**Greenwich**: town and borough (founded in 1640); Fairfield co., Conn. (for location, see map of Connecticut, ref. 13–C); on Long Island Sound and the N. Y., N. H. and Hartford Railroad; 27 miles W. S. W. of Bridgeport, 28 miles N. E. of New York. It is a popular summer resort, and many New York business men have country residences here. Gen. Putnam's daring horseback ride in 1779 took place at Horseneck in this town. Pop. (1880) 7,892; (1890) 10,131; (1900) 12,172: borough (1900) 2,420.

**Greenwood**, FRANCIS WILLIAM PITT, D. D.: Unitarian minister; b. in Boston, Mass., Feb. 5, 1797; brought up under the religious care and teaching of Dr. James Freeman, and on graduating at Harvard in 1814 studied theology with Dr. Henry Ware, Hollis professor in Cambridge. He began his ministry at the New South church in Boston in 1818, but remained in it but a single year, a pulmonary attack forcing him to resign. The year of 1820–21 was passed abroad, chiefly in Devonshire, England. Two years were passed in Baltimore, where he edited *The Unitarian Miscellany*. In 1824 he accepted an invitation to become colleague pastor with Dr. Freeman, of King's chapel, and in 1827 became sole pastor. In 1837 an attack of hæmorrhage compelled him to make a voyage to Cuba, and his strength was never restored. D. in Dorchester, Mass., Aug. 2, 1843. Dr. Greenwood had a strong love for the natural sciences, and was one of the earliest members of the Boston Society of Natural History. He was a frequent writer for the Unitarian magazines and a contributor to *The North American Review* and *The Journal of Natural History*. He wrote *Sermons of Consolation* (Boston, 1842); *Sermons to Children*

(1841); *Lives of the Twelve Apostles* (1827), less known; and *History of King's Chapel* (1833). Two volumes of sermons, with a memoir by S. A. Eliot, were published in 1844, and a volume of *Miscellanies*, edited by his son, in 1846.

**Greer**, David Hummell: See the Appendix.

**Greer**, James Augustin: rear-admiral U. S. navy; b. in Cincinnati, O., Feb. 28, 1833; entered the navy as a midshipman Jan. 10, 1848. He commanded the Benton at the passage of the Vicksburg batteries on the night of Apr. 16, 1863; in the five hours' heavy engagement with the Grand Gulf batteries on Apr. 27 of the same year; and in the operations on the Mississippi river until the fall of Vicksburg, July 4, 1863. In many of the engagements the Benton carried the flag of Rear-Admiral Porter, which made her a conspicuous target; in 1873 he was chosen to command the Tigress in the search for the missing Polaris. From May 29, 1891, until his retirement, Feb., 1895, Admiral Greer was chairman of the lighthouse board.

**Greg**, William Rathbone: author; b. at Manchester, England, in 1809. He was educated at Edinburgh University; engaged in business and was appointed commissioner of customs in 1856 and controller of the Stationery Office in 1864. Among his publications, which are chiefly on economic and social topics, are *The Creed of Christendom* (1851); *Literary and Social Judgments* (1869); *Enigmas of Life* (1872); *Rocks Ahead* (1874). A posthumous volume of *Miscellaneous Essays* was published in 1884. D. Nov. 15, 1881. Henry A. Beers.

**Gregarin'ida** [Mod. Lat. deriv. of Lat. *grex, gregis*, herd; so called in allusion to the large numbers frequently found together]: a sub-class of *Protozoa* (class *Sporozoa*), the members of which live as internal parasites in other animals, mostly in annelids and arthropods. The single cell which makes up each of these animals is covered with a tough cell-wall, and external organs of locomotion are lacking. There is sometimes a hook-like means of attachment by which the parasite becomes fastened to the host. In some the cell is simple (*Monocystidea*), in others there is a partition cutting off a small anterior "head" (*Septata*). Nourishment is taken by absorption through the body-walls, and the small amount of locomotion is effected by slow contractions of the body. Two or more gregarines conjugate, joining themselves end to end. They then contract, surround themselves with a common coat or cyst, inside of which the cell protoplasm breaks up into a mass of spore-like bodies which change to spindle-like pseudo-navicellæ (so called from their resemblance to the diatom *Navicella*) or into rod-like spores. These develop amœba-like larvæ, which in turn change into the adult. Allied to the gregarines are the ovoid *Coccidia*, which occur in the intestinal epithelia and gall-duct of various vertebrates, including man. J. S. Kingsley.

**Gregg**, David McMurtrie: general; b. in Huntingdon, Pa., Apr. 10, 1833; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of dragoons July, 1855, receiving his full appointment as second lieutenant in September following. After serving a brief time in Jefferson barracks, Mo., Gregg was ordered to New Mexico, and thence to California, marching there with his command, and continued on frontier duty against hostile Indians, being engaged in numerous actions, up to the outbreak of the civil war. In Mar., 1861, he was promoted to be first lieutenant, and in May following captain Sixth Cavalry. In Jan., 1862, he was appointed colonel Eighth Pennsylvania Cavalry, which command he led in the Virginia Peninsular campaign (1862), being engaged at Fair Oaks, Seven Pines, and the "Seven Days'" fight. Appointed brigadier-general U. S. volunteers Nov., 1862, he commanded a division of cavalry in the Rappahannock campaign in the raid toward Richmond under Gen. Stoneman; participated in the battle of Gettysburg and subsequent pursuit of Lee's army. In Gen. Grant's Richmond campaign (1864–65) he was actively engaged, and in command of the cavalry corps of that army from Aug., 1864, till Feb., 1865, when he resigned from the army, and was breveted major-general of volunteers for highly meritorious conduct. He was U. S. consul at Prague, Feb.–June, 1874, and became commander of the Pennsylvania order of the Loyal Legion in 1886.

**Gregg**, John Irvin: general; b. in Bellefonte, Pa., July 19, 1826; entered the U. S. army as first lieutenant Eleventh Infantry 1847; promoted to be captain, and served during the Mexican war; discharged Aug., 1848. On the outbreak of the civil war he was chosen colonel of the Fifth Pennsylvania Volunteers, which commission he resigned May, 1861, to accept a captaincy in the Sixth U. S. Cavalry; was engaged in various actions in the Virginia Peninsular campaign 1862; appointed colonel Sixteenth Pennsylvania Volunteers Oct., 1862, and in command of a cavalry brigade 1863–65, during which time he was engaged in the battles of Gettysburg, Cold Harbor, Deep Bottom (wounded), and the various actions of the Army of the Potomac up to the final surrender of Lee. Three days prior he was taken prisoner, and held till the surrender. He was breveted major, lieutenant-colonel, colonel, and brigadier-general U. S. army, and major-general of volunteers; promoted to be colonel Eighth U. S. Cavalry July, 1866. Retired Apr. 2, 1879. D. in Washington, D. C., Jan. 6, 1892.

**Gregg**, Maxcy: general C. S. army; b. at Columbia, S. C., 1814; studied law, and was admitted to the bar in 1839; obtained prominence in his profession; in the war with Mexico served as major Twelfth Infantry; was a member of the South Carolina State convention in 1860, and of the committee which was appointed to prepare the ordinance of secession. In the civil war he commanded the First Regiment of South Carolina Volunteers, which on the expiration of its term of service he reorganized and continued to command; subsequently was made brigadier-general, and was constantly and conspicuously in service. He was killed at the battle of Fredericksburg, Va., Dec. 13, 1862.

**Gregg**, William, D. D.: a minister and scholar of the Presbyterian Church of Canada; b. at Killycreen, near Ramelton, County Donegal, Ireland, July 5, 1817. After some years spent in business, he studied for the ministry at Glasgow College, Edinburgh College, and New College, Edinburgh. In 1846 he was sent by the Free Church as a missionary to Canada. He was minister at Belleville 1847–57, and at Cooke's church, Toronto, 1857–72. He was lecturer in Knox College from 1864, and in Montreal College from 1867. In 1872, he became Professor of Apologetics in Knox College, also teaching classes in Church History and in Mathematics. In 1890 at his own request, he was relieved from the work in apologetics. He edited *Book of Passages for Family Worship* (Toronto, 1878; 3d ed. 1885), and wrote *History of Presbyterian Church in Canada from the Earliest Times to 1834*, with sketch of subsequent leading events (1885), and *Short History of the Presbyterian Church in the Dominion of Canada* (1892).

Willis J. Beecher.

**Grégoire**, grā'gwăär', Henri: Bishop of Blois, prominent in the French Revolution; b. Dec. 4, 1750; studied for the priesthood and became curé of Embermesnil, whence he was chosen in 1789 to represent the Lorraine clergy in the States-General. He had already achieved a reputation for liberality of view in his *Essai sur la Régénération physique et morale des Juifs* (1788), which was crowned by the Academy at Metz, and in the States-General he at once allied himself to the third estate, taking an active part in bringing the clergy into union with that order. In the National Assembly he advocated the abolition of the privileges of the nobility, and supported the civil constitution of the clergy, under which he was afterward appointed bishop. He was a member of the Convention, where he was foremost in calling for the abolition of the kingship, supporting the motion by a speech in which occurred the famous sentence, "The history of kings is the martyrology of nations"; but while favoring the condemnation of Louis, he opposed the imposition of the death penalty. As member of the committee of public instruction under the Convention, he opposed the vandalism of the times, favored artists and men of letters, and promoted the education of the people. Though a fanatic, he was singularly free from religious intolerance, sparing no pains to secure for the Jews an admission to civil rights, and asserting in the face of the uncompromising worshipers of reason like Hébert the right of himself and others to liberty of conscience. The abolition of African slavery in the colonies by the Convention was due chiefly to his efforts. He was a member of the Council of Five Hundred, of the Corps Législatif, and in Dec., 1801, was elected to the senate, where he was one of the few who dared to oppose the proclamation of the empire. Although created a count of the empire, and an officer of the Legion of Honor, he continued in the opposition till Napoleon's downfall. Under Louis XVIII. he was dismissed from the Institute and his pension as ex-senator was suspended, but disgust with ultramontanism at length

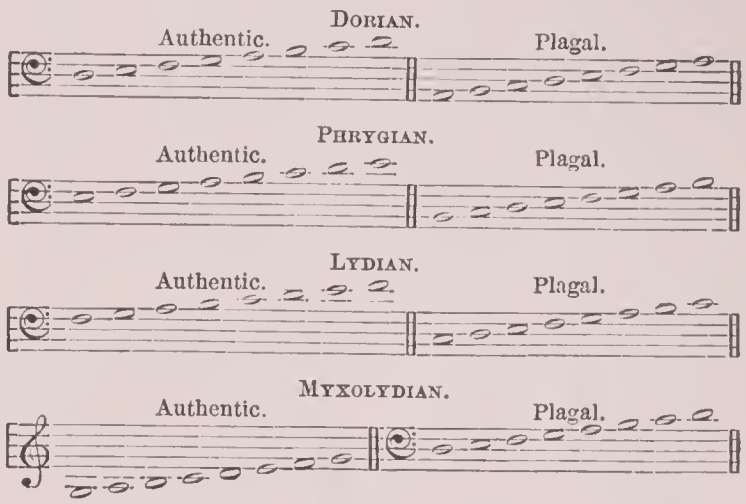
led to his election as deputy from the department of Isère. This scandalized both liberals and ultra-royalists, and his election was annulled 1819. The last years of his life were spent in retirement, and devoted to literary work. D. at Paris, May 28, 1831. The last offices of the Church were denied him by the ecclesiastical authorities, who refused him the rites of Christian burial; but by permission of the Government mass was said over his body at the Abbaye aux Bois by a proscribed priest. Among his writings are *Essai historique sur les libertés de l'église gallicane* (1818); *De l'influence du Christianisme sur la condition des femmes* (1821); *Histoires des confesseurs, des empereurs, des rois, et d'autres princes* (1824); and *Histoire du mariage des prêtres en France* (1826). F. M. Colby.

**Greg'oras Niceph'orus**: author; b. at Heraclea, in Pontus, probably in 1295; became a priest in Constantinople; went in 1326 as ambassador to the kral (the King of Servia); proposed the reform of the calendar in a treatise (*Paschalium correctum*) still extant, and highly prized for its scientific accuracy; lost his estate on the accession of Andronicus III. (1328); pronounced the eloquent funeral oration of Andronicus I., 1332; opposed Barlaam's theories and Pope John XXII.'s plan of uniting the Eastern and Western Churches; and late in life was involved in serious troubles arising from the new doctrines taught by Barlaam. He was alive in 1359, but the time of his death is not known. He was the author of many treatises on many subjects, but the most important of his works is the *History of the Byzantine Empire* (1204–1359), written in a very diffuse style and in a strongly partisan spirit, but valued for the great number of facts it preserves. Some of his works have been printed.

**Gregorian Calendar**: See Calendar.

**Gregorian Music**: the customary designation of the ancient music of the Church as regulated and improved by St. Gregory the Great, Bishop of Rome, in the latter part of the sixth century and the beginning of the seventh. Information relative to the music of St. Gregory's times is not only scanty, but obscure and perplexing. The art was then in its infancy. Melody existed only in a rude and vague inflection of the voice through the range of a few intervals, while harmony was utterly undeveloped, and probably was confined to an irregular and unsystematic use of the octave, fifth, and third as occasion served. The ancients had no accurate and intelligible system of notation; and for that reason the fragments of their music extant are difficult to interpret. It has been thought by some that in the early days of the Church the Hebrew chant was brought in by the numerous Jewish converts, and that it became the basis or ruling form of the Church's songs. It is more probable, however, that, as the Church spread far and wide among other races and nations, this element gave way to the adoption of the musical system of the Greeks, as having more affinity with the languages of the Christian liturgies and the musical habits of a people largely composed of Gentiles. Whatever the system was, Jewish, Greek, or a blending of both, it is certain that St. Ambrose, Bishop of Milan in the fourth century, found it in so confused and disorderly a condition as to render his interference desirable in the capacity of a musical reformer. Ambrose appears to have entered upon this work with energy and good judgment, and soon molded into a more consistent shape the various and conflicting forms which music had assumed in the Church. In doing this he retained and made use of the four original Greek modes or scales—viz., the Dorian, or scale of D, the Phrygian, or scale of E, the Lydian, or scale of F, and the Myxolydian, or scale of G (all formed of the natural notes as they stand, without flats or sharps). These were known as the *authentic* modes, and the chant or ritual-song of the Church was based upon or composed of the elements forming these scales. The ecclesiastical music thus purified and systematized in the Church of Milan obtained the name of the "Ambrosian" chant, and was soon brought into extensive use.

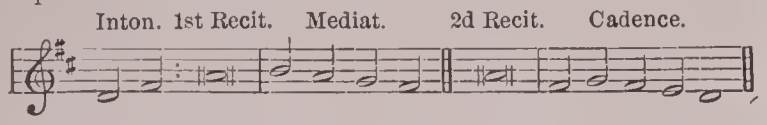
Two centuries later St. Gregory, who then occupied the papal throne, entered upon a further reform in the music of the Church. The simplicity and plainness of the Ambrosian chants had been overlaid in the course of time with embellishments of too frivolous, ambitious, and fanciful a character to be congruous with the solemnity of divine worship. These innovations were promptly denounced by St. Gregory, who had little sympathy with the promoters of what was called figured song, or with the early experimenters in the florid style. He also collected and arranged in a methodical form such fragments of psalmody and ecclesiastical hymns as had been approved by former bishops in whose judgment he could confide. But the greatest improvement made by Gregory, or under his auspices, was the addition of four new modes or scales to those already in use. The old modes—viz., the Dorian, Phrygian, Lydian, and Myxolydian—were called the authentic modes, as already stated; and those now derived from or added to them received the name of *plagal*, relative, or collateral. Each plagal scale was formed by commencing on *the fourth degree below the lowest note* of the corresponding authentic. Thus as the first authentic mode or scale consisted of D, E, F, G, A, B, C, and D, the octave, its plagal mode would be formed of A, B, C, D, E, F, G, and A. The three other authentic modes were in like manner attended by their respective plagal derivatives—the fourth note of the plagal always corresponding with the first note of the authentic, thus:




These modes, composed of the natural intervals of the diatonic scale, without reference to the position of whole tones and semitones, are (with one exception) more or less imperfect, being neither major nor minor, but each having its own distinctive character as the result, indeed, of that imperfection. Thus the Dorian has neither F♯ and C♯ to render it a true *major* scale, nor B♭ to form the true *minor*. Melodies, therefore, written on such scales differ considerably in their fitness to express various shades of feeling and sentiment. The Phrygian, e. g., so far resembles the modern minor mode as to possess a certain plaintive and mournful character; the Dorian, though strongly minor in its general cast, is expressive of dignity, grandeur, and solemnity; the Myxolydian, closely approaching our G major, suggests peace, serenity, and joy; while the Lydian, with its irregular fourth occasionally corrected, has the gentle and soothing tranquillity of many modern pieces in F major. These various qualities may, however, be in part attributed to other causes. It has been thought very probable by several modern writers "that as these modes have their names from some Grecian nations, part of the very great effects ascribed to them may have depended on the particular melodies of those nations and their rhythms, more than on the mode in which they were composed; in the same manner as still the national dance-tunes of different countries—e. g. a Scotch reel, a polonaise, a Siciliano, etc.—are strongly characteristic merely by their rhythms." *Kollmann.*

The music of the Church, as thus modified and settled by St. Gregory, came into general use in the Western Church, and is commonly known as the "Gregorian." In each of the modes, scales, or gamuts (to which another has been added, under the name of irregular or peregrine) short chants or melodies for the psalms were prepared. These are commonly styled Gregorian *tones*, and are distinguished or spoken of as the first, second, or third tone, etc. These psalm-chants consist of two strains each; and the latter of these strains frequently has several terminations, called "endings." Of these endings, the first tone has six; the third tone, four; the fourth tone, four; the fifth tone, two; the seventh tone, six; and the eighth tone, two; while the second and sixth tones have each only one ending. Hence in designating a psalm-chant it is customary to say, e. g., "First tone, third ending," etc. In each of these tones or chants a certain note called the *dominant* is more frequently used than the others, and is the reciting note in chanting. Preceding the dominant are two or more short intro-

ductory notes called the *intonation*, to be sung by the minister or precentor with the first division of the first verse of a psalm or hymn. The other portions of each strain are the *recitation*, *mediation*, and *cadence*, as in the following example:




Gregorian music is still frequently written or printed in ancient character on the old stave of only four lines. Two clefs are used—viz., the F and the C. These are not permanently fixed on certain lines, like the clefs of modern music, but are placed on such lines as will bring the notes of the melody within the compass of the stave, and thus avoid the resort to ledger lines. The notes in use are chiefly three: 1, the long, a black square (or oblong figure) with a stem; 2, the breve, a black square without a stem; 3, the semibreve, a black diamond-shaped note. These notes do not express exact measures of duration, as the ratios of 4, 2, and 1, but are very much dependent for their times on the sentiment and accent of the words sung. In most cases they are simply signs to express in an indefinite way the relations of long, shorter, and shortest. From this it will be readily understood that *rhythm* (as now understood) has no place in Gregorian music. There is no division into bars or measures; nor can music of this kind be brought, without great difficulty, within the limits and form of any regular musical movement.

In an adapted form the psalm-chants or tones (with some other music of the Gregorian school) are in common use in the Anglican Church, modernized, however, so much by the addition of harmony and more or less of rhythmical order, as to be recognizable only by the crudeness of their melodic phrases and the quaintness of not a few of their cadences. Revised by DUDLEY BUCK.

**Gregoro'vius**, FERDINAND ADOLF: poet and historian; b. at Neidenburg, in East Prussia, Jan. 19, 1821; studied theology and philosophy at the University of Königsberg 1838; and began his public career as a literary critic with the romance *Werdomar und Wladislaw, aus der Wüste der Romantik* (1845), and *Goethe's Wilhelm Meister in seinen socialistichen Elementen* (1849). In 1848 and 1849 he published two minor works, reflecting his sympathy for Poland —*Die Idee des Polenthums* and *Polen- und Magyarenlieder*; and in 1851 his tragedy, *Der Tod des Tiberius*, and his first historical work, *Geschichte des Römischen Kaisers Hadrian und seiner Zeit.* In 1852 he went to Italy, of whose history, literature, and political and social circumstances he made a comprehensive and penetrating study, and on which he wrote several works of great merit—*Corsica* (2 vols., 1854); *Wanderjahre in Italien*, a collection of several minor works (4 vols., 1874); *Die Grabmäler der Römischen Päpste* (1857). His most important works are *Geschichte der Stadt Rom im Mittelalter* (8 vols., 1859–72); *Geschichte der Lucrezia Borgia* (2 vols., 1874); *Kleine Schriften zur Geschichte und Cultur* (2 vols., 1887–88); *Geschichte der Stadt Athen im Mittelalter* (1889). Worth noting also are his brief epic *Euphorion* (1858), and his translation of the poems of Giovanni Meli (1856). D. in Munich, May 1, 1891.
Revised by A. R. MARSH.

**Gregory**: the name of several of the popes. GREGORY I.: a saint and doctor of the Roman Catholic Church, called Gregory the Great; a great-grandson of Pope Felix II.; b. at Rome about 540; became a senator, and in 573 a prætor, and soon after entered a monastery and devoted his great wealth to the founding of religious establishments; went as nuncio to Constantinople, and reconciled the emperor to the pope, and in 590 became pope himself; sent missionaries to Sicily, Sardinia, Lombardy, England, etc.; attempted the union of the Eastern and Western Churches; strengthened and reformed the papal see; confirmed the celibacy of the clergy; extended greatly the monastic system; was confirmed in his primacy over the other patriarchs by the Emperor Phocas; and reformed the liturgy. He has been called the father of the mediæval Church. Author of numerous works, of which his *Magna Moralia*, his *Homilies*, his *Book of Pastoral Rule*, and the liturgical treatises are the most important. The best edition of his works is that by Dionysius Sammarthanus (Paris, 1705, 4 vols. fol.), reprinted in Migne, *Pat. Lat.* lxxv.–lxxvi. There is a partial edition of the *Letters*, by P. Ewald (Berlin, 1887). See Chevalier, *Répértoire des sources historiques du Moyen Âge*, for the literature; also Snow, *St. Gregory the Great* (London, 1892). D. Mar. 12, 604.—GREGORY II., Saint: a Roman of high birth; became a Benedictine, and in 715 became pope; sent Corbinian and Boniface as missionaries to Germany; assumed the government of Rome in 726, and did much to establish the temporal power of the popes; engaged in a famous contest with Leo the Isaurian and the Iconoclasts, whom he anathematized. D. Feb. 10, 731.—GREGORY III.: a Syrian; became pope in 731; opposed the Iconoclasts and the Byzantine emperors; encouraged the work of St. Boniface in Germany; appealed to Charles Martel for aid against the Saracens and the Lombards. D. Nov. 28, 741.—GREGORY IV.: a Roman; became pope in 827, succeeding Pope Valentine; attempted to reconcile Louis the Pious with his sons; fortified the mouth of the Tiber against the Saracens; made the feast of All Saints a general one. D. Jan. 27, 844.—GREGORY V.: a German, and nephew of King Otho III. His name was Bruno; became pope in 996, when twenty-four years old; was a virtuous and active man; held several important synods; obliged Robert, King of France, to give up his incestuous marriage with Bertha. As to his conduct toward the antipope John XVI., the contemporary chroniclers do not agree, and much of what they say sounds like the exaggeration of popular gossip (see the texts in Watterich, *Vitæ RR. Pontificum*, i., 67–68, and Duchesne, *Liber Pontificalis*, ii., 263). D. Feb. 18, 999.—GREGORY VI., Antipope: assumed the papal title in June, 1012; expelled Benedict VIII., and was himself expelled (Dec. 25, 1012) by the Emperor Henry II.—GREGORY VI. (*Johannes Gratianus*), Pope: arch-priest of the Lateran Church. With the best of intentions he purchased the abdication of the unworthy Benedict IX., but the latter revived his claim, and Sylvester III. and John XX. were also elected (1044); Henry III., the emperor, caused all to be deposed, and Clement II. to be elected, 1046. D. at Cologne in the summer of 1048.—GREGORY VII. (*Hildebrand*): b. at Soana, in Tuscany, probably before 1020; was a carpenter's son; became a monk at Cluny; was called to the priory of St. Paul, *extra muros*, at Rome, and was the chief adviser of Leo IX., who made him cardinal. Hildebrand assumed at once a commanding position in the affairs of Italy and the Church; repressed the interference of the laity and of the emperors in ecclesiastical affairs; punished simony and licentiousness, and stopped the marriage of the clergy; reformed the convents; restrained the progress of Berengarius's doctrine regarding the Eucharist, though the equivocations of the latter made it difficult to convict him of heresy; improved the manner of papal elections so as to prevent bribery (1058); in 1073 succeeded Alexander II. as pope, after which he still more actively engaged in his reforms; forbade in 1074 all marriage and concubinage in the clerical ranks; in 1075 summoned a council at Rome which prohibited all lay investitures, by which the bishops were brought into almost absolute dependence on the imperial or royal power. Thus Gregory, by one of the boldest strokes recorded in history, attempted to cut the Church free from the domination of the German emperors, which a few years before had been absolute and almost unquestioned. Henry IV. thereupon called a diet at Worms, and declared the pope deposed; and in 1076 Gregory retaliated by excommunicating and deposing Henry. The civil war, already brewing in Saxony for other reasons, was carried on with great vigor, and the pope was obliged to look for help to the Normans. Henry, everywhere overcome, humiliated himself to the earth, and received the papal absolution at Canossa (1077). But when the emperor had recovered sufficient strength, he besieged Rome and shut up the pope in the Castle of St. Angelo, whence he was released by Robert Guiscard; and Gregory, having for the fourth time excommunicated the emperor, retired to Salerno, where he died May 25, 1085. Gregory invented nothing new. He only took up and applied in all their logical consequences principles and views familiar to the Catholic world of the Middle Ages (see Lavisse-Rambaud, *Histoire Générale*, vol. ii., 1893). He was a man of excellent abilities. In its bearing on the destinies of Europe no pontificate was more important than that of Gregory. (See Voigt, *Hildebrand*, 1846, 2d ed.) Roman Catholic writers look on Gregory VII. as the liberator of the ecclesiastical authority from the usurped control of the civil power, and the restorer of the Church discipline to its former rigor and efficiency. (See O. Delarc, *Vie de Grégoire VII.*, 2 vols., Paris, 1891.)—GREGORY VIII., Antipope (*Maurice Bourdin*): a Frenchman, Bishop of Coimbra, Archbishop of Braga 1110; became papal legate to Henry V. of Germany 1111; was chosen by the emperor in

1118 as pope in opposition to Gelasius II., but was imprisoned, and died at Fumona in 1122.—Gregory VIII., Pope (*Alberto de Mora*): b. at Benevento; became a cardinal in 1135; as papal legate absolved Henry II. for the murder of Becket 1172; elected pope Oct. 21, 1187. D. at Pisa, Dec. 17, 1187.—Gregory IX. (*Count Ugolino*, of Legni): a relative of Innocent III., succeeded Honorius III. Mar. 20, 1227. His reign is remarkable for the long politico-religious struggle with Frederick II. of Germany, whom he four times excommunicated. His *Decretals*, published in 1234, are the basis of the canon law of the Roman Catholic Church. D. Aug. 21, 1241.—Gregory X. (*Tebaldo Visconti*, of Piacenza): chosen pope in 1271; promoted the crusades; convened the Council of Lyons (1274), and reformed the conclave. D. at Arezzo, Jan. 10, 1276.—Gregory XI. (*Pierre Roger de Montroux*): b. at Maumont, Limoges, in 1329, of a noble family; became cardinal in 1348, and pope at Avignon Dec. 30, 1370; removed to Rome in 1377. His death was the immediate cause of the Western schism. D. Mar. 28, 1378.—Gregory XII. (*Angelo Cornaro*): b. at Venice about 1325; became a cardinal-priest 1405; was elected pope, in opposition to Benedict XIII., Nov. 30, 1406; deposed by the Council of Pisa 1409; abdicated his claim at the Council of Constance 1415, and held the office of Cardinal-Bishop of Porto till his death Oct. 18, 1417.—Gregory XIII. (*Ugo Buoncompagno*): b. at Bologna, Feb. 7, 1502; was a learned doctor of the university, and instructed Alexander Farnese, St. Charles Borromeo, and other eminent men in the law; became cardinal-priest in 1565; succeeded Pius V. May 13, 1572. The great events of this pontificate were the reform of the calendar, the *Te Deum* sung and medal struck on the occasion of the massacre of St. Bartholomew, the efforts made to spread the Church by missionary operations, and the publication of a new edition of the *Decretum Gratiani*. D. Apr. 10, 1585.—Gregory XIV. (*Niccolò Sfondrate*): b. at Cremona, 1535; became a cardinal 1583; succeeded Urban VII. Dec. 5, 1590. D. Oct. 15, 1591.—Gregory XV. (*Alessandro Ludovisio*): b. at Bologna, Jan. 9, 1554; became a cardinal in 1616; succeeded Paul V. Feb. 9, 1621; reformed the conclave 1621; established the Propaganda 1622; and zealously pushed forward the missionary work. D. July 8, 1623.—Gregory XVI. (*Mauro Capellari*): b. at Belluno, Sept. 18, 1765; became in 1814 vicar-general of the Camaldules; cardinal-priest and prefect of the Propaganda 1826; succeeded Pius VIII. Feb. 2, 1831. D. at Rome, June 1, 1846.

Revised by J. J. Keane.

**Gregory**, Caspar René, Ph. D.: expert in biblical text-criticism; b. in Philadelphia, Pa., Nov. 6, 1846; graduated from the University of Pennsylvania (1864) and from Princeton Theological Seminary (1870), taking the degree of Ph. D. at Leipzig in 1876. He was pastor of the American chapel at Leipzig 1878–79, privat docent in the University of Leipzig from 1884, and honorary ordinary professor in that university from 1890. He assisted Dr. Charles Hodge in the publication of his *Systematic Theology* (1870–73), himself preparing the important separate index volume. He had charge of the bibliographical department of Schürer and Harnack's *Theologische Literaturzeitung* (1876–84). He published a translation of Luthardt's *St. John the Author of the Fourth Gospel* (Edinburgh, 1875; 2d ed. 1885), adding a critical account of the literature of the subject. He also translated Luthardt's *Commentary on St. John's Gospel* (1876–78). Besides important articles and pamphlets, notably on Tischendorf (1875) and *Les Cahiers des Manuscrits Grecs* (Paris, 1885), he is the author of the *Prolegomena* to Tischendorf's *Editio Octava Critica Major* of the New Testament, of which part i. appeared in 1884, part ii. in 1890, and part iii. in 1893. In these prolegomena he gives a description, from personal observation, of all the uncial MSS. of the New Testament. Willis J. Beecher.

**Gregory**, Daniel Seely: See the Appendix.

**Gregory**, Edward John: portrait and genre painter; b. at Southampton, England, in 1850; pupil of Southampton and South Kensington Art Schools; member British Institute of Water-color Painters; associate Royal Academy, London; second-class medal, Paris Exposition, 1889; and first-class medal for water-colors. Among his principal works are *A Rehearsal* (1882); *The Swans of the Thames*; and *In Scotland*. Studio at Cookham Dean, Berkshire, England.

**Gregory**, James, F. R. S.: mathematician; b. at Drumoak, Aberdeenshire, Scotland, in Nov., 1638; studied at Marischal College, Aberdeen: invented the Gregorian reflecting telescope (see Telescope) when twenty-four years old; published *Optica Promota* in 1663; studied at Padua, and while there published *Vera Circuli et Hyperbolæ Quadratura* (1667); *Geometriæ Pars Universalis* (1668); and *Exercitationes Geometricæ* (1668); was Professor of Mathematics at St. Andrews 1668–74, and at Edinburgh 1674–75, where he died Oct., 1675. He was the inventor of many important mathematical processes.—His grandson, Prof. John Gregory, M. D. (1724–73), was a brilliant author; and Prof. James Gregory, M. D. (1753–1821), son of the latter, was a professional writer of high authority.—David Gregory, M. D., F. R. S. (1661–1708), nephew of the first mentioned, was successively mathematical professor at Edinburgh and Savilian Professor of Astronomy at Oxford. He published able mathematical treatises, and was the friend and associate of Newton.

**Gregory**, Olinthus Gilbert, LL. D.: mathematician and miscellaneous writer; b. at Yaxley, Huntingdonshire, England, Jan. 29, 1774; became in 1798 a bookseller of Cambridge; in 1802 a master, and 1807–38 Professor of Mathematics at the Royal Military Academy, Woolwich. His *Lessons, Astronomical and Philosophical* (London, 1793), was published when he was but nineteen years old. He was also author of several mathematical text-books; *Letters on the Evidences of Christianity* (1810); *Lives* of J. M. Good (1828) and Robert Hall (1832). D. in Woolwich, Feb. 2, 1841.

**Gregory Nazian'zen**, Saint [Gr. Ναζιανζηνός, of or pertaining to Nazianzos]; one of the most eloquent of the Greek Church Fathers, a man of high culture and of great force and versatility of character, whose whole life was one of violent contrasts. His father's name also was Gregory, Bishop of Nazianzus, in Cappadocia. His mother was the saintly Nonna. He was born at Arianzus, a village close to Nazianzus, where his father owned an estate. A sister, Gorgonia, probably was older than he; his brother Cæsarius, afterward an eminent physician at the imperial court, apparently was younger. The dates, many of them, are uncertain, but he was born probably about the year 325, while his father was yet a presbyter. He studied first at Cæsarea, in Cappadocia, where he met Basil, then at Cæsarea in Palestine, and then in Alexandria. For ten or twelve years (ending in 356) he studied in Athens, where Basil and he were again together, and where Julian, afterward emperor, was also pursuing his studies. For two or three years after returning from Athens he lived in monastic retirement with his friend Basil in Pontus. At Christmas, 361, he was ordained presbyter by his father, whom he assisted in the discharge of his episcopal duties. In 372 he was consecrated bishop of the little market-town of Sasima, but apparently never resided there. From 375 to 379 he was in retirement again at Seleucia, in Isauria. Early in 379 he went to Constantinople as the champion of a depressed and persecuted orthodoxy. He was made Bishop of Constantinople by the œcumenical council which met there in 381, but his election was protested against, and he left Constantinople in June of that year. For a while he was occupied with ecclesiastical affairs at Nazianzus and Sasima, but in 383 he retired to his paternal estate in Arianzus, where he died about the year 390. His published works consist mainly of forty-five sermons (or orations), 243 letters, and many poems. The Benedictine edition, vol. i. by Clemencet (Paris, 1778) and vol. ii. by Cailleau (1842), remains the best (reprinted in Migne, *Pat. Gr., xxxv.–xxxviii.*); Eng. trans. in vol. vii. of *Nicene and Post-Nicene Fathers* (New York, 1894). There are monographs by C. Ullmann (Gotha, 1825; 2d ed. 1867), A. Benoit (Paris, 1876; 2d ed. 1885, 2 vols.), and L. Montaut (Paris, 1878). Revised by S. M. Jackson.

**Gregory of Nyssa**, Saint: a younger brother of Basil the Great; b. probably at Cæsarea, in Cappadocia, about the year 335. His father was Basil, an eminent advocate and rhetorician. His mother, Emmelia, and his sister, Macrina, were eminently saintly. A feeble constitution predisposed him to a quiet literary career in his native city, and he was for a time an advocate. In 362 he yielded to the persuasions of Macrina and entered Basil's monastery in Pontus, on the river Iris. In 372 Basil became Metropolitan of Cæsarea, in Cappadocia, and obliged Gregory to become Bishop of Nyssa (now Nirse), an obscure town in Cappadocia. Bitterly persecuted by the Arians, he was deposed and banished in 376, but was restored in 378 to his see, where he died probably about the year 395. He wielded a powerful influence and was favored by the imperial court. He delivered the inaugural address at the Œcumenical Council of Constantinople 381. He was one of the clearest and

strongest champions of the Nicene Creed, but in eschatology was a restorationist. A good critical edition of his works is greatly needed. The best complete edition as yet is that of F. Morel (1638; reprinted in Migne's Series, *Pat. Gr.*, xliv.–xlvi.; Eng. trans., *Selected Writings and Letters*, vol. v. of *Nicene and Post-Nicene Fathers*, New York, 1893). There are monographs, not very satisfactory, by J. Rupp (Leipzig, 1834), E. W. Möller (Halle, 1854), and G. Herrmann (Halle, 1875).

Revised by S. M. Jackson.

**Gregory of Tours** [originally *Georgius Florentius*], Saint: b. at Arverni (now Clermont), chief city of Auvergne, in 538. He was of a noble Roman family, and after his conversion took the name of Gregory out of regard for his mother's grandfather, the Bishop of Langres. About 573 he became Bishop of Tours, and died there Nov. 17, 593 (some say 594). His principal work is *A History of the Franks*, in ten books, which has earned for him the title of "Father of French history." Other works of his are *Miraculorum Libri Duo*, *Liber de Gloria Confessorum*, *Vitæ Patrum*, *De Miraculis S. Martini*, and *Fragmenta Commentarii in Psalmos*. His Latin is full of barbarisms, and his honesty is equaled only by his credulity. The best edition of his works is by Arndt and Krusch (2 vols., Hanover, 1884–85). Of monographs there are, in German, J. W. Löbell (Leipzig, 1839; 2d ed. 1869) and C. G. Kries (Breslau, 1838), and a very learned work by Max Bonnet, *Le Latin de Grégoire de Tours* (Paris, 1890).

Revised by M. Warren.

**Gregory Thaumatur'gus** [Gr., liter., wonder-worker; *θαῦμα*, *θαύματος*, a wonder + *-ουργός*, working], Saint: of heathen parentage, and originally called Theodore; b. at Neocæsarea, Pontus, Asia Minor, about 210 A. D.; when fourteen years of age lost his father, and became a Christian; in 233 fell under the influence of Origen at Cæsarea, in Palestine, and studied with him till 238; was made Bishop of Neocæsarea in 240, when there were only seventeen Christians in the place, and died there in 270, when, as it was said, there were only seventeen persons in the place who were *not* Christians. His biographer, Gregory of Nyssa, relates in a legendary way the miracles (chiefly of exorcism) which he was said to have performed. His principal literary work is *The Oration and Panegyric Addressed to Origen*, whose peculiar theological opinions he labored to establish in Pontus and Cappadocia. He also wrote *A Metaphrase of the Book of Ecclesiastes*, an important *Confession of Faith*, and some other pieces. The best edition of his works is in Migne's *Patrologiæ Græcæ*, vol. x.; there is an English translation by S. D. F. Salmond, *Ante-Nicene Fathers*, vol. xi. (New York, 1888). See his *Life* by Victor Ryssel (Leipzig, 1880).

Revised by S. M. Jackson.

**Gregory the Illuminator** (in Armenian, *Lusavoritch*), Saint: apostle of Armenia, in regard to whom the old authorities are hardly to be trusted. The story is that he belonged to the royal family of the Arsacidæ, who nominally ruled Armenia from 149 B. C. to 428 A. D.; that he was born about 258 A. D.; that his father, Anak, having assassinated the king, Chosroes I., was put to death with all his family except Gregory, who, when two years old, was taken to Cæsarea, in Cappadocia, where he was brought up in the Christian faith, and whence he returned as a missionary to Armenia about 286; that he baptized the king, Tiridates III., in 289; that in 302 Leontius of Cæsarea ordained him Patriarch of the Armenian Church; that in 331 he retired to a cave and lived till 332 A. D. His *Homilies* were published at Constantinople in 1737, and again by the Mechitarists of San Lazaro at Venice in 1837. Many *Prayers* in the Armenian liturgy and thirty *Canons* are also ascribed to him. See *History of Armenia*, by Moses Chorenensis, written about the middle of the fifth century; *Acta Sanctorum*, Sept. viii., pp. 292–413; and Rev. S. C. Malan's *Life and Times of S. Gregory the Illuminator, translated from the Armenian* [of the Vastabed Matthew] (London, 1868).

Revised by S. M. Jackson.

**Greifswald**, grīfs'vält: town of Prussia, in the province of Pomerania; on the Ryk, near its mouth; 25 miles by rail S. E. of Stralsund (see map of German Empire, ref. 2–G). It has a university, especially known for its medical department, and several other educational institutions, large salt-works, iron-foundries, manufactures of soap, oil, leather, and paper, and a shipping trade. Pop. (1890) 21,633.

**Greiz**, grīts: a town of Central Germany; the capital of the principality of Reuss-Greiz; on the White Elster; 47 miles S. S. W. of Leipzig (see map of German Empire, ref. 5–F). It is the residence of the sovereign prince, and has a fine palace surrounded by beautiful gardens. It has considerable manufactures of woolens, cottons, cashmeres, and shawls, and large breweries and distilleries. Pop. (1890) 20,141.

**Grell**, August Eduard: musician; b. in Berlin, Germany, Nov. 6, 1800; studied under Zelter, and early became a fine organist; was director of the Sing-Akademie for over twenty years; and was connected with that institution in various ways for nearly sixty years. His compositions are entirely vocal, and for the most part sacred. They include an oratorio, *Die Israeliten in der Wüste*, a *Te Deum*, psalms in eight and eleven parts, motets, cantatas, and a polyphonic mass in sixteen parts *a capella*, first produced by the Riedelscher Gesangverein in Leipzig about 1884 and afterward at Dresden. It was performed in New York by the Oratorio Society on Mar. 27, 1889. D. Aug. 10, 1886.

D. E. Hervey.

**Grellet**, Stephen (orig. *Étienne de Grellet de Mabillier*): preacher in the Society of Friends; b. of noble parentage at Limoges, France, Nov. 2, 1773; educated in the Roman Catholic faith; became one of the king's body-guard, but escaped sentence of death at the Revolution; emigrated to New York in 1795, and there joined the Society of Friends, and after 1800 made preaching journeys all over the U. S. and Europe. He addressed the Czar of Russia and the pope upon the subject of personal religion. He was also engaged in very successful mercantile pursuits. He died in Burlington, N. J., Nov. 16, 1855. See his biography by Benjamin Seebohm (Philadelphia, 1868).

Samuel Macauley Jackson.

**Grenada**, gre-nā'da (in Spanish, *Granada*): one of the British West Indian islands; the southernmost of the chain on the eastern side of the Caribbean Sea; 68 miles S. of St. Vincent and 96 miles N. N. W. of Trinidad; area, 133 sq. miles (see map of West Indies, ref. 9–M). More than three-fourths of the inhabitants are Negroes or mulattoes, and a large proportion of the whites are of French descent. The surface is mountainous, several peaks exceeding 2,300 feet, and one attaining 2,800 feet. The formation is mainly volcanic, but there is no active or recent crater. Formerly the island was covered with forest, and considerable tracts still remain. The damp and fertile valleys are especially adapted to the cultivation of cacao and nutmegs, which are largely supplanting sugar-cane; small plantations are numerous, and nearly all the Negroes cultivate their own ground; their condition is therefore much better than in most of the other islands. Cacao, nutmegs, and sugar are the principal exports. The climate is temperate and healthful; hurricanes rarely pass so far S. as this island. Pop. (1891) 54,062. Capital and principal town, St. George's (*q. v.*); it has an excellent harbor. Grenada was perhaps seen but not visited by Columbus in 1498. It was settled in 1651 by the French, who conquered the Carib inhabitants after a fierce war. It was taken by the British in 1762, retaken by the French 1779, and ceded to Great Britain by the peace of 1783; several subsequent revolts of the French inhabitants were put down with much bloodshed. Grenada forms part of the British colony of the Windward islands, and is the residence of the governor. Carriacou, the southernmost of the Grenadines (11 sq. miles; pop. 6,000), is attached to it.

Herbert H. Smith.

**Grenada**: town; capital of Grenada co., Miss. (for location of county, see map of Mississippi, ref. 5–G); on the Yallabusha river at the head of navigation, and on the Illinois Central Railroad; 100 miles S. of Memphis, 112 miles N. by E. of Jackson. It is an important business center in a cotton-growing region, and has flour, planing, lumber, and rolling mills, a collegiate institute of the Methodist Episcopal Church South, and a weekly newspaper. Pop. (1880) 1,914; (1890) 2,416; (1900) 2,568.

**Grenade**, grē-nād' [from O. Fr. *grenade*, from Span. *granada*, grenade, a figurative use of *granada*, pomegranate < Lat. *grana'tum*]: a small shell, usually of iron, charged with powder and thrown into a mass of attacking troops by the garrison. They have a straight fuse, and are thrown by hand or rolled into the trench by a wooden trough or spout. When first used they were fired from a musketoon.

**Grenadier'** [= Fr. *grenadier*, deriv. of *grenade*, grenade, formed after analogy of Span. *granadero*, grenadier, deriv. of

*granada*, grenade. The grenadiers at first threw grenades]: in some armies a soldier of the first company of a battalion of foot-troops. Grenadiers are chosen for their tall stature and fine appearance. The first regiment of British foot-guards is called the Grenadier Guards.

**Grenadines**, gren-a-deenz′, or (Span.) **Granadillos**, grăă-năă-deel′yōs: a group of small islands in the West Indies; between St. Vincent and Grenada (see map of West Indies, ref. 8–M). They appear to be the summits of a large submerged island, indicated by the shallow water which lies between them, while they are separated from St. Vincent and Grenada by deep channels. The largest are Becquia, Canauan, Mustique, Union, and Carriacou; the latter is politically attached to Granada, the others to St. Vincent, and all are included in the British colony of the Windward islands. Total area about 55 sq. miles; pop. about 8,000. Carriacou has 6,000 inhabitants, and is in a prosperous condition; most of the other islands are wretchedly poor, and owing to the lack of good watêr some of them are unhealthful. Sugar is the principal agricultural product; cattle and horses are raised on Mustique; and the whale-fisheries are of considerable importance. Admiralty Bay, in Becquia, is one of the best harbors in the West Indies.

**Grenfell**, George: See the Appendix.

**Grenoble**, gre-nō′b'l [Fr. < Lat. *Gratiano'polis*, city of Gratian; Lat. *Gratia'nus*, a proper name + Gr. *πόλις*, city; anc. *Gratianopolis*]: town of France, in the department of Isère, on both sides of the Isère; 59 miles S. E. of Lyons (see map of France, ref. 7–H). The river is crossed by three beautiful bridges. Grenoble is fortified, and celebrated for its manufactures of gloves, hats, hardware, cement, liqueurs, brandies, and perfumes. It is a bishop's see, and contains a cathedral built in the fifteenth century. In the museum is a fine and extensive collection of works of art. The educational institutions include a university and a school of forestry. Pop. (1896) 64,002.

**Grenville**, George: English statesman; b. Oct. 14, 1712; entered Parliament in 1741; treasurer of the navy 1754; was a Secretary of State 1762; First Lord of the Admiralty 1762; First Lord of the Treasury and Chancellor of the Exchequer 1763–65. His administration is noted for the prosecution of Wilkes and the passing of the Stamp Act, which constituted one of the grievances of the American colonies. He was an able statesman, but, according to Whig authorities, was the head of the worst administration Great Britain ever knew, and his imperious temper and excessive ambition made him unpopular even with the Tories. He resigned in 1765. Author of *Considerations on Commerce and Finances* (1767) and other writings. D. Nov. 13, 1770.

**Grenville**, or **Granville**, Sir Richard: a relative of Sir Walter Raleigh; b. in 1540; went in 1556 to fight the Turks in Hungary; entered Parliament, was made high sheriff of Cornwall 1571, and knighted about 1577; assisted Raleigh in planting the Roanoke colony 1585; vice-admiral 1591; attacked a Spanish fleet of 53 vessels with only 6 ships (1591); sunk 4 ships, and after being twice wounded was taken prisoner, and died soon afterward.

**Grenville**, William Wyndham, Lord: statesman; son of George Grenville; b. in England, Oct. 25, 1759; educated at Eton and Oxford; was elected to Parliament in 1783, and in 1789 was chosen Speaker of the House of Commons. He was soon afterward appointed Secretary of State for the Home Department, and in 1790, on being raised to the peerage, took his seat in the House of Lords. Appointed Foreign Secretary in 1791, he supported Pitt's policy toward France, and resigned with him in 1801 when the king opposed the project of Roman Catholic emancipation. In 1806 he was the head of the ministry of "all the talents," which, though inglorious in its military record, will be remembered on account of the act abolishing the slave-trade. The demand of the king that no steps should be taken toward Roman Catholic emancipation caused the resignation of the ministry, and after this Grenville never held office, though he continued to take an active part in politics, generally voting with the Whigs. D. at Dropmore, Buckinghamshire, Jan. 12, 1834. F. M. Colby.

**Gresham**, Walter Quinton: cabinet officer; b. at Corydon, Ind., Mar. 17, 1832; educated at Bloomington University; studied law, was admitted to the bar in 1853, and practiced in his native place; elected to State Legislature 1860. At the outbreak of the civil war he joined the army as lieutenant-colonel of the Thirty-eighth Indiana Regiment; promoted colonel of Fifty-third Regiment Dec., 1863; brigadier-general Aug., 1863; served under Grant at Vicksburg, under Sherman before Atlanta; brevet major-general of volunteers Mar. 15, 1865; mustered out of service Apr. 30, 1866; settled at New Albany; appointed U. S. district judge for Indiana Dec., 1869; Postmaster-General Apr., 1882–84; U. S. judge for the seventh judicial district 1884; Secretary of the Treasury 1884; was a candidate for the Republican nomination for President in 1884 and 1888; declined the nomination tendered by the Populist party 1892; soon afterward identified himself with the Democratic party, and was appointed Secretary of State Mar. 4, 1893. D. May 28, 1895.

**Gresham's Law**: See Currency.

**Gresset**, gres'sā′, Jean Baptiste Louis, de: poet; b. at Amiens, France, Aug. 29, 1709; admitted to the order of Jesuits as novice in his sixteenth year; completed his studies in Paris at the Collège Louis le Grand, and became a teacher. In 1734 he surprised and delighted the literary world by a masterly poem, *Vert-Vert*, which relates in musical verse with charming humor the story of a parrot trained in a convent and sent to another convent as a gift. On his way the parrot fell into bad company, and on his arrival shocked the sisters by evil language. The lines

> Désir de fille est un feu qui dévore,
> Désir de nonne est cent fois pis encore,

gave offense to an influential nun, who managed to have Gresset expelled from his order, whereupon Parisian society opened its doors and he became a social lion. His *Édouard III.* (1740) and *Sidney* (1745) were tedious, but *Le Méchant* (1747) was received with great favor, and in the following year he was admitted to the Academy, of which he afterward became a director. Meanwhile the influence of his early training was making itself felt, and he came to look on his work as sinful. Returning to Amiens in 1748, he renewed his religious affiliations, and ten years later issued an open letter solemnly abjuring the frivolities of his literary career. D. at Amiens, June 15, 1777.

**Gretna**: town (founded in 1835); capital of Jefferson parish, La. (for location of parish, see map of Louisiana, ref. 10–F); on the Mississippi river and the N. O., Ft. J. and Gr. Isle, the S. Pac., and the Tex. and Pac. Railways; directly opposite New Orleans. The principal industry is the manufacture of cotton-seed oil, the town having three of the largest mills in the U. S. There are eight churches, a graded public school for white children, with four departments, known as Gretna Academy, several private schools for white children and one for colored, and a weekly newspaper. The town suffered severely from crevasses in 1868, 1880, 1884, and 1891, though no breaks have ever occurred in front of the town itself. A protective embankment has been built in the rear of the town to insure it against damage from breaks above it. Pop. (1880) 2,396; (1890) 3,332; not returned separately in 1900. Editor of "Courier."

**Gretna Green**: a village in Dumfriesshire, Scotland, near the English border (see map of Scotland, ref. 14–I). It had at one time a curious celebrity. The English law acknowledges the validity of a marriage if it is contracted in accordance with the laws of the country in which it has taken place, while the Scotch law simply demanded that a mutual declaration of marriage should be exchanged in presence of a witness, and thus it became fashionable for young couples in England, to whom it was not convenient to await the consent of their parents, the publication of banns, etc., to run away to Gretna Green, and declare their marriage in the presence of any convenient witness. In 1856 all irregular marriages were rendered invalid unless one of the parties had been residing in Scotland for three weeks previously.

**Greuze**, gröz, Jean Baptiste: painter; b. at Tournus, near Macon, France, in 1725. He showed such talent in drawing in his youth that the painter Grandin offered to teach him portraiture in his study at Lyons gratuitously. He followed this master to Paris, and lived for some time on his slender earnings. His picture of a father reading the Scriptures to his son first attracted attention to his great talents. Being accused of want of correct taste, he went to Rome with Gougenot, in order to improve his coloring and to acquire a nobler style of drawing, but he soon perceived he was losing his own qualities without gaining others more to be desired. He returned to Paris, achieved fresh successes, but his extreme vanity caused a quarrel with the Academy, so that he no longer exhibited at the annual Salon until the

Revolution. He was, however, admitted to the Academy of France in 1769. Many of his works have been engraved. D. at Paris, Mar. 21, 1805. His pictures are to be found in all the public galleries of Europe; there are many in the Louvre, at Montpelier, Versailles, St. Petersburg, London, Cambridge, and Edinburgh. W. J. Stillman.

**Greville**, Charles Cavendish Fulke: author; b. in England, Apr. 2, 1794; educated at Eton and Oxford; on leaving the university was appointed private secretary to Earl Bathurst; and in 1821 became clerk of the council in ordinary, a position which he held for nearly forty years. His fame rests for the most part on his *Journals of the Reigns of George IV. and William IV.*, which ran through many editions, both in Great Britain and America, and is a valuable source of historical information, owing to the author's sincerity and keenness of observation as well as to his exceptional opportunities for the study of his times. D. Jan. 18, 1865.

**Gréville**, Henry: pseudonym of Madame Alice Mary Céleste Durand (born Fleury); author. She was born in Paris, Oct. 12, 1842; educated at home; removed early to St. Petersburg, her father having received an appointment there as professor in French; married M. Durand, who was a professor in the law school, and returned in 1872 to Paris, where she soon after began to publish her sketches of Russian life. Author of *Dosia*, *L'Expiation de Savelli* (1876); *Les Koumiassine*, *Gabrielle*, *Sonia* (1877); *Dournof* (1878); *Le Violon Russe* (1879); *Le Moulin Frappier* (1880); *Perdue* (1881); *Rose Rozier* (1882); *L'Ingénue* (1883); *Un Crime* (1884); *Clairfontaine* (1885); *Cléopâtre*, *Le Comte Xavier*, (1886); *La Fille de Dosia*, *Nicanor*, *Frankley* (1887); *Comédies de paravent*, *La Seconde Mère* (1888); *L'Avenir d'Aline* (1889); *Le Passé*, *Un Mystère* (1890); *Aurette*, *Péril*, *L'Héritière* (1891).

**Grévy**, grā′vĕē′, François Paul Jules: politician; b. at Mont-sous-Vaudrey, in the Jura, France, Aug. 15, 1807; was a student in law when he took an active part in the three days' fight of the Revolution in 1830. During the reign of Louis Philippe he often pleaded in political cases, especially for two friends of Barbés in 1839. Grévy was elected representative to the National Assembly in 1848, and, without acting with the ultra-radicals, still sat on the benches of the Montagne. Under the empire he was elected *bâtonnier*, or president, of the lawyers' corporation of Paris, and was sent as deputy to the Corps Législatif by the department of Jura. He acted there as a moderate republican, which character he maintained after the Revolution of 1870, when he was elected to the National Assembly. Having acted twice as president of the Chamber of Deputies and filled the position with uncommon dignity, firmness, and impartiality, he was elected President of France Jan. 30, 1879. His administration was marked by its conciliatory policy, both at home and abroad, and by the republican simplicity which the chief magistrate assumed in his mode of life and social relations. It was exceedingly popular, and Grévy was re-elected Dec. 28, 1885, but his second administration was unsuccessful. He surrendered himself to the influence of his son-in-law, M. Wilson, who guided the policy of the executive to suit his personal ends and soon involved Grévy in a scandal. The latter, trying to shield his son-in-law, clung to his presidential office until he was forced to resign Dec. 2, 1887, thus closing his political career in circumstances unfortunate for his reputation. D. at Mont-sous-Vaudrey, Sept. 9, 1891.

**Grey**, Charles, Second Earl: statesman; b. at Fallowden, Northumberland, England, Mar. 15, 1764; educated at King's College, Cambridge; entered Parliament as a Whig 1789; was one of the managers of the Hastings trial; was an early friend of parliamentary reform, for which he agitated both in and out of Parliament, and aided in forming the Society of the Friends of the People, whose petitions he presented in the House. He opposed the Irish union 1799; became (as Lord Howick) First Lord of the Admiralty 1806, and succeeded Fox as Secretary of Foreign Affairs in the Grenville cabinet; carried the bill for abolishing the slave-trade 1807; and went out of office on the downfall of the ministry on the question of Roman Catholic emancipation. He took the title of Earl Grey 1807; acted a most honorable part in opposing the persecution of Queen Caroline, but incurred thereby the anger of the king, which prevented his holding office during the king's life; long led the Reform party, and was Premier in 1830–32. Wellington's ministry had fallen on account of its opposition to reform, and when Grey was chosen to form a cabinet he was confronted with the difficult task of securing the passage of a moderate measure in the face of the excessive demands of the Radicals and the unreasonable opposition of the Tories. In the midst of formidable agitation outside of Parliament such a measure was at length carried in the House of Commons, but thrown out in the House of Lords in Oct., 1831. The crisis that followed constitutes one of the most important events in the history of England. For a moment civil war was threatened. Grey demanded the creation of new peers. This was refused and he resigned, but popular pressure was too great and Grey was recalled with authority to create as many peers as he chose. The threat of resorting to such a measure was enough to bring the House of Lords to terms, and the bill was passed June 4, 1832. Grey resigned in July, 1834, and spent the last years of his life in comparative retirement. D. at Howick, July 17, 1845.

Revised by F. M. Colby.

**Grey**, Sir George, D. C. L., LL. D., K. C. B.: governor of New Zealand; b. at Lisburn, Ireland, in 1812; educated at Sandhurst Military College, and entered the army, from which he soon after retired, and in 1839 accompanied an exploring expedition to Australia, receiving the appointment of governor of South Australia in 1841, and held the position till appointed governor of New Zealand in 1845, his abilities in this capacity being acknowledged in 1848 by the bestowal of the title of K. C. B., and in 1854 by his advancement to the governorship of the Cape of Good Hope, returning, however, at the request of his government, to New Zealand in 1861, where he contributed to the suppression of the insurrection. He returned to England in 1867; became superintendent of the province of West Auckland in 1875 and Premier of New Zealand in 1877, and retired in 1884. Among his published works are *Journals of Discovery in Australia* (1841); *Polynesian Mythology and Traditions of New Zealand* (1855); *Proverbial Sayings of the Ancestors of the New Zealand Race* (1858). D. in London, Sept. 19, 1898.

**Grey**, Henry, Earl: son of Charles, second earl; b. Dec. 28, 1802; educated at Trinity College, Cambridge; entered Parliament 1826 as Lord Howick, and in the same year was called to the bar; was Under Secretary for the Colonies 1830–33; Under Secretary for the Home Department 1834; became a privy councilor 1835; Secretary of War 1835–39; was returned for Sunderland 1841; came to his title 1845; Colonial Secretary 1846–52; became lord-lieutenant of Northumberland 1847; received the Garter in 1863, and the Grand Cross of SS. Michael and George 1869. Author of *Defense of the Colonial Policy of Lord Russell's Administration* (1853); *Essay on Parliamentary Government* (1858). D. Sept. 9, 1882.

**Grey**, Lady Jane: daughter of Henry Grey, Duke of Suffolk, and great-granddaughter of Henry VII. in the female line; b. at Bradgate, Leicestershire, 1537; under the tutelage of Ascham and Aylmer, Bishop of London, acquired a good knowledge of Greek, Latin, French, and Italian, and such proficiency in the Oriental languages as caused her to be regarded as a prodigy of learning, while her piety and excellence of disposition were equally remarkable. She married Lord Guildford Dudley, son of the Duke of Northumberland, in 1553. Edward VI., persuaded by Lady Jane's father and father-in-law, had set aside the claims of his sisters and declared Lady Jane his successor. Accordingly, after much persuasion, she reluctantly assented, and was proclaimed queen July 10, 1553. Ten days later Queen Mary was proclaimed, and Lady Jane and her husband were confined in the Tower. Nov. 30 she was tried for treason at the Guildhall, and pleaded guilty, and on Feb. 12, 1554, she and her husband were beheaded, chiefly, it is believed, on account of Suffolk's rash revolt against Queen Mary in his daughter's behalf, and the later and more formidable rising under Sir Thomas Wyatt.

**Grey Friars**: See Franciscans.

**Greyhound**: a variety, or group of varieties, of the domestic dog, distinguished chiefly by slender, graceful build, quick sight, and great speed in the chase. In other points there is much lack of uniformity. For example, in India there are long-haired and even shaggy greyhounds, while China and Turkey have breeds with no hair, or next to none. Scotland, Ireland, and Russia have stocks of the greyhound which are keen of scent, but most greyhounds are deficient in this respect, and follow the game by sight alone. Some strains are of very large size and treacherous disposition,

while the little Italian greyhound is a gentle household pet. The celebrated dog Gelert, a greyhound whose mythus is found in the folk-lore of several nations, was a most faithful servant, but with few exceptions his modern representatives are unintelligent, and do not attach themselves strongly to any master. Greyhounds are descendants of a long line of clearly marked ancestry. Celtic, Teutonic, Latin, Greek, Persian, Indian, Egyptian, and Chinese literature and tradition testify to the antiquity of the race. It has been much modified by crossing with other breeds. See Dogs.

**Grey Nuns**: See Charity, Sisters of.

**Greytown, San Juan del Norte**, or **San Juan de Nicaragua**: a seaport-town of Nicaragua; on the Caribbean Sea, at the mouth of the San Juan river; 190 miles E. S. E. of Managua (see map of Central America, ref. 7–J). It is built on a low, sandy point, backed by swampy lands; the situation is insalubrious, though less so than many other parts of the coast. The houses generally are of wood, whitewashed, and with the mingling of palms and fruit-trees are very picturesque. Greytown is the only port of importance on the Atlantic side of the republic. The harbor, protected by a sand-bar, formerly admitted large vessels, but, owing to the opening of a new mouth of the San Juan, it became obstructed; this has been partially remedied by the construction of jetties and a breakwater. The town was bombarded by Capt. Hollins, of the U. S. navy, July 13, 1854, and it was nearly destroyed by fire Jan. 1, 1890. Pop. about 2,500. A few miles to the N. W., on the coast, is the village of America, founded by the Government Jan. 1, 1890, at the entrance of the proposed Nicaragua interoceanic canal.

**Gridley**, Charles Vernon: See the Appendix.

**Grieg**, Edvard: composer and pianist; b. at Bergen, Norway, June 15, 1843. He went to Leipzig in 1858, having Hauptmann and Richter as masters in harmony and counterpoint, Rietz and Reinecke in composition, and Moscheles in piano-playing. After his return to his northern home Grieg's talent soon began to assume its characteristic national quality. He has published many works in various forms for piano solo, piano with orchestra, chamber music, large orchestral suites, such as *Peer Gynt*, and other works, all imbued with a keen originality and enjoying a wide popularity. Dudley Buck.

**Grier**, James Alexander, D. D.: a theologian of the United Presbyterian Church of North America; b. in Waltz's Mills, Pa., May 8, 1846, and educated at Monmouth College, Illinois, and the Newburg Theological Seminary, New York. He has been pastor at Locust Hill, Pa., and at Mercer, Pa. From 1886 he has been Professor of Systematic Theology in the Allegheny Theological Seminary. He published *Secret Societies* (1878); *Biography of Jeremiah Rankin Johnston, D. D.* (1892). W. J. B.

**Grier**, William Moffatt, D. D.: minister and educator in the Associate Reformed Presbyterian Church of the South; b. in York co., S. C., Feb. 11, 1843; graduated at Erskine College in 1860. After four years' pastoral labor he became president of Erskine College in 1871. He is also Professor of Mental and Moral Philosophy in the college; Professor of Greek Exegesis and Homiletics in the Erskine Theological Seminary; and editor of *The Associate Reformed Presbyterian*. Willis J. Beecher.

**Griesbach**, grees'bäk'h, Johann Jakob: theologian; b. at Butzbach, Jan. 4, 1745; studied theology at the universities of Tübingen, Halle, and Leipzig; traveled in 1769 and 1770 through Holland, England, and France; became Professor Extraordinary in Theology at the University of Halle 1773; professor ordinary at Jena 1775, which office he held till his death there Mar. 24, 1812. After finishing the ordinary course of theology, he devoted himself almost exclusively for many years to critical researches concerning the original Greek text of the New Testament, the result of which was his edition of the Greek New Testament (Halle, 1775–77), which, properly speaking, was the first critical edition ever made, and which has been reprinted since in many editions. It is to him that we owe the division of the authorities for the text of the Greek New Testament into the three families—(1) the Alexandrian; (2) the Latin, or Western; and (3) the Byzantine, or Eastern—and the now familiar rules that a reading must be supported by ancient testimony; that the shorter reading is preferable to the longer, the more difficult to the easy, the unusual to the usual. His works on other theological subjects are of less importance, though his *Anleitung zum Studium der populären Dogmatik* (Jena, 1779; 4th ed. 1789) was once popular. See his *Life* by F. A. Köthe (Jena, 1813) and by J. C. G. Auguste (Breslau, 1813).

Samuel Macauley Jackson.

**Grif'fenfeld**, Peter Schumacher, Count: b. at Copenhagen, Denmark, in 1635; the son of a wine-dealer. He early entered the service of Bishop Swane as private secretary; and as Swane played a very conspicuous part in the Danish revolution of 1660, by which the power of the nobility was broken and the constitution of the kingdom changed into an absolute monarchy, a way was thus opened for the talent and ambition of the young Schumacher. The bishop recommended him to the king, Frederick III., who employed him in several responsible positions in the Government offices. He was the author of *Lex Regia Danica*, promulgated Nov. 17, 1665. On his death-bed Frederick III. said to his son and successor, concerning Schumacher: "Give him power, but do it slowly": but it was not in the character of Christian V. to do anything slowly. In 1670 Schumacher was ennobled under the name of Griffenfeld; in 1673 he was made a count and chancellor of the realm; in 1674 president of the Supreme Court and chancellor of the university. The king had great confidence in him, and his talents were noticed and respected at the courts of France and England. But his policy was in utter opposition to that of the court, and even to that of the king. In 1676 he fell out with the king, and the courtiers hastened to have him bereft of his honors and put in prison, and finally had him sent 1,000 miles away, to Munkholm, a lonely rock-fortress in the fiord of Trondhjem. The king soon forgot him, and he remained imprisoned for twenty-three years. D. May 11, 1699.

**Griffin** [from O. Fr. *griffon*: Ital. *grifone*: Span. *grifo* < Lat. *gryphus*, from Gr. γρύψ]: a fabulous animal, part lion and part eagle, and having the characteristics of both—strength, rapacity, courage, and swiftness. Its figure varies in different countries and eras. It was emblematic of vigilance, and as a symbol of divine power it originally attended upon any of the Greek gods, though in classical times it belonged first of all to Apollo, and then to Bacchus, Diana, and Nemesis. The home of the griffins was in the far north, between the Hyperboreans and the one-eyed Arimaspi. There, on Mt. Rhipæ, they guarded the gold of the north, which the Arimaspi, mounted on horses, tried to take from them. The Greeks really believed in the existence of the griffin, and the poet Aristeas of Proconnesus (Tournier, *De Aristea Proconnesio et Arimaspeo poemate*, Paris, 1863) says (according to Herodotus, iv., 13) that he visited the Issedones who lived beyond the Scythians and affirmed the existence of the Arimaspi and the griffin watch-dogs. (Cf. Æschylus's ὀξύστομοι Ζηνὸς ἀκλαγγεῖς κύνες.) Ctesias, the Greek physician of Artaxerxes, outdoes Aristeas in his wonderful story about the griffins in India. He says that their backs are black, their wings white, their necks dark blue, and that in other respects they are exactly as depicted in later Greek art; the grown animal can not be captured, but the young may be caught; the griffins dig the gold from the mountains and build their nests with a part of it, while the rest is taken from them by the Indians. The griffin was not an original creation of the Greek imagination, but was borrowed from the Orient, improved upon, and in Parthian and Sassanide times restored to the Orient. The griffin, obtained from the Hittites of Northern Syria, appears frequently as a decoration on the monuments of Egypt, though it was also used as a hieroglyph signifying *swiftness*. Unlike the sphinx, it had no sacred meaning or character in Egypt. From Egypt the griffin passed over to Mycenæ, where it appears (e. g. on the swords discovered by Schliemann) as a wild and swift beast of prey, and is depicted running at full speed. On the monuments of Chaldea and Assyria the griffin appears as a lion with the wings, hind legs, and tail of the eagle; it is usually depicted as rampant and in the act of attacking a god with his fore feet; it is the dragon-foe of the gods. In Persia it is figured precisely as in Chaldea and Assyria, but with goat-horns on its head and sometimes with a scorpion-tail. This is the evil demon Tiamat; he appears standing on his hind legs fighting the king, who disembowels him by a thrust of his sword. Among the Hittites the griffin is the symbol of divine power, and appears quietly seated dog-fashion on his hind legs, sometimes lifting one fore paw. It is found mostly on Hittite cylinder seals and other gems, and is quite like the griffin of Chaldea, but often has no comb. The griffin of Cyprus (on cylinder seals) is also a direct importation from the Hittites. The griffin of archaic

Greek art (non-Mycenean) came in the main from the Hittites, though it exhibits peculiarities of Greek origin; it has no comb, but has something like a top on its nose below the eyes. In the later period of Greek art the griffin has the body of the lion, an eagle's head, with long sharp ears, a quill mane, and large beautiful wings; he is swift and rapacious, preying on other animals. The belief in the griffin continued throughout the Middle Ages, and consequently it appears everywhere in heraldic coats-of-arms.

LITERATURE. — Furtwängler's learned article *Gryps* in Roscher's *Ausführliches Lexicon der Griechischen und Römischen Mythologie*; Seeburg, *Die Sage von dem Greifen* (Göttingen); Brown, *Gryphon* in *Archæologia* (1885).

J. R. S. STERRETT.

**Griffin**: city; capital of Spalding co., Ga. (for location of county, see map of Georgia, ref. 4–G); on the Central Ga., the Chatt., Rome and Col., and the Ga. Mid. and Gulf Railways; 43 miles S. of Atlanta. It is the center of a large cotton and fruit and wine trade, having a cotton-compress and two cotton-factories, and in its immediate vicinity 250,000 peach-trees and 500,000 grape-vines. Adjoining the city are the State agricultural experiment station and the permanent State military encampment. There are 11 churches, high school, public grammar schools, Y. M. C. A. building, and 1 monthly, 2 daily, and 3 weekly periodicals. Griffin has become a popular winter resort for people from the North, and a summer resort for South Georgians. Pop. (1880) 3,620; (1890) 4,503; (1900) 6,857.

EDITOR OF "NEWS AND SUN."

**Griffin**, CHARLES: soldier; b. in Licking co., O., in 1826; graduated at West Point 1847; entered the army as brevet second lieutenant of artillery, and served in the war with Mexico 1847–48; became a second lieutenant in Oct., 1847, and first lieutenant June, 1849, serving on frontier duty and against hostile Indians. Appointed captain in 1861, he served during the civil war at the first battle of Bull Run, being breveted major for gallant conduct. Promoted to be brigadier-general of volunteers June, 1862, he commanded a brigade in the Virginia Peninsular campaign, and distinguished himself at Yorktown, Gaines's Mill, Malvern Hill, etc., and subsequently in the second battle of Bull Run and at Antietam. In the Rappahannock campaign he commanded a division at the battle of Fredericksburg, Dec., 1862, at Chancellorsville, May, 1864, Gettysburg, July 3, 1863, Wilderness, May 5 and 6, 1863, and at Spottsylvania, assault and siege of Petersburg, and the various battles of the final campaign 1864–65. For conspicuous gallantry in this latter campaign he was breveted major-general of volunteers. Appointed major-general of volunteers Apr. 2, 1865, he commanded the Fifth Army-corps until Jan. 28, 1865. He was appointed one of the commissioners to carry out the terms of the surrender of Gen. Lee at Appomattox Court-house Apr. 9, 1865. Being mustered out of the volunteer service, Jan., 1866, he was in July following appointed colonel Thirty-fifth Infantry, and commanded military districts in Texas and Louisiana. D. at Galveston, Tex., Sept. 5, 1867.

Revised by JAMES MERCUR.

**Griffin**, EDWARD DORR, D. D.: b. at East Haddam, Conn., Jan. 6, 1770; graduated at Yale 1790; was settled at New Hartford, Conn., from 1795 to 1801, at Newark, N. J., from 1801 to 1809; was Professor of Sacred Rhetoric in Andover Seminary from 1809 to 1811; was settled in Boston, Mass. (Park Street Congregational church), from 1811 to 1815; at Newark again from 1815 to 1821; was president of Williams College from 1821 to 1836. He published several works, the most noted of which is a *Course of Lectures in Park Street Church* (Boston, 1813). Sixty of his sermons, with a biography prefixed, were published in two vols. by Rev. Dr. William B. Sprague, in New York, in 1838. D. at Newark, N. J., Nov. 8, 1837. Revised by S. M. JACKSON.

**Griffin**, GERALD JOSEPH: author; b. at Limerick, Ireland, Dec. 12, 1803; went in 1823 to London with a view of becoming a dramatist, but the failure to dispose of his tragedies *Aguire* and *Gisippus* obliged him to become a writer for periodicals. His *Holland Tide* (1826); *Tales of the Munsler Festivals* (1827); *The Collegians* (1828); *The Invasion*; *The Rivals*; *The Duke of Monmouth*, and other novels were successful. In 1838 he became a postulant of the Christian Brothers, and took the name of Brother Joseph. D. at the North Cork monastery, Ireland, June 12, 1840. His *Life* was written by his brother.

**Griffis**, WILLIAM ELLIOT, D. D.: b. in Philadelphia, Pa., Sept. 17, 1843; served in the Forty-fourth Pennsylvania Regiment in 1863; graduated at Rutgers College, New Brunswick, N. Y., 1869; studied in the New Brunswick (Reformed Dutch) Theological Seminary 1869–70; went to Japan in 1870 to organize schools under Government appointment; was superintendent of education in province of Echizen, Japan, 1871; Professor of Physics and Chemistry in the Imperial University of Tokio, Japan, 1872–74; studied in Union (Presbyterian) Theological Seminary in New York city 1875–77, and graduated; was pastor of the First Reformed Dutch church, Scheneetady, N. Y., 1877–86; pastor of Shawmut Congregational church, Boston, 1886–92; of the Congregational church, Ithaca, N. Y., 1893. He is the author of *The Mikado's Empire* (New York, 1876; 7th ed. 1891); *Japanese Fairy World* (Scheneetady, N. Y., 1880); *Corea, the Hermit Nation* (New York, 1882; 3d ed. 1889); *Corea, Without and Within* (Philadelphia, 1884; 2d ed. 1885); *Matthew Calbraith Perry* (Boston, 1887; 2d ed. 1890); *The Lily among Thorns: a Study of the Biblical Drama entitled the Song of Songs* (1889); *Honda the Samurai: a Story of Modern Japan* (1890); *Sir William Johnson and the Six Nations* (New York, 1891); *Japan in History, Folk-lore, and Art* (Boston, 1892).

C. H. THURBER.

**Griffon Vulture**: a name applied to the large vulture (*Gyps fulvus*) of Europe and Asia. See VULTURE.

**Griggs**, JOHN WILLIAM: See the Appendix.

**Griggsville**: city; Pike co., Ill. (for location of county, see map of Illinois, ref. 7–B); on the Wabash R. R.; 4 miles W. of the Illinois river, 50 miles E. of Quincy. It has public schools and churches, public library, one weekly newspaper, and manufactures of agricultural implements, etc. Pop. (1890) 1,400; (1900) 1,404. EDITOR OF "INDEPENDENT PRESS."

**Grigoriopol**, grĕĕ-gō-rĕĕ-ō′pōl [Russ., from Gr. Γρηγοριόπολις, city of Gregory]: town of Russia; in the government of Kherson, on the Dniester; 82 miles N. W. of Odessa (see map of Russia, ref. 10–C); founded in 1793 by a colony of Armenian settlers, who are mostly engaged in the cultivation of tobacco, wine, and fruit, and manufacture of leather. Pop. 9,000.

**Grijalva**, grĕĕ-chaal′vaă (also called TABASCO, and in its upper course CHIAPA and MESCALAPA): a river of Guatemala and Mexico, rising in the mountains of Huehuetenango, making a great curve to the W., N. W., and N. E., through Chiapas, and then flowing N. through Tabasco to the Gulf of Mexico. Length, 265 miles. In its lower course it passes through wide flood-plains, where the channel was changed in 1765. Frontera, just above the mouth, is the principal port of Tabasco, and small steamers run up to San Juan Bautista, 50 miles.

H. H. S.

**Grijalva**, JUAN, de: Spanish soldier; discoverer of Mexico; b. at Cuéllar, 1489 or 1490. He went to Española, and in 1511 joined his uncle, Diego Velasquez, in Cuba. When Córdoba returned to Cuba from the discovery of Yucatan (1517) Velasquez chose Grijalva to command an expedition to the same coasts. Grijalva left Santiago de Cuba with four caravels Apr. 8, 1518; sailing along the shores of Yucatan, he had an encounter with the Indians at Campeche. He entered the river which bears his name in Tabasco, had friendly intercourse there with the natives, obtained a considerable quantity of gold, and first heard of the rich empire of the Aztecs in the interior. Beyond this he followed the coast to Cape Rojo, or perhaps to Tampico, finally returning to Cuba about Nov. 1. Instead of evincing gratitude for this important discovery, Velasquez reproached Grijalva because he had not formed settlements, and he was dismissed in disgrace. He went to Santo Domingo and thence to Jamaica, and in 1523 accompanied Garay from that island to the shores of Northern Mexico. Later he took service with Pedrarias at Panama, and was sent to Nicaragua, where he died Jan. 21, 1527.

HERBERT H. SMITH.

**Grillage**: a timber platform built on piles as the foundation for a masonry structure. See FOUNDATION.

**Grillparzer**, gril′paărt-ser, FRANZ: dramatist; b. in Vienna, Jan. 15, 1791; studied law at the University of Vienna, and in 1832 became director of the imperial archives. His first tragedy, *Die Ahnfrau*, which was successfully performed for the first time in 1816, and in which the romantic idea of "fate" (*Schicksal*) played a great *rôle*, caused the critics for a long time to underestimate Grillparzer's position in literature. His subsequent dramas, *Sappho*, *Das goldene Vliess*, *Des Meeres und der Liebe Wellen* (Hero and Leander), *König Ottokar's Glück und Ende*, and the witty comedy *Weh dem, der lügt*, have proved, however, be-

yond doubt that Grillparzer is one of the greatest German dramatists of the period following the classical era. He combines the dramatic power and pathos of Schiller with the repose and beauty of Goethe's verses, and displays, especially in lyrical passages, a command of expression and language which must be termed truly classical. For a long time his dramas were overlooked by the German stage, until Laube, the director of the Burgtheater in Vienna, had them performed with the utmost success. The poet now became very popular, and on the occasion of his eightieth birthday received a most brilliant ovation. See Heinrich Laube's biography of Grillparzer (Laube also published Grillparzer's works for the first time); W. Scherer, *Zum Gedächtniss Franz Grillparzers* (1872); Frankl, *Zur Biographie Franz Grillparzers* (1883); J. Volkelt, *Franz Grillparzer als Dichter des Tragischen* (1888); Lichtenheld, *Grillparzer-Studien* (1891); R. Mahrenholtz, *Franz Grillparzer, sein Leben und seine Schriften* (1890); E. Reich, *Grillparzers Kunstphilosophie* (1890). JULIUS GOEBEL.

**Grilse**: the young salmon on its first return to fresh water from the sea. See SALMON.

**Grimaldi**, gree-maal'dee: an old Guelphic family of Italy, whose principal seat was at Genoa. They traced their origin to one Grimoald (d. 714), major-domo to Childebert III. (683–711), Merovingian King of Neustria and Burgundy. The Grimaldi were long (980–1731) princes of Monaco, but on the extinction of the male line of the princely house the title passed to the Goyen-Matignon line; and the princes of Monaco still bear the name of Grimaldi, though not of the direct male line. The name became a common one in Italy, as well as France and Spain; and in the Middle Ages many poets, artists, scholars, churchmen, nobles, generals, and admirals bore this name.

**Grimaldi**, JOSEPH: pantomimist and actor; b. in London, Dec. 18, 1779; began to appear in pantomimes when a child, attending boarding-school in the intervals between his engagements at the theater, and while still very young had become one of the most successful pantomimists in London. As clown in the pantomime of *Mother Goose* he won his chief renown, and the piece was continually repeated. But from the year 1822 his health, which had suffered from overwork, grew steadily worse, and, as he had saved little from his former earnings, the last years of his life were passed in poverty. D. at Pentonville, May 31, 1837. In the species of drollery peculiar to the genuine pantomime, Grimaldi is said to have had no equal, and his name is often cited as that of the last and greatest representative of this form of comic acting. The chief authority for the facts of his life is the *Memoirs* edited by Boz, i. e. Charles Dickens (2 vols., 1838).

**Grimes**, JAMES WILSON, LL. D.: U. S. Senator; b. in Deering, Hillsboro co., N. H., Oct. 20, 1816; the youngest of eight children, and of Scotch-Irish extraction. He entered Dartmouth College Aug., 1832; settled at Burlington (now in Iowa, then in the "Black Hawk Purchase," which was attached to the Territory of Michigan) May, 1836, and engaged in the practice of law, in which he was highly successful. Reared among the Whigs, and sustaining their general principles, he earnestly opposed the repeal of the Missouri Compromise, and was one of the founders of the Republican party. On several occasions he canvassed nearly the whole of Iowa, and addressed the people upon public questions. He was chosen Governor Aug., 1854. He convened the general assembly in special session July, 1856, to act upon land grants made to the State by Congress for the purpose of aiding in the construction of railways, by which the material development of the State has been greatly promoted. By the effect of a new constitution his tenure of office terminated Jan., 1858, when he was chosen U. S. Senator for the term of six years from Mar. 4, 1859. In Jan., 1864, he was chosen for a second term. In the impeachment trial of President Johnson he regarded himself as acting, not in a representative capacity but as a judge, and gave his opinion that the President was not guilty of an impeachable offense by reason of anything alleged in the articles preferred against him. In common with those who acted with him in the final vote he incurred great temporary unpopularity, but he declared that "neither the wealth nor the honors of the world would have induced him to act otherwise." During that trial he was stricken down by an attack of paralysis, but went into the Senate chamber and recorded his vote. He died suddenly of heart disease at Burlington, Ia., Feb. 7, 1872. Revised by C. K. ADAMS.

**Grimké**, grim'ke, ANGELINA EMILY: reformer; sister of Frederick Grimké (1791–1863), judge of the Ohio Supreme Court 1836–41; b. in Charleston, S. C., Feb. 20, 1805; removed to Philadelphia in 1828, and joined the Society of Friends; in 1830 she published *An Appeal to the Christian Women of the South*, advocating anti-slavery measures. In 1836 she emancipated the slaves she had inherited from her father. In that same year in New York, in company with her sister Sarah, she addressed large audiences of women on the subject of slavery. At the invitation of the Massachusetts Anti-Slavery Society the sisters went to New England, and by their eloquent addresses did much to further the work of that society. In 1837 Angelina wrote several letters to Catharine Beecher in reply to an essay on slavery and abolitionism. May 14, 1838, she was married to Theodore Dwight Weld. See May, *Recollections of the Anti-Slavery Conflict* (1868). SUSAN B. ANTHONY.

**Grimké**, SARAH MOORE: reformer; b. in Charleston, S. C., Nov. 6, 1792; in 1821 made Philadelphia her place of residence, and published in 1827 *An Epistle to the Clergy of the Southern States*. This was considered one of the most efficient anti-slavery documents of the day. While lecturing in New England she wrote *Letters on the Condition of Woman and the Equality of Sexes*, published in a volume in 1838, and afterward made her home with the Weld family, and assisted as a teacher in their school, established in Belleville, N. J., in 1840. She also published a translation of Lamartine's *Biography of Joan of Arc* and other smaller works. D. at Hyde Park, N. Y., Dec. 23, 1873. SUSAN B. ANTHONY.

**Grimm**, FRIEDRICH MELCHIOR, Baron: a literary adventurer; b. at Ratisbon, Bavaria, Dec. 25, 1723; studied at the University of Leipzig. Having failed sadly with his tragedy *Banise*, he went to Paris as tutor in a noble family. Rousseau made him acquainted with Diderot, d'Alembert, d'Holbach, and other literary celebrities. Count Friesen, to whom he had become private secretary, introduced him in the most elegant salons. Voltaire made him famous by exclaiming, after reading his pamphlet *Le petit prophète de Boemischbroda* (1753): "De quoi s'avise donc ce Bohémien d'avoir plus d'esprit que nous?" He became the regular correspondent of Catharine II. of Russia, Gustavus III. of Sweden, Stanislas of Poland, and other sovereigns, and his letters give a minute chronicle of French literature from 1753 to 1790. In 1776 he was made a baron and ambassador from the Duke of Saxe-Gotha to the French court, but in 1792 he had to leave France with the rest of the foreign diplomats. He retired to Germany, where Catharine II. gave him a pension and some shadow of a diplomatic position. D. at Gotha, Dec. 19, 1807. A complete edition of his *Correspondance littéraire, philosophique, et critique* was published in 15 vols. in Paris in 1829; German abridgment in 2 vols., 1823. Rousseau gives an interesting description of Grimm in his *Confessions*, greatly exaggerated, but nevertheless strikingly true.

**Grimm**, JAKOB LUDWIG KARL: philologist and archæologist; b. at Hanau, Germany, Jan. 4, 1785; studied law at Marburg 1802; received in 1805 an office in the war department of Hesse; accompanied in 1814 the Hessian ambassador to the Congress of Vienna; went in 1815, under Prussian authority, to Paris to reclaim such manuscripts as Napoleon had carried away from German libraries; became in 1816 librarian at Cassel, and in 1830 professor at Göttingen. When in 1837 the Hanoverian king arbitrarily abolished the constitution, Grimm signed a protest against the measure, and was dismissed, but in 1841 received a chair at the University of Berlin, which he held for the rest of his life. He began his literary career in 1811 with *Ueber den altdeutschen Meistergesang*, followed in 1819 by his *Deutsche Grammatik* (unfinished), in 1828 by his *Deutsche Rechtsalterthümer*, in 1840 by his *Weisthümer*, and in 1844 by his *Deutsche Mythologie*. But besides these, and a great number of minor essays and archæological researches and collections undertaken in connection with his brother, his two principal works are *Geschichte der Deutschen Sprache* (1848) and *Deutsches Wörterbuch* (1852): the former a history of the German language, of paramount importance for all linguistical study on account of the brilliant discoveries it contains, by which some of the fundamental laws for the development of a language are established; the latter a dictionary of the German language, arranged on a broader plan than any other dictionary. Only the first volumes, to the word *Garten*, were finished. D. in Berlin, Sept. 20, 1863. See GRIMM'S LAW.

**Grimm**, Wilhelm Karl: philologist and archæologist; brother of Jakob Ludwig Karl Grimm; b. at Hanau, Feb. 24, 1786; studied law at Marburg, and followed his elder brother as librarian and professor at Cassel, Göttingen, and Berlin. Although he took part with his brother in all his studies, and divided the labor, he seems to have been more attracted to the poetical side of the questions which the two brothers raised and answered. The most important of his independent works are *Altdänische Heldenlieder, Balladen und Märchen* (1811); *Ueber die Deutschen Runen* (1821); *Die Deutschen Heldensage* (1829; 3d ed. 1889), his principal work; *Der Grosse Rosengarten* (1834); *Das Rolandslied* (1838); *Konrad von Würzburg* (1849); *Altdeutsche Gespräche* (1851). In connection with his brother he edited *Kinder- und Hausmärchen* (1812), a collection of fairy and other popular tales; *Altdeutsche Wälder* (1813–16); *Deutsche Sagen* (1816–18). D. in Berlin, Dec. 16, 1859.

**Grimm's Law**: Jakob Ludwig Karl Grimm's classification of the interchange of consonants in Teutonic words and their cognates. The Teutonic languages receive their impress of individuality in part from certain changes to which the explosives *k*, *t*, *p*, *g*, *d*, *b*, *gh*, *dh*, *bh* are subjected in passing from the Indo-European to the Teutonic form. The credit of first discovering the uniformity of these changes is largely due to a Danish scholar, Rasmus Kristian Rask (1787–1832), but the formulation of them in the shape of a general law, and the exhibition of the parallelism contained in the second or High German shifting, are the work of Jakob Grimm (1785–1863).

I. The Teutonic or first shifting.

| | | | | |
|---|---|---|---|---|
| (1) Indo-Europ. | gh | dh | bh |
| beeome Teuton. | (ȝ) g | (đ) d | (ƀ) b |
| (2) Indo-Europ. | g | d | b |
| become Teuton. | k | t | p |
| (3) Indo-Europ. | k | t | p |
| become Teuton. | h | þ (th) | f |

The regular correspondences in the cognate languages are as follows: (1) the Indo-European aspirates. See Aspirate.

| I.-E. | Skr. | Gr. | Lat. | | Teuton. |
|---|---|---|---|---|---|
| | | | Initial. | Medial. | |
| gh | h | χ | h | h (g) | g (ȝ) |
| gh | gh (jh) | φ, θ, χ | f | gu̯ (v) | gw (ȝw) |
| dh | dh | θ | f | d | d (đ) |
| bh | bh | φ | f | b | b (ƀ) |

The symbol *gh* in the second line represents, as do *g* and ḳ (see the artiele Velars), the Indo-European series of velars or baek-gutturals which show a tendency to labialization; ȝ, *đ*, *ƀ* represent spirants whieh generally in the West Germanic dialects (i. e. all except Gothic and Scandinavian) pass secondarily into the voiced explosives or mediæ *g*, *d*, *b*, though in other than the High German dialeets medial ȝ and *ƀ* (*v*) are retained. Examples:

| Skr. | Gr. | Lat. | Eng. |
|---|---|---|---|
| haṅsá-, *goose* | χήν | (h)anser | goose |
| váhati, *convey* | ὄχος | veho | way |
| gharmá-, *warmth* | θερμός | formus | warm |
| vidhávā, *widow* | ἠίθεος | vidua | widow |
| bhárati, *bear* | φέρω | fero | bear |

(2) The Indo-European mediæ:

| Skr. | Gr. | Lat. | Eng. |
|---|---|---|---|
| jánu-, *race* | γόνυ | genu | knee |
| gámati, *comes* | βαίνω | venio | come |
| dáça, *ten* | δέκα | decem | ten |
| dubùs, *deep* (Lith.) | | | deep |

(3) The Indo-European tenues:

| Skr. | Gr. | Lat. | Eng. |
|---|---|---|---|
| çvan-, *dog* | κύων | canis | hound |
| ka-, *who* | πόθεν | quod | what |
| tráyas, *three* | τρεῖς | trēs | three |
| pād-, *foot* | πούς | pēs | foot |

The apparent exceptions to these laws may be chiefly summarized under the following heads:

(1) Dissimilation of Indo-European aspirates in Sanskrit and Greek. In Greek it occurred after the voiced aspirates had beeome voiceless; thus Indo-European *dh* — *dh* > Skr. *d* — *dh*, Gr. *t* — *th*, Teuton. *d* — *d*. Cf. Skr. *bŏdhati*, Gr. πεύθομαι, Goth. *ana-biudan* (Indo-European *bheudh-*); Skr. *bāhú-*, Gr. πῆχυς, O. H. G. *buog* (Indo-European *bhāghú-*). See Grassmann, *Kuhn's Zeitschr.* (xii., 81 ff.).

(2) Shifting of *k*, *t*, *p*, cheeked by preceding voiceless spirant in the combinations, Indo-European *sk*, *st*, *sp* and Teuton. *ht* (< Indo-European *kt*), *ft* (< Indo-European *pt*). Cf. Lat. *piscis* : Goth. *fisks*; Gr. ἔστι : Goth. *ist*; Lat. *rectus* : Goth. *raíhts*; Lat. *captus* : Goth. *hafts*. See Brugmann, *Compar. Gramm.*, i., § 528.

(3) Interchange of mediæ and tenues and of mediæ and aspirates in Indo-European, especially at the end of roots. This dualism was probably originally due to the character of the following consonant. So are probably to be explained, e. g., Gr. ἀσταμφής in contrast with O. H. G. *stampfōn*, Goth. *táikns* in contr. to *teihan*, etc.

(4) The phenomena discussed under Verner's Law (*q. v.*).

II. The High German or second shifting. This affects only a portion of the West German dialects. It began in the fifth century A. D. at the extreme south, affecting most powerfully the dialects of the Lombards, Allemans, Bavarians, and South Franks, but losing its force as it spread toward the north. (Cf. Braune, *Paul-Braune's Beitr.*, i., 1 ff.) The frontier between the present High German and Low German dialeets is formed without any reference to the older dialectal boundaries by the final halt in the shifting of the tenues, so that the dialects whieh change initial *t* to *ts* (*z*), medial and final *t* to *s*, medial *p*, *k*, to *f*, *ch* are High German, the others Low German. The course of this frontier is approximately indicated by a line drawn from Aix-la-Chapelle through Düsseldorf, Siegen, Cassel, Magdeburg, Lübben, Fürstenberg on the Oder, to the Slavic speech-frontier at Birnbaum. The most prominent features of the second shifting may be exhibited by a comparison of the sounds concerned as they now stand in English and German respectively. The Modern German is based upon dialects, however, which shifted less radically than those of the extreme south.

| | Tenues. | | | Mediæ. | | | Spirants. | | |
|---|---|---|---|---|---|---|---|---|---|
| Eng. | k | t | p | g (y) | d | b (v) | h | th (þ) | f |
| Germ. Initial and after conson. | k | ts (z) | pf | g | t | b | h | d | f |
| Germ. After vowel | ch | ss | f | | | | | | |

Examples: *cold* : *kalt*; *yoke* : *joch*; *ten* : *zehn*; *token* : *zeichen*; *heart* : *herz*; *bite* : *beissen*; *goat* : *geiss*; *path* : *pfad*; *sleep* : *schlafen*; *gird* : *gürten*; *day* : *tag*; *dead* : *tot*; *deed* : *tat*; *bread* : *brot*; *that* : *das*; *thorn* : *dorn*; *three* : *drei*; *earth* : *erde*, etc.

References.—Brugmann, *Elements of the Comparative Grammar of the Indo-Germanic Languages* (i., §§ 342–344, 374–376, 393–395, 439–444, 527–541; Wilmanns, *Deutsche Grammatik* (§§ 17 ff.); Kluge, *Paul's Grundriss der german. Philologie* (i., 324 ff.); Behaghel, *Paul's Grundriss* (i., 584 ff.); Brandt, *American Journal of Philology* (i., 146 ff.); Skeat, *Principles of English Etymology* (first series); Streitberg, *Urgermanische Grammatik* (1896). See Teutonic Languages and German Language. Benj. Ide Wheeler.

**Grimsby**: See Great Grimsby.

**Grimshaw**, Robert, M.E., Ph.D., B.C.L.: civil engineer; b. in Philadelphia, Pa., Jan. 25, 1850; educated at Wilmington, Del., Andalusia, Pa., and in Europe; Professor of Physics in Andalusia College; head master of St. Stephen's School, Milburn, N. J.; Lecturer on Physics in Franklin Institute, Philadelphia; member of jury of award at Universal Exposition 1878; editor of vol. vii. of *The Iconographic Encyclopædia*, and one of the editors of the *Standard Dictionary*; author of numerous works, including *Saws* (1880); *Steam-engine Catechism* (1885); *Hints on House-building* (1889); *Record of Scientific Progress* (1891); *Hints to Power-users* (1891); *Fifty Years Hence* (1892); and articles in various encyclopædias.

**Grindelwald**, grin'del-vaălt [Germ., alderwood]: village of the canton of Berne, Switzerland; 35 miles S. E. of Berne; in a valley just N. W. of the great mountains Eiger, Mettenberg, and the Wetterhorn, between which descend the upper and lower glaciers of Grindelwald (see map of Switzerland, ref. 5–E). The manufacture of kirschwasser and the herding of cattle are the chief industries of Grindelwald, which is much visited in summer by tourists. Pop. 3,089.

**Grinding and Crushing Machinery**: mechanical deviees for disintegrating hard or fibrous substanees. The reduction of large masses to the state of powder usually involves the use both of crushing and of grinding apparatus. Crushing maehinery usually reduces the size of masses, or breaks up fragments, by simple pressure. Such action is best in the reduetion of hard, brittle, non-fibrous substances.

Grinding machinery acts by compression, combined with a lateral action. Such attrition is better adapted to produce extreme fineness of division than simple crushing; and where the material to be ground is organic, particularly if fibrous and tenacious, this is the only satisfactorily efficient method. Pulverization of hard substances is also frequently effected by percussive action.

In breaking up hard materials existing naturally in masses—as, for example, minerals and the metallic ores—the first operation is usually that of blasting. Holes are drilled to a depth of from a few inches to many feet, according to the nature of the material and the scale upon which the work is to be prosecuted. For this work drills worked by steam, by compressed air, or by electricity, are frequently used. These holes are charged with explosive materials, which are fired, and the mass is rent into fragments. Very large pieces are blasted again, and all, when sufficiently reduced in size, are broken up by the workmen with blows of heavy hammers or by crushing machinery. The *stamp-mill*, shown in Fig. 1, is one of the oldest and most generally known forms of crushing apparatus. A heavy mass of chilled cast iron, B, is secured upon the lower end of a strong vertical beam, E, which also carries, near the upper extremity, a bracket, K, which is engaged by a cam, D, which lifts it to the required height. This beam is guided by a suitable frame, F G, and the lifting is done by a cam or by a series of cams which are keyed upon and revolve with a horizontal shaft, A, driven by a steam-engine or other prime mover. A shield, C, of wood or metal protects the workman against injury by flying fragments. D represents the ore flowing under the stamp-heads, which crush it against the floor, H. A stream of water, I, usually flows over the minerals, carrying off the fine particles, and also preventing the rising of dust. Usually a battery of such stamps, placed side by side, operated by a single shaft, is used. In this case they are so arranged, by the adjustment of the elevating cams upon the shaft, as to make their combined action in resisting the driving-power as uniform as possible. Where two are worked by one shaft their cams are set opposite each other; where three or four or six form a battery their cams are so set as to make angles of 120°, 90°, or 60° with each other. The stamps are sometimes arranged in a circle about a central vertical shaft carrying a single lifting cam which operates all. Its advantages are compactness, low cost with high efficiency, and light driving-power.

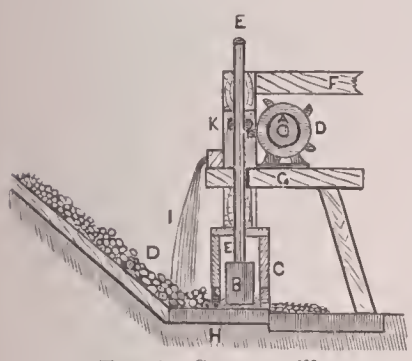


Fig. 1.—Stamp-mill.

A modification of the steam-hammer, resembling somewhat that used in forging iron, is sometimes used as a steam-stamp. When properly designed it is very effective in breaking up bowlders and masses too small to be cheaply broken by the use of gunpowder, and too large and too hard to be crushed by ordinary stamps or other breaking apparatus. The stamp-heads, in the ordinary form, are often made to revolve, so as to change their positions with each blow. A battery of five stamps, running on quartz, crushes about 200 bush. in ten hours. The pestles, or stamp-heads, weigh 250 to 500 lb. They are mounted on white oak or hickory beams 6 inches square in section, and make 100 blows per minute, with a fall of 10 or 12 inches. As an average, two-horse power is required per head. *Cornish crushers*, or rolls, somewhat similar to those used in iron-works, are sometimes used for crushing ores and stones.

Where it is not essential that the material shall be completely powdered, or in the reduction to small pieces of masses already broken to moderate size, as in the breaking up of large pebbles in road-making, or in metallurgy in the preparation of coarse material for the more complete comminution effected by stamps or by mills, *stone-breakers* are used. These machines, by the exertion of immense crushing force, crumble the hardest known rocks, and ores broken by them are often better prepared for subsequent operations than are those treated by stamps. The fragments are given a more uniform size, have a cleaner fracture, and are freer from dust. In all varieties of stone-breakers the crushing force is exerted through an extremely small range, and intermittently.

Fig. 2 represents the Blake stone-crusher, an example of this variety of machinery, the drawing exhibiting a longitudinal section, such as would be obtained by removing one side of the main frame A A. The circle at D exhibits a section of the driving-shaft, with the eccentric which actuates the pitman or connecting-rod F, giving it a vertical motion, and, through it, working the toggle-joint C C. This elbow, or toggle-joint, acting against the movable jaw J on the one side and the fixed abutment, or frame of the machine, on the other, forces the former toward the fixed jaw H, crushing any material which may have been thrown into the intervening space from above. N is a wedge which by means of the screw attached can be raised or lowered to diminish or to increase the size of product. B represents the fly-wheel, and C the driving-pulley. The faces of the jaws are protected by removable plates, which sustain all of the wear produced by abrasion. A spring of rubber, L, withdraws the swinging jaw when it has made its forward movement, and the toggle releases it. The action of the machine is as follows: The material, being already broken to a size which admits of its being placed between the jaws, is thrown into the machine, and the movable jaw, swinging through a small arc at each revolution of the fly-wheel shaft, fractures the pieces, and they drop until caught in the narrower space below, and the next approach of the pendent jaw produces new fractures, and again it releases them. The pieces finally become sufficiently small to fall out through the opening at the bottom, which is adjusted by the wedge O to the proper width to suit the individual case. The momentum of the fly-wheel, which makes from 100 to 250 revolutions per minute, and the great leverage obtained by the use of the knee-joint, enable such a machine to exert a crushing force which is only limited by the strength of the frame. With argillaceous minerals water is used to insure free discharge.

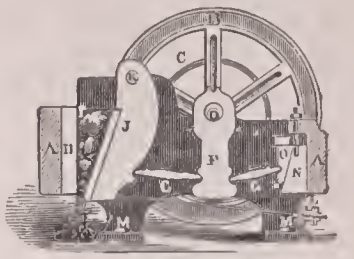


Fig. 2.—Blake stone-breaker.

Various forms of rock-breaking machines have been designed, all of which embody the principles illustrated by the machine just described as a typical example of the class. The work done varies from a half ton per hour, in the smallest machines reducing to coarse sand, up to 12 or 15 tons with the larger sizes doing less complete work. The power required varies from one-half to one and a half horse-power per ton of product per hour.

Fig. 3 represents an example of that class of machinery in which crushing is produced by percussive action—the Whelpley & Storer crusher. It consists of a cylinder or tub-shaped

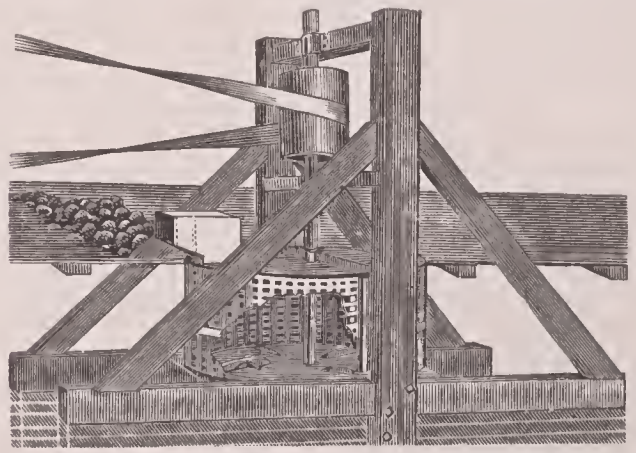


Fig. 3.—Whelpley & Storer crusher.

vessel 30 or 40 inches in diameter, made in sections of heavy iron plates, and perforated with holes of three-fourths of an inch in diameter, or larger, as may be determined by the nature of the material and the fineness of division desired. The top of the cylinder is of thick cast iron, and contains an opening through which the material to be broken falls from a hopper placed above. The bottom of the cylinder is detached, and revolves about a vertical shaft, which is supported by a step-bearing below. It extends upward through the top of the cylinder, and is driven by a belt running upon a pulley at the upper end. On this cylinder bottom or table are bolted several heavy blocks of iron faced with steel. The cylinder just described is surrounded by an inclosure which receives and retains the crushed material thrown out

by the machine. When in operation the table carrying the blocks or "hammers," and forming the bottom of the cylinder, is set in motion, revolving at the rate of from 1,000 to 1,500 turns per minute. The material to be crushed is fed into the hopper, and, falling into the cylinders, meets the whirling hammers, and is at once broken up by collision with their edges and faces and by mutual impact, and is then thrown out, through the perforations in the sides of the cylinder, into the surrounding chamber. The size of the pieces is determined by the diameter of the holes in the cylinder. The larger proportion usually are of about two-thirds the diameter of these holes. The hammers and their steel faces are so attached that they may be readily removed when the former are broken or when the latter become worn out, and new ones may be put in their places. From 5 to 10 tons of material are crushed per hour by these machines in average work, when the entering pieces average between 4 and 5 inches in diameter. The power required to drive these machines is stated to average one and a half horse-power for each ton of broken material.

Materials requiring to be more thoroughly comminuted, or to be reduced to the state of fine powder or of flour, are usually ground in mills such as are hereafter to be described. Fibrous substances and organic materials generally are not readily crushed by the machinery above sketched. For simply crushing sugar-cane and similar substances, where the cellular or porous mass is to be compressed and broken to expel the contained liquid, a set of rolls such as are shown in Fig. 4 is used. These rolls are of cast iron, and

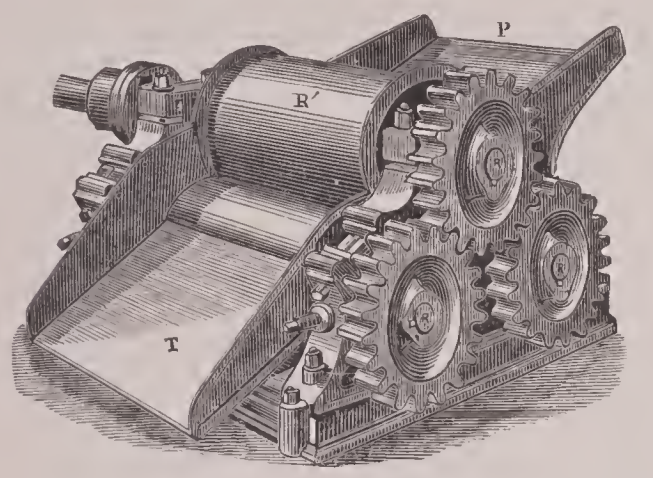



Fig. 4.—Rolls for crushing sugar-cane.

are from $1\frac{1}{2}$ to 3 feet in diameter, arranged as shown in the sketch, one being placed above and between the two others. The cane is fed between the rolls R $R^1$ from an apron, P. Passing under the rolls, it is guided by a plate arranged for that purpose, between R and $R^2$, and then, the juice being thoroughly expressed, the crushed cane (or bagasse, as it is called) falls clear, led by the tail-trough T. The effect of the action of the first pair of rolls R $R^1$ is to crush the cane, and the succeeding heavy pressure exerted by $R^1$ and $R^2$ expresses the juice very completely. The juice falls into a trough below, which leads it to a reservoir conveniently situated to receive it. A good mill expresses from 70 to 75 per cent. of the juice of the cane. The larger the rolls, the slower their speed, and the heavier the pressure exerted by them, the more perfectly is the work done. A mill having rolls 40 inches in diameter and 6 feet long, making three revolutions per minute, requires a driving-power of 60 or 70 horses, and expresses 20 tons of cane-juice per day.

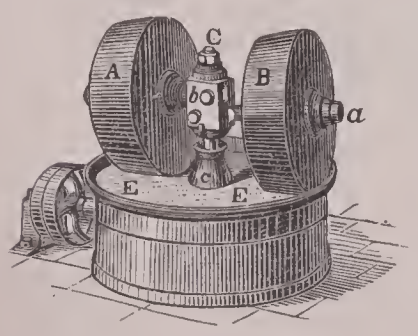



Fig. 5.—Vertical seed-mill.

Fig. 5 represents a form of mill which is also used principally for crushing organic materials, for expressing oil from seeds, and for similar work. It is also used in grinding chocolate, in mixing mortar, and in kneading clay for brick or porcelain manufacture. A and B are two millstones revolving on horizontal axes, *a b*, which are held in position by bearings fastened by bolts to the framework of the machine. The vertical shaft C revolves in bearings steadied by the framework above, and its weight, with that of its appurtenances, is carried by a step at its lower end. Keyed upon this shaft is a strong cast-iron disk, having a high flange around its edge. Fitted to this disk, and well bedded upon it, is a thick stone, E E, upon which the millstones A B rest. The vertical shaft C is driven by a bevel-wheel at its lower extremity, and carries with it the horizontal table E E. The material to be crushed is thrown upon the table, and as the latter revolves the former is carried under the millstones, which revolve by contact, and is crushed and ground by the weight of the stones and by the slight twisting action arising from the combination of the relative motion of the two sets of stones in the vertical and the horizontal plane. In a better form of this mill the bed or table is fixed, and the axle carrying the vertical stones is attached to the vertical spindle and revolves with it. Where the stones are small and their orbit is of large diameter, the action is almost purely that of crushing, but where, as is customary, the millstones are of large diameter and revolve in small orbits, the action combines grinding with crushing. The hydraulic press is often used as a substitute for this form of mill. In crushing and kneading soft materials, as paints or chocolate, the stones have a diameter of 24 or 30 inches, but when designed for breaking ore or for crushing seeds containing oil, they are given a diameter of 5 feet. They make from three to five or six revolutions per minute. The stones are made of some hard rock, as granite, gneiss, or trap, or occasionally of cast iron. Making five revolutions per minute, the heavier stones require about 5 horse-power to drive them over materials offering moderate resistance.

When a thorough pulverization of materials is desired mills of various kinds, in which the action is purely that of grinding, are generally used. An exception to the general rule exists in the pulverizer of Whelpley & Storer, shown in Fig. 6. This machine is only intended for the reduction to fine powder or to dust of such materials as sand, gravel, or

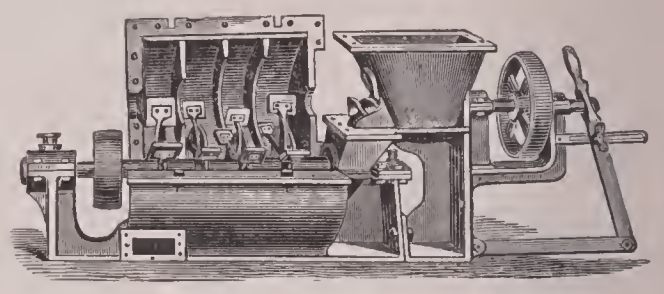


Fig. 6.—Whelpley & Storer pulverizer.

crushed ore. The material is fed regularly and automatically into the machine from the hopper above, and, entering the cylinder, encounters the swiftly revolving "paddles," and, becoming entangled among the accompanying and surrounding eddies and whirlwinds of air, the particles are, by mutual attrition and collision, ground into sometimes impalpable powder. The coarser particles thrown out are found to have rounded surfaces, instead of broken faces and sharp edges, as would be the case were they simply crushed. The velocity of the paddles is about 2 miles per minute. The dust is drawn out by a suction-fan or blower at the end of the cylinder opposite the feed apparatus. One of these machines, a foot in diameter, requires a power of three horses. Those of 2 feet, $2\frac{1}{2}$, and $3\frac{1}{2}$ feet diameter are rated at 9, 12, and 18 horse-power respectively. The weight of the product and its fineness are determined by the rate of feeding and the speed of the blowing-fan. It may be given any degree of pulverization, from that of fine sand to that of an impalpable powder.

For grinding coffee and spices, dry paints, soft ores, solid chemicals, and easily crushed substances in general, mills with grinding surfaces of cast iron are commonly used. In these mills the rubbing faces of the metal are usually corrugated or ribbed in a manner and to a degree which is determined by the nature of the work to be done. Fig. 7 exhibits a mill of this class, such as is designed specially for grinding soft ores and salt. The cone-shaped grinding portion, or stone, A A, is of chilled iron, and the surrounding casing, B B, is of the same material. The form given both surfaces is such that the actions of gravity and of centrifugal force combine to urge the ground material downward and into closer contact with those surfaces. The grinding cone is capable of adjustment vertically by means of the screwed bar, C, carried in the hollow portion of the vertical shaft D, and turned by means of the horizontal handle at the top. The connection between this bar and the cone is

made by means of a "cotter" passing through a slot cut in the shaft, which has the necessary length to permit the vertical motion. The bevel-gear, E, on the horizontal driving-shaft is not keyed in its place, but is secured by taper keys

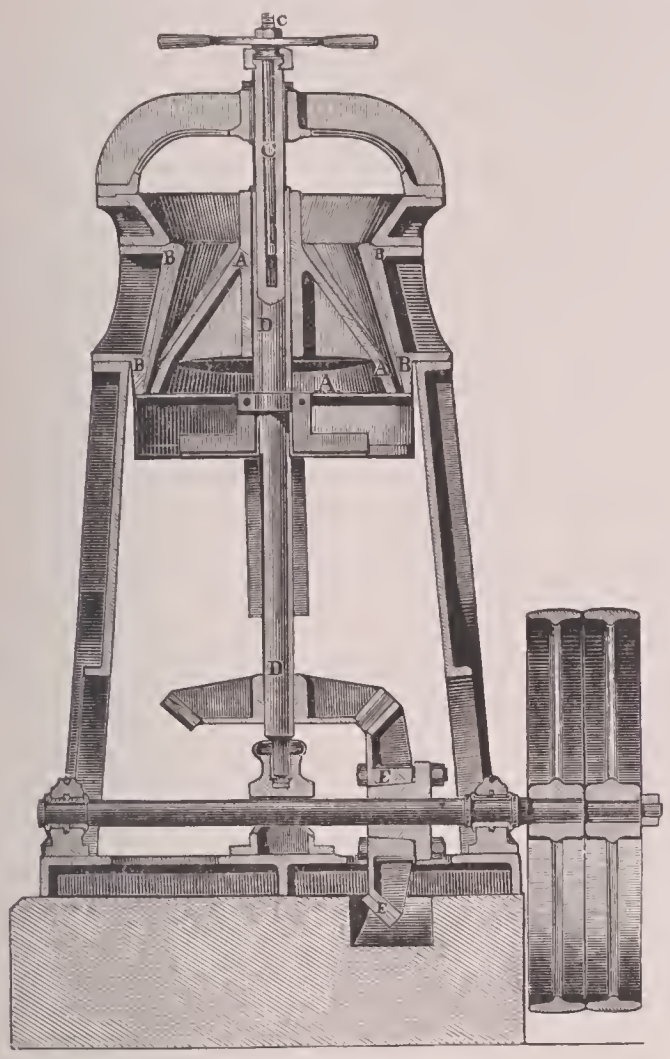



Fig. 7.—Salt and spice mill.

which hold only by friction. Should too heavy a strain come upon the machine, it slips on the shaft, and thus prevents injury of the mill.

Another form of mill which has been extensively used in the U. S. is that of Bogardus. This is shown in section in Fig. 8, where *c c* is the lower plate driven by a vertical shaft revolving in the bearing *h*, and supported by the step *g*, and counterbalanced by the weighted lever *a b*, by means of which the required pressure is applied with steadiness and uniformity. The upper plate, similar in form to the lower, is capable of taking up a motion of revolution, also, about a center out of line with the axis of the lower plate, being screwed by bolts *a a* to the loose collar *f f*. A shoe, *l*, acting upon the collar, causes a vibration which shakes the material in the hopper, and sends it downward as rapidly as it can be ground. A screw, *e*, is so arranged as to prevent the weighted lever from forcing the grinding plates into actual contact when the supply of material to be ground has been

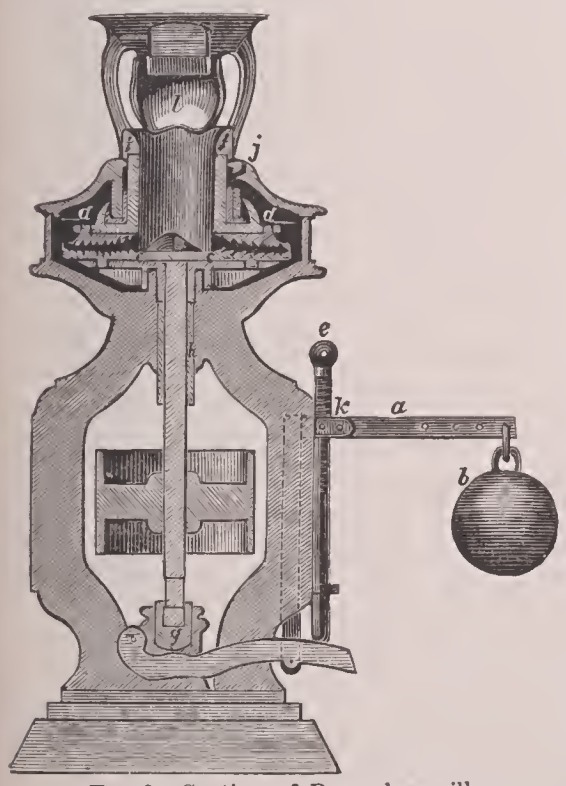



Fig. 8.—Section of Bogardus mill.

nearly or quite exhausted. The counterbalance also acts as a safety attachment, allowing any foreign material too hard to be ground to separate the plates, and to leave the mill uninjured, should such substance by any accident enter it. Fig. 8*a* herewith shows the form of the plates used and their relative position when in place. They should be made of carefully selected and strong chilled iron. Their centers being out of line with each other, their peculiar form gives them a relative motion which is admirably adapted to grinding. These mills are driven from 600 to 800 revolutions per minute. The weight of material ground varies greatly with its character and with the degree of fineness of the product. Two tons of black lead, 1 to 2 tons of dry bones, 3 to 4 tons of iron ore, 1½ tons of white lead in oil, half a ton of bark, 4 to 5 tons of oilcake, and twenty barrels of sugar per hour are said to represent the average work of a mill 16 inches in diameter. The power required is stated at from three-quarters to one and a quarter horse-power. The peculiar form of the plates and their eccentricity of position cause an unusual rapidity of discharge and freedom from liability to choke, thus permitting the grinding of adhesive substances which would obstruct ordinary mills. These peculiarities produce also a uniform action over all portions of the grinding surfaces, and consequent durability.

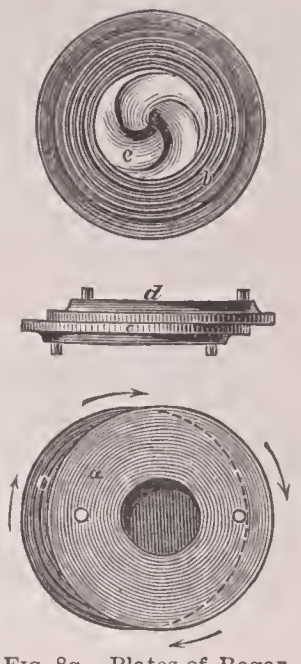



Fig. 8*a*.—Plates of Bogardus mill.

For grinding grain a standard mill is shown in Fig. 9. The grinding surfaces are the faces of two stones, one of which is secured to the frame A which supports the hopper E, and carries the bearing C of the driving-shaft. The other stone revolves, in close proximity to the first, upon the spindle J, which receives its motion from the driving-shaft. The stones are surrounded by a cylindrical casing, C C, which supports the hopper above. This casing is divided at the middle, in order that the upper portion may be removed to allow of the adjustment or repair of the top stone. The upper portion is made lighter than the lower, and frequently of thin sheet iron. The top is open to allow free access of air. The shaft F drives the spindle J by bevel gearing, as shown, or frequently the spindle is driven directly by means of belting. The upper stone is balanced upon the spindle, instead of being rigidly attached, in order that it may adjust itself freely to the slightly irregular distribution of grain between it and the lower stone. The spindle J rests upon a "step" of bronze or other alloy well adapted for machinery bearings. It is so fitted as to be capable of adjustment in all directions, and is supported by a lever, M, which is raised or depressed by the screw and nut N, thus determining the pressure upon the substance passing through the mill and the degree of fineness to which it is ground. The hopper E receives the grain, and, falling downward, it passes through the tube O, flows over the

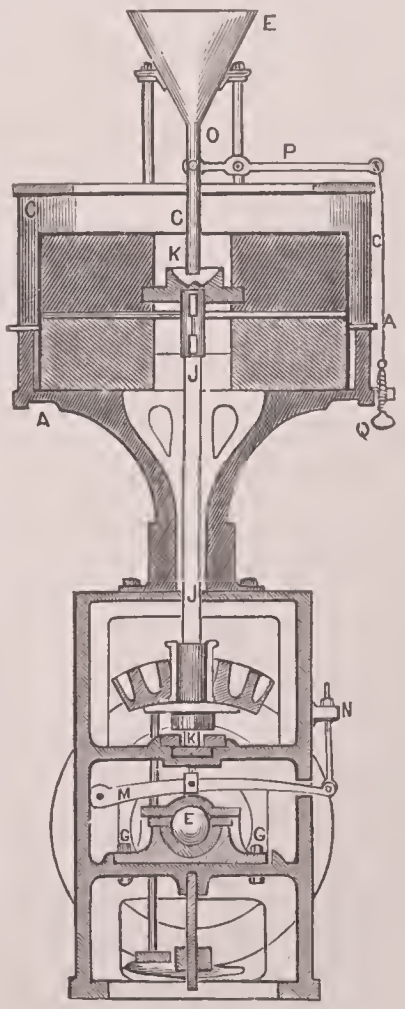



Fig. 9.—Corn-mill.

"rhind" K—the piece of metal by which the upper stone is supported upon the spindle—and enters between the stones. The pipe O is supported by a lever, P, and its height above the rhind can be adjusted by the screw Q upon the side of the standard above N, that screw being connected with the end of the lever by a chain or cord. The pipe being lowered upon the rhind, the flow of grain is stopped; being raised, it allows the feeding to go on with greater and greater rapidity as it rises clear of K.

Many other forms of mill are in use, all, however, containing the essential details of the standard mill just described, and shown in Fig. 9. The framing and the hopper and feed-spouts were formerly, and are still frequently, made of wood. The feeding apparatus is often of different form, and the sizes of stones and speed of mill vary greatly. In some cases, as shown in Fig. 10, mills are constructed having the stones set with their axes horizontal, the special advantages being the convenience with which pressure may be adjusted, and the more rapid feed and delivery secured, which permits higher speed and reduces liability of choking. In other mills the spindle is vertical, as in Fig. 9, but the upper stone is stationary, and secured firmly in the casing, while the lower revolves. This gives somewhat more stability, and therefore increased speed and steadiness of motion. In both the latter forms the stones, being less liable to strike and dull each other than in the preceding style of mill, may be expected to wear longer. Their frames are light, yet strong; they occupy comparatively small space; their spindles are short; and the mill with horizontal spindles may be very conveniently driven from the line shafting. The journals of mills running at high speed should always be made long, to insure freedom from heating. The bearings of the mills with horizontal spindles are often made 8 or 10 inches long.

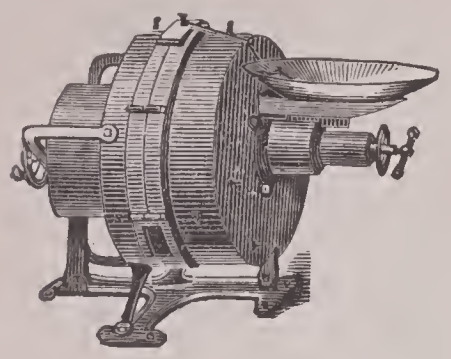


FIG. 10.—Forsman vertical mill.

The stones of the mill Fig. 9 are frequently 4 or even 4½ feet in diameter, and a foot in thickness. They are built up, the lower half of the top stone being of pieces of French burr-stone, cut to fit well and cemented firmly together. The upper half is of plaster-of-Paris. The lower stone is of French burr also, the pieces firmly cemented and bedded upon the frame. In the other forms of mill the stones are usually smaller and are often made in a single piece. Where not of one piece they are strongly cemented and surrounded by a strong iron band to prevent liability of being ruptured by the centrifugal force due to their high velocity of revolution. The fixed stone has usually a perfectly flat grinding face; the moving stone is hollowed toward the center to allow the material ground to flow freely between the grinding surfaces, and in order that a more thorough comminution may be secured during its passage toward the circumference. The faces of both stones are cut, as shown in Fig. 11, with straight grooves, of wedge-formed section, and in directions inclined to the radii. The edges of the grooves are thus given a cutting action somewhat resembling that of scissor-blades, and also a tendency to force the grain outward toward the circumference is secured, and thus the feeding is accelerated and choking is avoided. These grooves are usually cut by hand. Machines have been designed to do this work, but none have been generally introduced. They usually consist of a revolving horizontal shaft carrying diamond cutters, and capable of being adjusted and fed automatically along the proper lines.

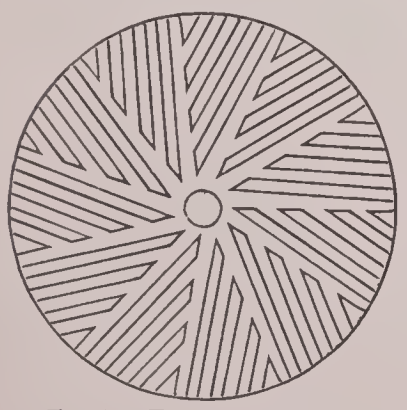


FIG. 11.—Form of mill-stone.

The stone used in mills of the class just described are usually of French burr, a siliceous rock containing many small rough cavities, by which the grains are caught and retained until crushed. The stone is very hard, and wears very slowly. It therefore does not injure the flour or meal by mingling with it in fragments or powder. It is quarried of finest quality near La Ferté-sous-Jouarre, in the geological district known as the Paris basin, where it forms a bed of from 10 to 15 feet in thickness. Great difficulty is found in getting out stones of large size; for this reason the stones of large mills are generally built up of fragments. Quarries of very good stone of the quality desired for millstones are worked near Andernach on the Rhine. This is supposed to be a kind of lava from a neighboring and now extinct volcano. In the U. S. there are several deposits of stone suitable for use in mills, but they are usually inferior to imported stones. A quarry of stone nearly if not quite equal to the French stone has been worked many years in the valley of the Savannah river, about 100 miles above Savannah.

Mills, such as are illustrated in Fig. 9, with stones 4 feet in diameter, driven at the rate of 200 revolutions per minute, grind from 7 to 10 bush. per hour, the quantity varying with the degree of fineness. The power required is usually not far from one horse-power per hour for each bushel ground. In later styles, with smaller stones running at higher speed, the yield is greater and the power is less. With 20-inch stones, making 700 revolutions per minute, the power required varies from five to eight, and the product is from 6 to 12 bush. per hour. A stone 2½ feet in diameter, making 500 revolutions, grinds from 15 to 20 bush. an hour with an expenditure of from 10 to 20 horse-power, the meal produced being in the first case very coarse, and in the latter very fine. Roller-mills are the most successful and their new-process flour is in extensive use. See FLOUR.

R. H. THURSTON.

**Grindstone**: a thick circular disk of stone, usually sandstone, used for bringing dull cutting instruments of steel to an edge, the blade being applied to the edge of the stone, which revolves around a central axis. The best grindstones used in the U. S. are obtained in Berea, O., and on Grindstone island, Nova Scotia. Various forms and materials are also used in making grindstones for cutting glass, gems, etc.

**Grindstone Island**: a small island near the head of the Bay of Fundy, in Albert County, N. B.; has a lighthouse and grindstone-quarries, the products of which are sent to the U. S.—Another GRINDSTONE ISLAND is one of the Magdalen group, in the Gulf of St. Lawrence.

**Gringoire**, or **Gringore**, PIERRE: poet; b. at Caen, France, about 1475. Of his life little is known except what can be gathered from his writings. He went to Paris about 1502 and joined the Enfants sans Souci, one of the foremost literary and dramatic brotherhoods of the time, in which he was promoted to the highest dignity. For this society he wrote farces, *soties*, and satires, which achieved a wide but short-lived popularity. D. about 1547. Though he lived after the Renaissance had brought a new spirit into European literature, he belongs rather to the old school of writers than the new, and his writings have the artificial and allegorical character of the works of the later *trouvères*. Chief among his earlier works is *Le Château de Labour*, while of his later works may be mentioned *Les folles Entreprises*, *Les Abus du Monde*, *La Chasse de Cerf des Cerfs*, *Jeu du Prince des Sots et de Mère Sotte*, *L'Homme obstiné*, *Le Monde*, and *Le Nouveau Monde*. Besides these were many moralities, mysteries, and satires, attacking the Church and society in general. Late in life he became a champion of orthodoxy, and wrote the *Blason des Hérétiques*. To this period also belongs the *Mystère de la Vie de Saint-Louis*. His works were published in Paris by Hériault and Montaigeon (1858–75, 4 vols.).

**Grinnell**: city (founded by Josiah Bushnell Grinnell in 1854); Poweshiek co., Ia. (for location of county, see map of Iowa, ref. 5–I); on the Iowa Cent. and the Chi., R. I. and Pac. Railways; 55 miles E. by N. of Des Moines. As originally laid out, its site comprised 6,000 acres of rich prairie land. The tract was deeded to trustees for the founding of an educational institution, which was first known as Grinnell University, and afterward was consolidated with IOWA COLLEGE (*q. v.*). The city has important branch railway connections, is the center of an agricultural and wool-growing region, and has manufactures of flour, gloves, carriages and wagons, worked lumber, and foundry and machine-shop products. Pop. (1880) 2,415; (1890) 3,332; (1900) 3,860.

**Grinnell**, JOSIAH BUSHNELL: See the Appendix.

**Grinnell Land**: a tract of land in the Arctic Ocean; the northernmost land known except the N. of Greenland; first seen in 1850, and mapped in 1854 by Dr. Hayes of Kane's expedition. It was named after Henry Grinnell, who fitted out the Arctic expeditions of 1850 and 1854. The station, Camp Conger, occupied by the Lady Franklin Bay expedition, was on Grinnell Land. It is found to extend slightly N. of 83° N. lat., and has on the N. that part of the Arctic Ocean called Lincoln Sea, which when visited was covered with palæocrystic ice.

**Grippe**: See INFLUENZA.

**Griqualand**, gree'kwa-lănd: two interior districts of South Africa, denominated **East** and **West** respectively. Griqualand East lies between lats. 30° and 32° S. and lons. 28° and 30° E., with Basutoland and Natal on the N. and Kaffraria and Pondoland on the S. Area, 7,594 sq. miles. Pop. 152,618, of whom 4,150 are Europeans. It is a dependency of Cape Colony. Griqualand West is incorporated into Cape Colony. It lies between lats. 27° and 29° S. and lons. 22° and 25° E., N. of the Orange river and W. of Orange Free State. Area, 15,197 sq. miles. Pop. 83,375, of whom 29,670 are Europeans. M. W. HARRINGTON.

**Gri'quas**: called BASTAARDS by the Boers; a mixed race in South Africa, the offspring of Hottentot and Bushwomen by the Boers, or colonists of Dutch descent. Many of them are well-to-do breeders of cattle, and have adopted the habits and religion of Europeans. They inhabit the districts known as Griqualand East and Griqualand West.

**Griscom**, JOHN, LL. D.: chemist and educator; b. at Haneock's Bridge, N. J., Sept. 27, 1774; was for thirteen years prineipal of the Friends' Monthly Meeting School in Burlington, N. J., after which he removed to New York city, and was for more than a quarter of a century an eminent teacher there. With others he organized Rutgers Medical College, in which he was Professor of Chemistry and Natural Philosophy; one of the first to introduce lectures on scientific subjects. He was chiefly instrumental in organizing the Society for the Prevention of Pauperism, and was prominent in many philanthropic movements. D. at Burlington, N. J., Feb. 26, 1852. C. H. THURBER.

**Grisebach**, gree'se-bäăkh, AUGUST HEINRICH RUDOLPH: botanist; b. at Hanover, Germany, in 1814; studied medicine and botany at Göttingen and Berlin; was sent by the Hanoverian Government in 1839 to study the flora of Turkey; traveled through Thrace, Macedonia, Albania, and Bithynia, and in 1841 was appointed Professor of Botany at Göttingen and director of the botanical garden. He published *Reise nach Rumelien und Brussa* (2 vols., 1841); *Spicilegium floræ Rumelicæ* (2 vols., 1843–45); *Flora of British West India Islands* (1864); *Die Vegetation der Erde* (1872). D. May 9, 1879. Revised by CHARLES E. BESSEY.

**Grisi**, gree'zĕe, GIULIA: singer; daughter of a French topographical officer; b. at Milan, May 22, 1812. She studied at Milan and Bologna, where at the age of sixteen she made her first public appearance in Rossini's *Zelmira*, and captivated the audience by the charm of her voice, manner, and person. Subsequently she achieved triumphs at Florence, Pisa, and Milan. At the Scala she first appeared as Norma. Her efforts to overcome defects of training were so successful that she ranked with Pasta and Malibran. For her the opera *Puritani* was written. In 1836 Grisi married a Frenchman, Gérard de Meley, but the union was unhappy and was legally dissolved. She afterward married Signor Mario, the tenor. In Aug., 1854, they visited the U. S. together, and sang in the principal cities. In later years her residence was in England. She appeared at Covent Garden theater as late as 1864. Before that time her popularity in Italy and France had been on the wane. D. in Berlin, Nov. 29, 1869.

**Grisons**, grĕe'zōn' [Fr., the Germ. name being *Graubünden*]: the easternmost and largest, but at the same time the most thinly peopled, canton of Switzerland; bounded E. by Tyrol, S. by Lombardy, W. and N. by the cantons of Uri, Glarus, and St. Gall. Area, 2,773 sq. miles. The whole canton consists of a system of high and wild mountains, containing 240 glaciers, from which rise the Rhine, Inn, Ticino, and Adda; these rivers form valleys, and thereby give the country its geographical physiognomy. The southern valleys are fertile; wheat, vines, and figs are grown. But the highlands yield only pasturage, and dairying and cattle-rearing are the main sources of wealth. The name Grisons (Graubünden), "the gray league," is derived from the plain gray garment worn by the Swiss farmers who in the beginning of the fifteenth century formed a league and broke the yoke under which the nobility held them. Pop. (1894) 95,469, of whom one-third speak German, and the rest peculiar Romanic dialects. The principal town is Chur (Ital. *Coira*; Fr. *Coire*), with 9,000 inhabitants.

**Griswold**, ALEXANDER VIETS, D. D.: bishop; b. at Simsbury, Conn., Apr. 22, 1766; ordained priest 1795; rector of St. Michael's church at Bristol, R. I., 1804–30; of St. Peter's, Salem, Mass., 1830–35. The eastern diocese of the Protestant Episcopal Church was organized in 1810, and in May, 1811, Dr. Griswold was ordained its first bishop. He published *The Reformation and the Apostolic Office* (Boston, 1843), sermons, etc. D. at Boston, Mass., Feb. 15, 1843. See *Memoirs* by John S. Stone, Philadelphia, 1844.

**Griswold**, MATTHEW, LL. D.: Governor of Connecticut: b. at Lyme, Conn., Mar. 25, 1714; held the office of Lieutenant-Governor of Connecticut for several years; Governor 1784–85; also judge of the Supreme Court; president of the convention which ratified the Federal Constitution 1788. D. at Lyme, Conn., Apr. 28, 1799.

**Griswold**, ROGER: Governor of Connecticut; b. at Lyme, Conn., May 21, 1762; graduated at Yale College in 1780 and was admitted to the bar in 1783. He was member of Congress from 1795 to 1805; appointed judge of the Supreme Court of Connecticut in 1807, and was Lieutenant-Governor 1809–11; Governor 1811–13; was regarded as a man of great talents and legal ability. D. at Norwich, Conn., Oct. 25, 1812.

**Griswold**, RUFUS WILMOT, D. D.: editor; b. at Benson, Vt., Feb. 15, 1815; spent much of his early life in travel at home and abroad; became a printer, then a Baptist preacher, and afterward a journalist. In 1841 he brought out an anonymous volume of poems and a volume of sermons. He became the chief editor of *Graham's Magazine*, Philadelphia, in 1842–43, and of *The International Magazine* of New York in 1850–52. He was author of *Poets and Poetry of America* (Philadelphia, 1842); *Prose-writers of America* (1846); *Washington and the Generals of the Revolution* (2 vols., 1847); *Curiosities of American Literature* (1847); *The Republican Court* (New York, 1854), and other works, and published the first edition of Milton's prose works in America (New York, 2 vols., 1847). He was also engaged as one of the editors of the works of Edgar A. Poe (New York, 3 vols., 1850). D. in New York city, Aug. 27, 1857.
Revised by HENRY A. BEERS.

**Griswoldville**: town; on railway; Jones co., Ga. (for location of county, see map of Georgia, ref. 4–H); 12 miles E. by N. of Macon; noted before the war for its extensive cotton-gin manufactory, and during the civil war for a pistol-factory. Here was fought on Nov. 22, 1864, a bloody battle between a portion of Gen. William T. Sherman's command, under Gen. Charles R. Woods, and a number of the Georgia reserves, under Gen. G. W. Smith, in which the latter lost between 500 and 600 in killed, wounded, and missing, while the Union losses were 84, Gen. Walcott being among the wounded. Pop. not returned separately.
Revised by JAMES MERCUR.

**Groats**: See FLOUR.

**Gröber**, GUSTAV: Romance philologist; b. in Leipzig, May 4, 1844. In 1869 he became privat docent in Zurich; in 1874 Professor of Romance Philology in Breslau; in 1882 professor in Strassburg. He is one of the most eminent living representatives of the new science virtually founded by DIEZ (*q. v.*). He is the founder and editor of the important *Zeitschrift für romanische Philologie* (1876, *seq.*). He is also the editor-in-chief of the work entitled Gröber's *Grundriss der romanischen Philologie* (Strassburg, 1888, *seq.*). To these and other works he has contributed many valuable linguistic and other studies. A. R. MARSH.

**Grocyn**, WILLIAM: philologist; b. at Bristol, England, 1442; educated at Oxford; became prebendary of Lincoln 1486, and about 1489 traveled abroad with the object of perfecting his knowledge of the Greek language, then but little studied in England. After a considerable time spent in Rome in the study of the language under eminent teachers, he returned to Oxford, where he was appointed the first professor of Greek. Grocyn was a friend of Erasmus, whom he entertained at his house in Oxford. D. in 1519.

**Gro'dek**: town of Austria-Hungary; in Galicia; 20 miles S. S. W. of Lemberg (see map of Austria-Hungary, ref. 3–K). The inhabitants are mostly engaged in the cultivation of flax. Pop. (1890) 10,717.

**Grod'no**: government of European Russia; bounded S. and W. by Volhynia and Poland, and N. and E. by the governments of Wilna and Minsk. Area, 14,931 sq. miles. The ground is low and level; in the northern part, in the basin of the Niemen, of a light, sandy soil, covered with immense forests of pine and beech; in the southern part, in the basin of the Dnieper, of a swampy and marshy character. Rye, flax, hemp, and timber are exported in great quantities; cattle and bees are reared; wolves, bears, elks, and roebucks abound in the forests. Pop. (1889) 1,354,425.

**Grodno**: town of Russia; capital of the government of Grodno; on the right bank of the Niemen; 148 miles by rail N. E. of Warsaw (see map of Russia, ref. 7–B). Many of the palaces formerly belonging to Lithuanian noblemen are now decaying, though one built by Augustus III. is still in good repair. Grodno has a medical academy, a cadets' school, two gymnasia, manufactures of weapons, silk, and cloth, and a lively trade. Pop. (1889) 39,826.

**Groesbeck**, William S.: See the Appendix.

**Grolier de Servier**, Jean, Vicomte d'Aguisy: art collector and bibliophile; b. at Lyons, France, 1479; acquired influence at the court of Francis I., and after holding several important commands, represented France as ambassador at Rome, where he became closely associated with savants and literary men of distinction, and made a remarkable collection of the best works of all kinds published at that time. Many volumes were printed expressly for him and bound in most luxurious styles, with the frontispieces and initials painted in gold and colors, each volume bearing the device *Portio mea, domine, sit in terra viventium*, on one side, and *Io. Grolierii et amicorum* on the other. He also made a valuable collection of medals. D. in Paris, 1565. In 1675 the volumes were sold and scattered, but the collection of medals was kept intact and purchased by Louis XIV. Grolier's volumes are much sought after by book collectors, and command very high prices.

**Groningen**, grōn'ing-*en*: northernmost province of the Netherlands; area, 790 sq. miles. It is flat and protected against the inundations of the sea by dikes. It is fertile and well cultivated. Its southeastern part is marshy, but affords good pasturage. Grass-culture, dairying, fishing, and ship-building are the main pursuits of the population. The people belong to the Frisian race and to the Reformed Church. Pop. (1890) 275,356.

**Groningen**: town of the Netherlands, the capital of the province of Groningen; on the Hunse, which here forms a good port, accessible for large vessels, and communicating by canals with the Dollart and the Zuyder Zee (see map of Holland and Belgium, ref. 2–I). Groningen has a university founded in 1614, a public library, a botanic garden, a hospital, and an institution for deaf and dumb. Boat-building is carried on, and there are manufactures of linen and woolen goods, tobacco and cigars, brushes and tiles. Pop. (1890) 56,413.

**Grono'vius** (*Gronov*): the name of a distinguished Dutch family of scholars. The eldest and most famous is Johann Friedrich, classical scholar and critic; b. in Hamburg, Sept. 8, 1611; educated in Jena, Leipzig, Altdorf, Leyden, and Groningen. Professor of History and Eloquence at Deventer in 1642; Professor of Greek and History in Leyden in 1659. D. Dec. 28, 1671. Prolific editor of Latin classics, *Livy*, his masterpiece (1645), the two *Senecas* (1649), *Gellius* (1651), also *Statius's Silvæ* (1653), *Tacitus* (1672), the two *Plinys*, *Sallust*, *Martial*, *Plautus*, and author of many archæological treatises. Cf. Urlichs in J. Müller's *Handbuch d. class. Alterth.*, i., p. 70.—Jakob, his son, b. Oct. 20, 1645, at Deventer. Studied in England; attached to the Dutch embassy at Madrid in 1672; Professor of Belles-Lettres at Pisa, and in 1679 in Leyden. Editor of Greek and Latin writers, such as *Stephanus Byzantius*, *Harpocration Lex.*, *Pomponius Mela*, *Arrian*, *Herodotus*, *Ammianus Marcellinus*, *Curtius*, *Phædrus*, and others. Chiefly remembered as the editor of the monumental *Thesaurus Antiquitatum Græcarum* (13 fol. vols., 1697–1702). D. at Leyden, Oct. 21, 1716.
Alfred Gudeman.

**Gros**, grō, Antoine Jean, Baron; historical and portrait painter; b. in Paris, Mar. 16, 1771. Pupil of David; Legion of Honor 1828; created baron 1824; member of the Institute 1816. He painted several large pictures depicting the campaigns of Napoleon, ceilings in the Louvre and the dome of St. Geneviève, and numerous portraits. One of the best of these is the portrait of *General Count Fournier-Sarlovèze*, in the Versailles Museum. Other works are in the Louvre; his style was stilted and pompous, but is not without serious qualities of color and drawing. D. in Paris, June 27, 1835.
William A. Coffin.

**Grosbeak**, grōs'bēēk [*gross*, large + *beak*, after type of Fr. *grosbec*, grosbeak; *gros*, large, coarse + *bec*, beak]: a popular name of several birds, principally belonging to the family *Fringillidæ*. The U. S. have the evening grosbeak (*Hesperiphona vespertina*), the pine grosbeak (*Pinicola enucleator*), the rose-breasted grosbeak (*Habia ludoviciana*), the blue grosbeak (*Guiraca cærulea*), and others. The cardinal grosbeak (*Cardinalis virginianus*) is the Virginia redbird, a fine songster, often seen in cages. The social grosbeak (*Philetærus socius*) of South Africa is one of the weaverbirds (*Ploceidæ*), which builds a huge roof in some large tree, beneath which sometimes as many as 300 pairs of birds are lodged.

**Grose**, Francis: antiquary; b. at Greenford, Middlesex, England, 1731; resigned his office of Richmond herald 1763; was a paymaster of militia whose convivial habits are immortalized by Burns, who was for a time his associate. Grose published several freely illustrated antiquarian works, which are not of high value, but his *Classical Dictionary of the Vulgar Tongue* (1785) and his *Provincial Glossary* (1787) are of some merit. D. in Dublin, May 6, 1791.

**Gross Aspern**: See Aspern.

**Gross**, Samuel D., M. D., LL. D., D. C. L.: surgeon; b. in Pennsylvania, July 8, 1805; graduated in the Jefferson Medical College, Philadelphia, 1828; in 1835 was elected Professor of Pathological Anatomy in the medical department of the Cincinnati College, Ohio, and in 1840 to the professorship of surgery in the University of Louisville, Ky. In 1850 he was selected to become Dr. Mott's successor in the University of New York, and in 1856 he succeeded Dr. Mütter in his *alma mater*. Author of *System of Surgery*, a cyclopædia of this department of medicine. D. May 6, 1884.

**Grosse Isle**: an island in the river St. Lawrence, 29 miles below Quebec; is 2½ miles long and a mile wide. It is the property of the province, and is used as a quarantine-ground.

**Grossenhain**, grōs'*en*-hīn: town of Germany; in the kingdom of Saxony; on the Röder; 21 miles by rail N. N. W. of Dresden (see map of German Empire, ref. 5–G); has large manufactures of cloth, hosiery, machinery, and cigars. It was a strongly fortified place in the Middle Ages. Pop. (1890) 11,938.

**Grosseteste**, grōs'test' [Anglo-Fr. *grosse*, fem. of *gros*, great + *teste*, head]: Robert, Bishop of Lincoln (probably named *Grosseteste*, great head, from his learning and ability); b. at Stradbrook, Suffolk, about 1175; studied law, physics, and divinity at Oxford and Paris; was made Archdeacon of Wilts in 1214; received other preferments, and in 1214 received the doctorate of theology and became *rector scholarum* at Oxford; defended (1232) the Jews against the king and people; became Bishop of Lincoln 1235; reformed his large diocese with vigor; opposed successfully alike the intrusions of king, nobles, and the pope in local ecclesiastical affairs; was involved in a long controversy with Innocent IV., who strove to fill the richest places in all the Church with Italians and Provençals; was one of the most learned and popular preachers of his day, a voluminous author, and a successful instructor, Roger Bacon being among his pupils. In 1253 he flatly refused to appoint the nephew of Pope Innocent IV., a young Italian, to a Lincoln canonry, but his clergy stood by him, and he kept on as if nothing had happened. This independence has given him his fame. D. at Buckden, Oct. 9, 1253. He is one of the central figures in the history of the thirteenth century. See his *Life* by G. G. Perry (London, 1871) and by J. Felten (Freiburg im Breisgau, 1887), and his letters, ed. by R. Luard, in the Rolls Series (1862).
Revised by Samuel Macauley Jackson.

**Grosse'to**: province of Tuscany, Italy, on the Mediterranean. Area, 1,710 sq. miles. Barren mountains and unhealthful and unproductive marshes occupy much of its surface. Capital, Grosseto. Pop. (1890) 120,836.

**Gross-Glogau**: See Glogau.

**Grossi**, grōs'sē, Tommaso: poet; b. at Belluno, on the Lake of Como, Jan. 20, 1791; passed his whole life as a notary in Milan. He began his literary career by a poem in the Milanese dialect, *La Principe*, which nearly cost him

his life. In 1816 followed two short poems in the same dialect, *La Fuggitiva* and *La Pioggia d'Oro*, the first of which is a model of pathetic poetry. His *Ildegonda*, a romance in verse (1820), made that species of writing fashionable in Italy, and its success led Grossi to try to restore the epic, neglected since the time of Tasso, by his poem, *I Lombardi alla Prima Crociata*. But this poem, printed in 1826 by a generous subscription, did not equal public expectation, and was soon forgotten. In 1834 Grossi published his *Marco Visconti*, which soon became very popular, and three years later his *Ulrico e Lida*. D. at Milan, Oct. 10, 1853.

**Gross Kaniza**: See KANIZA.

**Grossulite**: See GARNET.

**Grosswardein**, grōs-vaar'dīn; town of Upper Hungary; on the Körös; 130 miles E. by S. by rail from Budapest (see map of Austria-Hungary, ref. 6–J). It consists of the town proper, which was formerly a fortress, and eight suburbs. It manufactures oil, vinegar, spirits, tiles, watches, pottery, and wine; has a considerable trade in cattle, and has two Roman Catholic bishops—one of the Latin and one of the Roumanian rite. Pop. (1890) 38,219.

**Grosvenor**, EDWIN A.: See the Appendix.

**Gros Ventres**: See SIOUAN INDIANS.

**Grote**, GEORGE, D. C. L., F. R. S.: historian; b. at Clayhill, Kent, Nov. 17, 1794, of German ancestry; studied at the Charterhouse, and in 1809 entered his father's banking-house as a clerk; became a liberal political writer, and sat in Parliament for London 1832–41, and was distinguished by efforts in favor of the use of the ballot in elections. In 1823 he began to devote much attention to Greek history, and the fruit of his labors was his famous *History of Greece* (12 vols., 1846–56; 6th ed. 10 vols., 1888). His democratic standpoint made him peculiarly fit for a sympathetic interpretation of Athenian history and culture, but the great archæological and epigraphic discoveries made since his day have greatly diminished the scientific value of this work. His other principal works are *Plato and the other Companions of Socrates* (3 vols., 1865; 5th ed. 1888); *Aristotle* (unfinished, 2 vols., 1872; 2d ed. 1879); *Minor Works*, containing essays and reviews (1873). In 1860 he became vice-chancellor of the London University, and in 1869 president of University College. D. in London, June 18, 1871; was buried in Westminster Abbey. See *Character and Writings of G. Grote*, by Alex. Bain, prefixed to *Minor Works*, and *Memoirs*, by Mrs. Grote (London, 1873).

Revised by ALFRED GUDEMAN.

**Grotefend**, grō-te-fent', GEORG FRIEDRICH: philologist and archæologist; b. at Münden in Hanover, Germany, June 9, 1775; educated partly at Hanover and Ilfeld, and a student at the University of Göttingen 1795–97. Grotefend was for nearly thirty years director of the lyceum at Hanover, 1821–49. Much of his professional work was in the field of Latin philology; but his chief claim to fame rests upon his discovery of the key for deciphering the ancient Persian inscriptions of Persepolis. (See IRANIAN LANGUAGES and CUNEIFORM INSCRIPTIONS.) The results of his investigations he presented before the Academy of Science at Göttingen Sept. 4, 1802, having succeeded in deciphering, with comparative accuracy, the cuneiform names of Darius, Xerxes, and Artaxerxes. This discovery formed the basis for further researches, and the inscriptions have since been completely deciphered, thanks to Grotefend's beginning. The interest which he felt also in his own mother-tongue was shown by his founding a society for the preservation of the German language. Among his publications are *Rudimenta linguæ Umbricæ* (1835–38); *Neue Beiträge zur Erläuterung der babylonischen Keilinschrift* (1840); *Zur Geographie und Geschichte von alt-Italien* (1840–42). See the biographical sketch by B. Delitsch-Haupt in *Beiträge zur Assyriologie*, vol. i. D. at Hanover, Dec. 15, 1853.

A. V. WILLIAMS JACKSON.

**Grotius**, HUGO (*de Groot*, de grōt): jurist and scholar; b. at Delft, Holland, Apr. 10, 1583. His father, a learned man, who was burgomaster, sent him to Leyden at the age of eleven, and after three years' residence at the university, under Joseph Scaliger and other eminent professors, he accompanied the ambassadors of the States-General into France. Here he received notice from the king, Henry of Navarre, on account of his precocious learning. Returning to Delft in 1599, he was in the same year admitted to the bar at The Hague, and soon gained distinction by works in various departments of learning, such as editions of the classics (*Lucan*, *Silius Italicus*), and by original compositions. In 1601 he was appointed historiographer of Holland; in 1607 he was made advocate-general of the fisc for Holland and Zealand; and in 1610 the office of pensionary (paid counselor) of Rotterdam was conferred upon him. By virtue of this office he had a seat in the States of Holland, and afterward in the States-General. In these years he gave several works to the world—in 1608 his *De mari libero*, in defense of the freedom of the seas against the pretensions of Portugal and England; in 1610 his treatise in Latin—the language in which nearly all his works were written—on the antiquity of the Batavian republic; and in 1612 he finished his annals and history of Belgian affairs, which, however, did not see the light until after his death. All the time from his first visit to France he had enjoyed the friendship of John of Barneveldt, the grand pensionary of Holland, the head of the states' rights party, and a favorer of Arminian opinions in theology. Grotius shared his opinions in theology and polities; and when, about the time of the meeting of the synod at Dort, the stadtholder Maurice, the head of the national party, with whom the Calvinists sided, caused the arrest of Barneveldt on unfounded charges of secretly plotting for the Spaniards, Grotius also was arrested and imprisoned. The result is well known. Barneveldt was put to death, Grotius was held in confinement, first at The Hague, then in the Castle of Lowenstein, near Gorkum, until Mar. 21, 1621, when he was conveyed, by a stratagem of his wife, in an empty book-chest, to Gorkum, whence he escaped to Antwerp, and from there found his way to Paris. In his imprisonment he was not idle. He translated the *Phœnissæ* of Euripides into Latin verse, wrote an introduction to the jurisprudence of Holland, and composed his important commentaries on the New Testament, together with the treatise on the truth of Christianity. In France he had a pension from the king of 3,600 florins. Here he published, in 1623, his treatise *De jure belli et pacis*, to which modern international law owes its first development. He visited Holland in 1631, but found his enemies still able and willing to make him trouble, and chose Hamburg for his residence in 1632, where he entered the service of Queen Christina of Sweden two years later. He was made a privy councilor and the queen's ambassador in France. His diplomatic life becoming uncomfortable to him, in 1645 he asked for a recall. The queen offered him honorable employment, but he was unwilling to engage longer in the service of courts. He took ship for Germany, encountered a violent storm on the Baltic, and reached Rostock spent with fatigue, to die Aug. 28, 1645.

Grotius was one of the most versatile scholars of his age. His editions of several of the classics, with his elegant translations into Latin verse (especially of the *Anthologia Planudea* and *Theocritus*), show that he possessed high poetic genius, and assure to him a high place among classical scholars. His notes on the New Testament, marked by their purely philological character, and removed from theological bias, would alone have given him a high reputation; his historical and legal writings were the occasional works of a great man; his treatise on the truth of Christianity was long a classic; his theological works prove him to have been a believer in the atoning death of Christ for the sins of men upon an explanation of the doctrine different from that commonly received at the time, and they remove him from the doctrines both of Pelagius and of Socinus. But he will be remembered longest as having first brought system into the law of nature in his preface to the *De jure belli*, and into the law of nations in the body of that work. His mild Christian humanity led him to attempt to bring better principles than those of his age into the intercourse of nations, especially into the laws of war, and his thorough knowledge of Roman law furnished the basis of the system. See *Life of Hugo Grotius*, by Butler (London, 1826), and the work of Hély, *Étude sur le Droit de la Guerre et de la Paix de Grotius* (1875). *De Jure Belli* was translated into English by Whewell in 1853.

Revised by ALFRED GUDEMAN.

**Groton**: village; Tompkins co., N. Y. (for location of county, see map of New York, ref. 5–F); 26 miles S. of Auburn, 40 miles S. of Owego; is situated on the Southern Central Railroad. It has a union graded school, several large machine-shops, and other manufactories, including an immense cooperage and extensive carriage-shops. Pop. (1880) 913; (1890) 1,280; (1900) 1,344.

**Grotta del Cane**, grot'tăă-del-kaa'nā [Ital., Cave of the Dog]: a small cave, 10 feet deep, 4 feet wide, and 7 feet high, in Southern Italy, between Naples and Pozzuoli, remarkable

for its exhalations of carbonic acid gas, in which a candle is instantaneously extinguished and small animals stifled. It received its name from the circumstance that small dogs are generally used to show the experiment. It is mentioned by Pliny, and apparently the exhalations were more powerful in his time than now.

**Grottaglie**, grot-taal'yā: town of Italy; in the province of Lecce, on the highroad between Taranto and Brindisi (see map of Italy, ref. 7–H). It has some cotton-factories, and in its vicinity is found a peculiar red clay eminently suited to the manufacture of earthenware. Pop. 8,880.

**Grotte**, grot'tā: town of Sicily; in the province of Girgenti; about 12 miles E. of the ancient Agrigentum and 11 miles N. E. of Girgenti (see map of Italy, ref. 10–E). It has a considerable sulphur-trade. Pop. 8,775.

**Grouchy**, groo'shee', Emmanuel, Marquis de: marshal and peer of France; b. at Paris, Oct, 23, 1766; entered the artillery in 1781. On the outbreak of the Revolution he was colonel of a regiment of dragoons, advanced to brigadier-general, and fought in 1794 in La Vendée, but was discharged, like all officers of the nobility. After the fall of Robespierre he was reinstated in his former place, and fought with distinction under Joubert and Moreau in Italy and on the Rhine in 1799 and 1800, but was treated somewhat coldly by Napoleon on account of his sympathy for Moreau. On Oct. 26, 1806, he defeated the Prussian cavalry at Zehdenik, and after that time he was much and successfully employed in the campaigns in Prussia, Spain, Austria, and Russia; on the retreat from Moscow he led the body-guard of the emperor, a legion consisting of officers only. On the restoration of the Bourbons in 1814 he was banished from France, and although he was allowed to return in 1815, he was treated with suspicion. He joined Napoleon immediately on his return from Elba, received command, fought successfully in Northern France, and was made a marshal of France. On the afternoon of June 17, 1815, Napoleon having defeated the Prussians at Ligny on the preceding day, he was ordered to pursue Blücher with an army of 34,000 men and 100 guns, and although, on the 18th, he heard the cannonade from Waterloo, and was entreated by his staff to march in that direction, he adhered to his orders and pushed forward toward Wavre. As Napoleon sent no orders to recall him, it seems utterly unjust to lay the burden of the defeat on him. After the battle he collected the scattered remnants of the army and led it back to France, but resigned his command when the negotiations began between the allies and the provisional government. The Bourbons banished him a second time, but, after residing for five years in the U. S., he was permitted to return to his estate near Caen. After the Revolution of 1830 his rank of marshal was acknowledged, and he was created a peer of France. D. at St.-Étienne, May 29, 1847. Besides a number of pamphlets, he published *Fragments historiques*, in vindication of his conduct in 1815, military and diplomatic.

**Ground**: the foundation or basis upon which anything rests. Ground is in the idea what cause is in reality. That which actually causes the movement of the wings of a windmill is theoretically the ground of the phenomenon. Thus *ground* and *sequence* express in one sphere exactly the same correlation as *cause* and *effect* in another. Ground and reason are so far identical as they belong to the same sphere, but a different field is ascribed to them. Reason is objective, and refers to a process; ground is subjective, and refers to the volition. Reason is scientific, ground is moral.

**Ground Bass**: a musical form belonging to an early period of modern music. It consists in a short theme or subject placed in the bass and constantly reiterated throughout the piece. Over this play varied figures and contrapuntal conceits. Both Bach and Händel made occasional use of this device. In modern times Brahms may be mentioned as giving a fine example in his *Variations on a Theme of Haydn* for full orchestra. Dudley Buck.

**Ground-doves**: a popular name for those species of pigeon which seldom fly, but walk or run, often quite rapidly, upon the ground. The ground-dove of the Southern U. S. (*Chamæpelia passerina*) is less than 7 inches long. The genus comprises the smallest pigeons known. The name is also applied to a kind of thrush—the spotted ground-thrush or ground-dove—found throughout the greater part of Australia and Van Diemen's Land, and greatly prized on account of the delicacy of its flesh. Unlike the generality of thrushes, it cares little for trees or bushes and seldom is known to perch on the branches, preferring the tops of low stone-covered hills or rude and rocky gullies. It seldom voluntarily raises itself in the air except to fly from one side of a gully to another.

**Ground-finch**: See Chewink.

**Ground-gru**, or **Ground-ice**: See Anchor-ice.

**Ground-hog**: See Woodchuck.

**Ground-ivy**: See Gill-over-the-ground.

**Ground-nut**, or **Peanut**: See Goober.

**Ground-pines**: See Club-mosses.

**Ground-rent**: See Rent.

**Ground-squirrels**: any one of various rodents intermediate in character between the true squirrels and the marmots. They are of the genera *Tamias*, *Spermophilus*, etc. See Chipmunk, Prairie-squirrel, and Sciuridæ.

**Groundsel-tree** [O. Eng. *grundeswelge*, ground-swallower, by analogy of *grund*, ground for *gundeswilge*, pus-swallower; *gund*, pus + *swelgan*, swallow]: a name given in the U. S. to *Baccharis halimifolia*, *angustifolia*, and *glomeruliflora*, handsome resinous shrubs of the order *Compositæ*. They grow chiefly near the seacoast.

**Gronper** [an adaptation of the Spanish-American name *garrupa*, probably from Port. *garupa*, crupper]: a name popularly applied in the Southern Atlantic and Gulf States to marine fishes of the genus *Epinephelus* or *Mycteroperca*. The species of the genus are numerous, they attain a large size, and are very important food-fishes. F. A. L.

**Grouse** [formed (by analogy of *mouse*, *mice*, etc.) as a sing. to earlier *grice*, grouse, from O. Fr. *griesche*, *poule griesche*, moorhen, liter., gray hen]: a name given to the game birds of the sub-family *Tetraoninæ*, a group of large gallinaceous birds inhabiting the northern hemisphere, and most numerous in North America. They have the head completely feathered except a bare strip above the eye, the tarsus partly or completely feathered, the feathers sometimes, as in the ptarmigan, extending to the toes. The tail consists of sixteen to twenty feathers, and the sides of the neck are frequently adorned with tufts of feathers. The most common and best-known European species are the black grouse (*Tetrao tetrix*) and the red grouse (*Lagopus scoticus*). The former is found all over Central and Southern Europe, and is remarkable for the form of its tail, four or five of the exterior feathers being laterally curved. The red grouse is confined to the British islands, and is the popular game bird. See Blackcock, Capercailzie, Partridge, Pinnated Grouse, and Ptarmigan.

Revised by F. A. Lucas.

**Grove**, Sir William Robert, Q. C., F. R. S.: b. at Swansea, July 11, 1811; was educated at Brasenose, Oxford, and at Lincoln's Inn, and was called to the bar in 1835; gave special attention to experimental physics, and invented valuable electrical appliances, among which was the powerful voltaic battery which bears his name; was Professor of Experimental Philosophy in the London Institution 1840–47. In his remarkable lecture *The Progress of Physical Science since the Opening of the London Institution* (1842), he first advanced the doctrine of the mutual convertibility of the various natural forces, heat, light, electricity, etc., all of them being nothing but modes of motion. This doctrine is further developed in his famous essay *On the Correlation of Physical Forces* (1846). He became Q. C. in 1853; a royal medalist in 1847; president of the British Association in 1866; a justice of the common pleas in 1871; knight bachelor in 1872; and was judge of the high court of justice 1875–87, when he was made member of the privy council. D. in London, England, Aug. 2, 1896.

**Groveton, Battle of**: See Bull Run, Second Battle of.

**Grow**, Galusha Aaron, LL. D.: U. S. party leader; b. at Ashford, Conn., Aug. 31, 1823; graduated at Amherst College in 1844; studied law, and was admitted to the bar in 1847; was member of Congress from Pennsylvania in 1851–53, 1855–57, and 1859–63; he was chairman of the committee on territories 1859–61; was Speaker of the House of Representatives in the Thirty-seventh Congress (1861–63); and was appointed delegate to Baltimore convention in 1864 and 1868; president of International and Great Northern Railroad of Texas 1875. Declined mission to Russia 1876. Elected Congressman-at-large 1894.

**Growth or Development**: gradual natural increase; the increase in size of organisms and the evolution and perfection of their various functions. (For the development of functions, see article on EMBRYOLOGY.) The word growth is also applied to the increase in size of inanimate objects, such as stones, crystals, and other inorganic bodies, but such enlargement is of an entirely different character from that which occurs in living things. In the former growth is due to the addition of particles to the outside, while in plants and animals it is dependent upon assimilation and deposition within through the agency of living protoplasm. Stones grow with extreme slowness, crystals with varying rapidity, according to the degree of concentration of the solution, the nature of the substance, and many other attendant conditions, sometimes with such rapidity as to be distinctly visible to the naked eye. In living things the rapidity and degree of growth are governed largely by the species, the amount and nature of the nutritive material available, and many other circumstances. In some of the lowest forms of life, such as certain bacteria, etc., growth and development to perfect mature organisms require but minutes or hours; in other organisms it is but a question of days; while in higher forms of life years or centuries are required. In man growth is more rapid proportionately during the earliest periods of his existence, and as a rule becomes less and less with succeeding years until it ceases. He attains his full growth at about thirty years, although development of certain of his faculties may continue for years after.

The following table of measurements, founded chiefly upon the figures of Quételet, is generally a fair index of the average height and weight of the two sexes from the time of birth until ninety years. The table is inaccurate chiefly in not showing that girls from about twelve to fourteen are heavier than boys at the same age.

| AGE. | LENGTH (CENTIMETERS). | | WEIGHT (KILOS.). | |
|---|---|---|---|---|
| | Male. | Female. | Male. | Female. |
| Birth | 49·6 | 48·3 | 3·20 | 2·91 |
| 1 | 69·6 | 69·0 | 10·00 | 9·30 |
| 2 | 79·6 | 78·0 | 12·00 | 11·40 |
| 3 | 86·0 | 85·0 | 13·21 | 12·45 |
| 4 | 93·2 | 91·0 | 15·07 | 14·18 |
| 5 | 99·0 | 97·0 | 16·70 | 15·50 |
| 6 | 104·6 | 103·2 | 18·04 | 16·74 |
| 7 | 111·2 | 109·6 | 20·16 | 18·45 |
| 8 | 117·0 | 113·9 | 22·26 | 19·82 |
| 9 | 122·7 | 120·0 | 24·09 | 22·44 |
| 10 | 128·2 | 124·8 | 26·12 | 24·24 |
| 11 | 132·7 | 127·5 | 27·85 | 26·25 |
| 12 | 135·9 | 132·7 | 31·08 | 30·54 |
| 13 | 140·3 | 138·6 | 35·32 | 34·65 |
| 14 | 148·7 | 144·7 | 40·50 | 38·10 |
| 15 | 155·9 | 147·5 | 46·41 | 41·30 |
| 16 | 161·0 | 150·0 | 53·39 | 44·44 |
| 17 | 167·0 | 154·4 | 57·40 | 49·08 |
| 18 | 170·0 | 156·2 | 61·26 | 53·10 |
| 19 | 170·6 | ..... | 63·32 | ..... |
| 20 | 171·1 | 157·0 | 65·00 | 54·46 |
| 25 | 172·2 | 157·7 | 68·29 | 55·08 |
| 30 | 172·2 | 157·9 | 68·90 | 55·14 |
| 40 | 171·3 | 155·5 | 68·81 | 56·65 |
| 50 | 167·4 | 153·6 | 67·45 | 58·45 |
| 60 | 163·9 | 151·6 | 65·50 | 56·73 |
| 70 | 162·3 | 151·4 | 63·03 | 53·72 |
| 80 | 161·3 | 150·6 | 61·22 | 51·52 |
| 90 | ..... | ..... | 57·83 | 49·34 |

Immediately after birth, and for the first five to seven days, the body loses weight, but at the end of ten to twelve days the original weight has been regained. Growth is more rapid during the first year of life, the weight increasing about three to four times and the length more than during any subsequent year. Although full stature is acquired at about the thirtieth year, the body may continue to increase in weight. As a rule, after the fortieth year there is a slight annual decrease both in stature and weight. The diminution in stature is due chiefly to a shrinkage of the intervertebral disks. Some individuals grow heavier instead of lighter, especially so after the loss of the sexual functions. Girls and boys grow in about the same ratio up to about the eleventh year, then girls increase in weight more rapidly than boys, and from about twelve to fourteen are heavier; then boys increase in weight more rapidly, so that at fifteen or sixteen they are heavier than girls and continue so. For the definition of mental growth, see MIND.

EDWARD T. REICHERT.

**Grub** [deriv. of *grub*, dig]: the larva of a coleopterous insect. Larvæ of dipterous insects are called *maggots*; those of *Lepidoptera* are *caterpillars*. The distinction, however, is not always consistently carried through in popular parlance. Thus at certain seasons the gad-fly, which is a dipterous insect, will exceedingly annoy sheep by buzzing about their noses, making constant efforts to deposit eggs in their nostrils. The eggs thus deposited hatch into maggots, but the ailment they cause is called "grubs in the head." Larvæ of the other orders of insects have no special popular names. See ENTOMOLOGY.

**Grubb**, Sir HOWARD: See the Appendix.

**Grubb**, THOMAS: See the Appendix.

**Gruber**, groo'ber, JOHANN GOTTFRIED: author; b. at Naumburg, Prussian Saxony, Nov. 29, 1774; made from 1792 to 1797 extensive studies, though of a somewhat miscellaneous character, at the University of Leipzig. From 1803 to 1810 he resided in Weimar, where he became very intimate with Wieland, of whom he wrote a good biography (2 vols., 1815). In 1815 he was appointed Professor of Philosophy at the University of Halle, and in 1818 he began, with Ersch, the publication of the *Allgemeine Encyklopädie der Wissenschaften und Künste*, which he conducted alone for many years after the death of Ersch. D. Aug. 7, 1851.

**Grub Street**: a London street, described by Johnson as "originally the name of a street near Moorfields, much inhabited by writers of small histories, dictionaries, and temporary poems, whence any mean production is called *Grub Street*." It was originally tenanted by manufacturers of archery material. Marvell first used the name in its opprobrious meaning, as did Swift and Pope and other wits. Pope makes a severe assault in his *Dunciad* on the class who lived there, the most famous of whom are Goldsmith, Johnson, and Fox the martyrologist. During the Commonwealth it was a species of Alsatia, and was a safe refuge for the pursued. For more than a hundred years it was the residence of index-makers, copyists, translators, small writers, etc. A Grub Street author frequently lived a year on £15 or £20. The street is now known as Milton Street, the poet Milton having lived near it at one time.

**Grün**, ANASTASIUS: See AUERSPERG.

**Grün'berg**, grün'bärch [Germ., green mountain]: town of Prussia, in the province of Silesia; beautifully situated on an affluent of the Oder, 34 miles N. W. of Glogau by rail (see map of German Empire, ref. 4–H). It is famous for its wine, and has some manufactures of cloth and leather, woolen goods, twine, and machinery. Besides exporting large quantities of grapes, it annually produces about 700,000 gal. of wine somewhat similar to champagne and highly valued in Russia. Pop. (1890) 16,092.

**Grundemann**, PETER R.: See the Appendix.

**Grundt'vig**, NICOLAI FREDERIK SEVERIN: reformer; b. at Udby parsonage, in the island of Seeland, Denmark, Sept. 8, 1783; studied languages, history, and theology at the University of Copenhagen. In 1808 he attracted some attention by his book on the Scandinavian mythology (much enlarged in 1839; 3d ed. 1870), and still more in 1812 by a powerful picture in dramatic form of the contest between Christianity and heathenism in Denmark. His *World's Chronicle* (1812; new ed. 1837), was written from a positive Christian standpoint, considering all events as divine rewards or punishment. His first large religious work was *Kirkens Gjenmale* (1825), in which he attacked the rationalistic views then reigning in the Danish Church. The dispute was bitter, and brought Grundtvig under ecclesiastical ban from 1826 to 1831. His *True Christianity*, his *Sunday-book*, and many minor essays and papers are principally of practical tendency. He advocated the complete severance of Church and state. He possessed eminent gifts as an exhorter. He was pastor of the workhouse church of Vartou Hospital in Copenhagen from 1839 till his death there Sept. 2, 1872. He also deeply touched the hearts of his countrymen by his hymns and patriotic ballads. His party developed gradually into a school, and his school became an element of reform in Danish civilization. See his *Life* in German by J. Kaftan (Basel, 1878). See DANISH LITERATURE.

Revised by S. M. JACKSON.

**Grundy**, FELIX: jurist; b. in Berkeley co., Va., Sept. 11, 1777; was educated at the Bardstown Academy by Priestley; studied law and became famous in criminal cases; was chosen a member of the convention to revise the constitution in 1799; was elected to the Legislature in the same year; upon the resignation of Judge Todd was appointed

chief justice of Kentucky. Removed to Nashville, Tenn.; was in Congress 1811–15; U. S. Senator 1829–38. President Van Buren in 1838 selected him as Attorney-General of the U. S.; in 1840 he resigned his office, and was re-elected to the Senate. D. at Nashville, Tenn., Dec. 19, 1840.

**Grüneisen**, grün-ī′zen, KARL [in Germ., green iron]: theologian and writer; b. in Stuttgart, Germany, Jan. 17, 1802; studied theology at Tübingen and at Berlin, where he came under the special influence of Schleiermacher. After holding various ecclesiastical charges, he was appointed almoner to the royal court of Würtemberg. D. in Stuttgart, Mar. 1, 1878. Besides his theses for the degree (*De protestantismo artibus haud infesto*, Stuttgart, 1839), and several collections of sermons (1835, 1842, etc.), he published a volume of hymns (1823); several pamphlets relative to the projected union of the different churches in Germany (*Ueber Gesangbuchsreform*, 1839); and with Eduard Mauch, *Ulms Kunstleben im Mittelalter* (Ulm, 1840), etc.

**Gruner**, grün′er, or **Grüner**, WILHELM HEINRICH LUDWIG: engraver and ornamentist; b. at Dresden, Germany, Feb. 24, 1801. After studying copperplate engraving under Krüer, he devoted several years to travel and study in Italy, France, and in Great Britain, where he finally settled, and where most of his important works were executed. He is best known by a number of works on decorative art, among which may be mentioned *Specimens of Ornamental Art*, and monographs on the bas-reliefs of the façade of Orvieto, on the fresco decorations of the Renaissance in Italy, on the presses (*scaffale*) decorated by B. Luini in S. Maria delle Grazie, at Milan, and on his own decorations in Buckingham Palace. He also made decorations in Osborne House and in the mausoleum of the Duchess of Kent. Besides serving a brief term as professor in the Dresden Academy, he made a few short visits to his native city, dying there Feb. 27, 1882.
A. D. F. HAMLIN.

**Grünfeld**, ALBERT: See the Appendix.

**Gruppe**, groo′pe, OTTO FRIEDRICH: philosopher, archæologist, and poet; b. at Dantzic, Prussia, Apr. 15, 1804; entered the University of Berlin in 1825. In 1830 he became a contributor to the *Allgemeine Preussische Staatszeitung*, and his *Antæus* (1831), containing an open attack on the philosophy of Hegel, attracted some attention. In 1844 he was appointed Extraordinary Professor of Philosophy at the University of Berlin. The most noteworthy of his poetical works are his tragedies, *Otto von Wittelsbach* (1860) and *Demetrius* (1861), the latter a completion of a fragment by Schiller. His archæological writings, among which *Ariadne, die tragische Kunst der Griechen* (1830) may be mentioned especially, are very numerous, but are not distinguished by decided originality. D. Jan. 7, 1876.

**Gruter**, grü′ter, JANUS (*Gruytère*, grü′ĕĕ-tār′): classical scholar; b. in Antwerp, Dec. 3, 1560; studied in Cambridge (England) and Leyden; Professor of History in Wittenberg 1589, in Heidelberg 1592. On the siege of the city by Tilly (1622) he lost his private library, and the famous Palatine collection of books, of which he was keeper, was conveyed to Rome soon after. Gruter is best known for his *Inscriptiones antiquæ totius orbis Romani* (2 vols., 1603), which receives its chief value, however, from the famous indexes contributed to it by Joseph Scaliger. He also edited a number of classical authors, such as Seneca, Sallust, Tacitus, Ovid, Cicero, Plautus. His critical talent was not of the highest order, but his erudition was encyclopædic. D. Sept. 20, 1627. ALFRED GUDEMAN.

**Grütli**, grüt′lĕĕ, or **Rüt'li**, rüt′lĕĕ: a small plateau on the western shore of the Lake of Lucerne, in the canton of Uri, Switzerland; renowned as the place where Stauffacher, Fürst, Melchthal, and thirty other confederates met on the night of Nov. 7, 1307, and started the insurrection against Austria which resulted in the independence of Switzerland.

**Gruyère**, grü′yār′, or **Gruyères**: a small town in the canton of Freiburg, Switzerland (see map of Switzerland, ref. 6–C). The most famous cheese manufactured in Switzerland comes from the vicinity of Gruyère and bears its name. See CHEESE.

**Grysbok**, grīs′bok [from Dutch *grijsbok*: *grijs*, gray + bok, buck, antelope]: the *Calotragus melanotis*, a small reddish-gray antelope of the wooded mountains of South Africa. It is extremely active and timid, and its flesh is good.

**Guacharo Bird**, gwăă-chaa′rō-bėrd′ [Amer. Span. *guácharo*, guacharo, liter., sickly, moaning, so called from its cry]: a bird (*Steatornis caripensis*) related to the goatsuckers, but, on account of important structural differences, placed in a separate family or even sub-order. It has a wide, stout, hooked bill, slender body, long wings and tail, and small feet. The plumage is reddish brown, deepest on the back, lighter below, marked with dark bars and heart-shaped white spots. It lives in the northern parts of South America and the Southern West Indies, inhabiting caves and coming out only in the night. The large but shallow nest is built of the excrement of the bird, which consists largely of the seeds and tough coverings of the fruit on which it feeds. The birds become excessively fat, and are caught in great numbers by the Indians, who try out their oil, which is sweet and limpid and used as food. The flesh is also eaten. F. A. LUCAS.

**Guachos**: See GAUCHOS.

**Guadalajara**, gwăă-dăă-lăă-chaa′răă, or **Guadalaxa'ra**: province of Spain; the northernmost part of New Castile; bounded on the N. by the provinces of Segovia, Soria, and Saragossa, on the E. by Saragossa and Teruel, on the S. by Cuenca, and on the W. by Madrid. It is mountainous, covered by the Guadarrama range and its offshoots, fertile, without trees, but rich in minerals. Much wheat is raised here. Area, 4,870 sq. miles. Capital, Guadalajara. Pop. (1887) 201,496.

**Guadalajara**, or **Guadalaxara**: town of Spain, the capital of the province of the same name; on the left bank of the Henares; 35 miles N. E. of Madrid by rail (see map of Spain, ref. 15–F). It is picturesquely situated, well built, contains the magnificent palace of the Dukes del Infantado, and a royal college of engineering, and has manufactures of flannel and serge. Pop. (1887) 11,235.

**Guadalajara**: capital and principal city of the state of Jalisco, Mexico; near the west side of the Rio de Santiago; 408 miles N. W. of Mexico city, and 5,052 feet above the sea (see map of Mexico, ref. 7–F). A branch of the Mexican Central Railroad runs through the place, and will be continued to San Blas. Except Mexico and Puebla, Guadalajara is the largest and finest city in the republic. The streets are wide and straight, and there are numerous public squares, ornamented with trees and fountains. The cathedral, founded in 1561, had the cupolas of both towers shaken down by the earthquake of May 31, 1818, but it has been partially restored, and is one of the finest buildings in Mexico. The government palace, bishop's palace, and mint are all large and handsome structures. The city possesses a university and an academy of fine arts, both in flourishing condition. It is the center of the Mexican cotton and woolen trade, and has several large mills, besides manufactories of a peculiar glazed pottery, saddlery, confectionery, etc. The surrounding region is fertile, and there is an extensive local trade. The climate is dry, temperate, and healthful, though liable to sudden changes; average temperature, 71·7° F. Guadalajara was founded in 1542, and was early an important place. To a great extent it has retained its ancient appearance and customs. Pop. (1895) 83,870. HERBERT H. SMITH.

**Guadalaviar**, gwăă-daă-lăă-veĕ-aar′, or **Turia**, too′rĕĕ-ăă [Guadalaviar is Span., from Arab. *Wādī-al-abyadh*, White river]: a river of Spain; rises in the Sierra Albarracin, in Southwestern Aragon, near the sources of the Tagus, and after a southeastern course of 130 miles, through Valencia, it falls into the Mediterranean.

**Guadalcazar**, gwăă-daăl-kăă-zaar′: a city of the state of San Luis Potosí, Mexico; 40 miles N. E. of the city of Potosí and 15 miles from the railway (see map of Mexico, ref. 6–G); 6,000 feet above sea-level; celebrated for its production of mercury. Pop. 7,600. M. W. H.

**Guadalquivir**, gwăă-daăl-keĕ-veer′ [Span., from Arab. *Wādī-al-kabīr*, the Great river]: a river of Spain; rises in the Sierra de Cazorla, in the province of Jaen, and after a southwestern course of 316 miles through the provinces of Jaen, Cordova, and Seville, it falls into the Atlantic 18 miles N. of Cadiz. It is navigable to Seville, 12 miles below which it separates and forms two islands. Its lower course is sluggish, through a marshy, unhealthful, but fertile tract. Its affluents are: on the right, the Guadalamar and the Jandula; on the left, the Guadajoz and the Xenil.

**Guadalupe**: a river of Texas; a branch of the San Antonio; rises in Edwards County, and after a course of 200 miles falls into the San Antonio 13 miles from its mouth, in Espiritu Santo Bay. It flows for the most part through a beautiful region.

**Guadalupe Hidalgo**, gwăă-dăă-loo′pā-ĕĕ-daal′gō: a village of Mexico, in the federal district; at the foot of the Guadalupe Mountain; 3 miles N. of Mexico city (see map of Mexico, ref. 7–H). Pop. about 4,000. It is celebrated for a chapel built on the spot where, it is said, the Virgin Mary appeared to an Indian lad in 1736; in 1734 the Virgin of Guadalupe was proclaimed the especial patroness of the Indians. The shrine is yearly visited by thousands of pilgrims, and is very richly ornamented. Guadalupe Hidalgo gave its name to a treaty, signed there Feb. 2, 1848, between representatives of Mexico and the U. S.; by this treaty the war was brought to an end, and Texas, California, and the intervening territory were ceded to the northern republic.
HERBERT H. SMITH.

**Guadalupe Mountains**: a range of Northwest Texas and of New Mexico; between the Rio Grande and the Pecos, forming a long spur of the Rocky Mountain system.

**Guadeloupe**, gwăă-dā-loop′: one of the Lesser Antilles, in the West Indies; situated in lat. 16° N., between Dominica and Antigua; area, 618 sq. miles (see map of West Indies, ref. 7–M). Properly it is composed of two islands, separated by a narrow strait called Rivière Salée, or Salt river. The western and larger part is known as Guadeloupe proper, or sometimes Basse Terre, from the capital town; it is entirely mountainous, the highest peak being an active or hardly quiescent volcano called the Soufrière, 4,858 feet above the sea. The eastern portion, or Grande Terre, is mainly a coral formation, slightly undulated and nowhere more than 350 feet high. Both were originally covered with forest, now confined to the mountains. The soil is fertile and well watered; there are a number of hot springs. The climate is damp and warm (average temperature, 78·8° F.), but modified by sea-breezes and generally healthful. Epidemics of yellow fever are now rare. Guadeloupe belongs to France; it is ruled by a governor and elected council, and sends a senator and a deputy to Paris. United to it are the neighboring small islands of Marie Galante, Les Saintes, Désirade, and Petite Terre, with St.-Barthélemy and the French part of St.-Martin. Including the dependencies, the population in 1889 was 165,889, less than a sixth whites, the rest Negroes and mulattoes. Sugar, coffee, and cacao are the principal products. Exports in 1889, valued at over $5,000,000, nearly all going to France; the imports from various countries were somewhat less. Capital, Basse Terre, but Pointe à Pitre is the largest town. Guadeloupe was discovered by Columbus, Nov. 3, 1493; settled by the French in 1633, who finally drove out the Caribs. The British have taken it four times, but it has remained a French possession since 1815. HERBERT H. SMITH.

**Guadiana**, gwăă-dĕĕ-aa′năă [Span., from Arab., meaning river of joy]: a river of Spain; rises in the Sierra Alearaz, in La Mancha; runs for a distance of 30 miles under ground; passes through La Mancha and Estremadura, enters the Portuguese province of Alemtejo, and falls into the Atlantic after a course of 316 miles. It is navigable only for about 35 miles. Its chief affluents are: on the right, the Giguela; on the left, the Javalon and the Ardila.

**Guadix**, gwăă-deech′: town of Spain; in the province of Granada, on the river Guadix (see map of Spain, ref. 19–F). It is an old town, but well built, and contains a fine cathedral, a Moorish castle, and other handsome buildings. It is a bishop's see. In the vicinity are several hot mineral springs. Pop. (1887) 11,989.

**Guaduas**, gwăă′doo-ăăs: a town of Colombia; department of Cundinamarca; 53 miles N. W. of Bogotá, on the road to Honda and the Magdalena; in a beautiful valley, 3,353 feet above the sea (see map of South America, ref. 2–B). It is important for its transit trade, and, having a delightful climate, is much frequented by inhabitants both of the high land and of the river plain. In the vicinity there are hot springs and, it is said, a bed of coal. Sugar-cane and coffee are cultivated in the district. *Jipijapa* or Panama hats are exported in considerable quantities. Guaduas was founded in 1614. Pop. about 9,000; of the district, 11,000.
H. H. SMITH.

**Guahyba**: See JACUHY.

**Guaiacum**, gwī′a-kŭm [Mod. Lat., from Span. *guayaco*, from the native American name]: a genus of trees, natural order *Zygophyllaceæ*, of which the important species are *G. officinale* and *G. sanctum*, small evergreen trees, with blue flowers, growing in the West Indies and adjacent mainland. The wood, commonly called *lignum-vitæ*, is exceedingly hard and heavy, sinks in water, and is much used in manufactures, as for ship-blocks, ten-pin balls, etc. It is exported from the West Indies in logs or billets, of which the sapwood is yellow and the heart-wood greenish brown. It has a peculiar odor when rubbed or heated. *Guaiac resin*, or *guaiac*, is the concrete juice of the same tree, obtained from the wood, and also exported from the West Indies. It comes in deep greenish-brown or olive-colored brittle resinous masses, of feeble fragrant odor, and, after melting in the mouth, of a hot, pungent taste. It is a complex body, containing three acids, a peculiar resin, and other substances. It is completely soluble in alcohol, forming a deep-brown tincture. Guaiac readily oxidizes on exposure, turning green, and from the change of color produced by contact with some animal and vegetable substances is useful as a chemical test, as for detection of blood in stains. It is used sometimes in medicine as a so-called "alterative" in rheumatism and syphilis, and as an emmenagogue and sudorific *G. sanctum* grows in Florida. EDWARD CURTIS.

**Guaira** (or **Guayra′**) **Fall**: See PARANA (River).

**Guaira**, LA, Venezuela: See LA GUAIRA.

**Gualdo-Tadino**, gwaal′dō-tăă-dee′nō: town of Italy; 22 miles N. of Foligno (see map of Italy, ref. 5–E); in the province of Perugia; once fortified, and governing itself under the protectorate of Perugia. In 1815 it was incorporated with the papal states, and in 1833 it was honored with the title of City of Pope Gregory XVI. In its neighborhood are the ruins of the ancient *Tadinum*, where Narses defeated Totila in 552. Pop. 7,500.

**Gualeguay**, gwăăl-ā-gwăă-ee′: a city of the province of Entre Rios, Argentina; on a river of the same name, a branch of the Paraná (see map of South America, ref. 8–E). It is in the midst of a rich grazing district and has extensive meat-curing establishments, over 100,000 head of cattle being slaughtered annually. Dried meat, hides, tallow, and wool are exported in large quantities from Port Luiz, 7 miles below, where the river is navigable for large vessels; a railway connects this port with the city. Gualeguay was founded in 1783. Pop. (1892) about 12,000. H. H. SMITH.

**Gualeguaychú**, gwăă-lā-gwī-shoo′: a city of the province of Entre Rios, Argentina; about 50 miles E. by N. of Gualeguay (see map of South America, ref. 8–E); on a river of the same name, 8 miles above its mouth in the Uruguay. It is one of the principal cattle-markets of the republic, has very extensive *saladéros* or meat-drying yards, tanneries, and an establishment for preparing extract of beef. The Gualeguaychú river has a bar at its mouth; sea-going vessels load in the Uruguay, 20 miles below the city, and freight is carried down to them in barges. Notwithstanding this disadvantage, the port is the third in Argentina in commercial importance. Pop. (1889) 14,000. HERBERT H. SMITH.

**Guam**: See the Appendix.

**Gu'an**: a name applied to various gallinaceous birds of the family *Cracidæ*, all natives of warm parts of America. One of these, the *Penelope cristata* of Brazil and Guiana, is domesticated in those countries and in Holland, and prized as food. The only species found in the U. S. is the Texas guan or chachalaca (*Ortalis vetula maccalli*), a bird about 2 feet in length, of a dark olivaceous above, lighter below; tail glossy green, all save the middle pair of feathers tipped with gray. It is found in the valley of the lower Rio Grande, in Mexico and Texas, builds a flimsy nest in bushes, and is readily domesticated. F. A. LUCAS.

**Guanabacoa**, gwăă-năă-băă-kō′ăă: a town of Cuba; 3 miles E. S. E. of Havana, and practically a suburb of that city (see map of West Indies, ref. 3–B). It is built on a group of hills overlooking the harbor, and cooled by sea-breezes; in the vicinity there are fine groves, watered by many little streams, and hot springs and baths much frequented by invalids. The town has a small theater, casino, hospital, an old convent, now used as a school, and a fine public square. Many wealthy families reside here, or visit the place during the hot months. It is connected by railway with Havana. Pop. (1899) 13,965; of the district, 28,043. HERBERT H. SMITH.

**Guanacaste**, gwăă-năă-caas′tā: a province of Costa Rica; embracing the northwestern part of the republic, with the peninsula of Nicoya; area, about 4,000 sq. miles. It is crossed from S. W. to N. E. by a chain of mountains, with several active volcanoes and peaks over 5,000 feet high; the whole surface is much broken. There are extensive and

valuable forests, interspersed with open lands affording excellent pasturage. The principal industries are cattle-raising and timber-cutting. Pop. (1892) 20,049. Capital, Guanacaste or Liberia, centrally situated, with about 6,000 inhabitants (see map of Central America, ref. 7–I). Santa Cruz and Nicoya, in the peninsula, are towns of some importance. Until 1858 Guanacaste formed a part of Nicaragua. See Seebach, *Reise durch Guanacaste*, in Petermann's *Mittheilungen*, p. 241 (1865). HERBERT H. SMITH.

**Guanaco**, gwăă-naa′kō [or *huanaco*, Amer. Span., from the native name]: a kind of lama (*Auchenia guanacus*) found from the highlands of Ecuador and Peru to the plains of Patagonia, and even on some of the adjacent islands. The neck and legs are slender, the hair wavy, of a fawn color above, pale yellow to pure white below. The guanaco stands about 3 feet high at the shoulder. This animal is of great importance to the Patagonian Indians, not only furnishing them with the major part of their food, but providing them with clothing as well. The guanaco is regarded as the wild stock from which the domesticated LAMA (*q. v.*) has been derived. F. A. LUCAS.

**Guanahani**, gwăă-năă-haa′nĕĕ: the first American island discovered by Columbus in 1492. It was one of the Bahamas, near the middle of the group, but beyond this it can not be identified. According to Columbus's account, it was flat, covered with trees, surrounded by reefs, and had a lake in the interior. Geographers long identified it with Cat island, but the weight of modern opinion inclines to Watling's island as the first landfall. Various others, as Samana, Acklin, Mariguana, and Grand Turk, have had their advocates. HERBERT H. SMITH.

**Guanajay**, gwăă-naa′chī: a town of Cuba; 26 miles W. S. W. of Havana, with which it is connected by railway (see map of West Indies, ref. 3–B). Pop. (1899) 6,483. It is beautifully situated at the foot of the Anafe Mountains, and is one of the great sanitariums of Cuba. There are extensive coffee plantations in the vicinity. H. H. S.

**Guanajuato**, gwăă-năă-choo-ăă′tō, or **Guanaxuato**: a central state of Mexico; bounded N. by Zacatecas and San Luis Potosí, E. by Querétaro, S. by Michoacan, and W. by Jalisco; area, 11,374 sq. miles. The general surface is a plateau, over 6,000 feet high, but this is much broken by higher land and deep river-valleys. Two principal chains of mountains cross the central and northeastern parts of the state from S. S. E. to N. N. W.; in the southern part an isolated group of volcanic hills surrounds the plain of Santiago, and there are other extensive and fertile plains. Maize and wheat are largely grown in the higher lands, and sugar-cane in some of the warm valleys. Cotton and woolen cloths, pottery, etc., are manufactured in various places. But by far the most important industry is mining; the silver deposits are among the richest in the world; many of the ores contain a large percentage of gold; and there are valuable mines of copper, lead, and quicksilver. From 1812 to 1888 the mint of Guanajuato coined 257,590,997 silver dollars and $20,771,569 of gold; the average yearly coinage of silver is now about $4,500,000; that of gold is falling off. Guanajuato was settled by Spaniards soon after the conquest, and the mines were extensively worked during the colonial period. Pop. in 1895 1,047,238, including about 150,000 semi-civilized Indians, mainly of the Otomi race. The bishopric of Leon corresponds to this state. HERBERT H. SMITH.

**Guanajuato**, or **Santa Fé de Guanajuato**: capital and principal city of the state of Guanajuato; centrally situated in the rocky valley of the Guanajuato river, a small branch of the Lerma, 6,663 feet above the sea (see map of Mexico, ref. 6–G). It is built on very uneven ground, with steep and tortuous streets, but with many handsome buildings, including the government palace, mint, and Jesuit church. There is an ancient university, little frequented. The surrounding region presents a singular appearance, owing to the mining villages on the hills and the many establishments for treating ore in the valleys. The celebrated *Veta Madre* (parent vein), to which the city owes its existence, was long reputed to be the richest in the world. There are about fifty crushing-mills. A short branch railway connects the city and mines with the Mexican Central line. Guanajuato was founded in 1554. It was the scene of several striking episodes of the war for independence. Pop. (1895) 39,337. HERBERT H. SMITH.

**Guanare**, gwăă-naa′rā: a city of Venezuela; capital of the state of Zamora; on a beautiful plain at the foot of hills; 2 miles from the river of the same name and 218 miles S. W. of Caracas; 469 feet above sea-level (see map of South America, ref. 1–C). It lies in a rich grazing region, and is one of the principal centers of the trade in cattle, horses, and mules; coffee, cacao, etc., are cultivated on the neighboring hills. Several highways meet here, and there is an active commerce with Valencia, Puerto Cabello, and Ciudad Bolivar. The city was founded in 1593. Pop., including the immediate vicinity, 10,880. HERBERT H. SMITH.

**Guancavelica**: See HUANCAVELICA.

**Guanches**, gwaan′chez: the aboriginal race of the Canary islands, now extinct, though the chief families of the group boast of their Guanche blood. Partly subdued (1402–05) by Bethencourt, who forced those who submitted to embrace Christianity, they were not wholly conquered till 1495. They were of large stature and possessed some noble traits of character. A short vocabulary of their words has been preserved, and has led some writers to assert that the Guanches were of Berber origin. Catacombs where they placed the embalmed bodies of their dead are shown.

**Guanine**, gwaa′nĭn [deriv. of *guano*]: a white, amorphous powder, insoluble in water, alcohol, and ether ($C_5H_5N_5O$); discovered in guano by Unger in 1844. It does not occur in fresh excrement of birds, but is found in excrements of garden spiders, in the green organ of the river-crab, in the Bojanian organ of the pond-mussel, in the pancreas of horses, in the scales of the bleak, and in concretions of pork diseased with the guanine gout. Guanine combines with acids, bases, and salts, forming well-crystallized compounds. By digestion with hydrochloric acid and chlorate of potassa it yields guanidine and parabanic acid, with some other substances in lesser quantities. Guanidine has the formula $CH_5N_3$, is crystalline and alkaline, with a caustic taste. It combines with acids, forming crystalline salts.

**Guano**, gwaa′nō [= Span. *guano*, *huano*, from Peruvian *huanu*, dung]: properly, the accumulated excrement of birds. In his *The Natural and Moral History of Indies* (Seville, 1590), Father Acosta, a Jesuit priest, speaks of islands off the coast of Peru which resemble hills covered with snow, so deeply are they covered with sea-fowls' dung, and says that the natives use this as a manure and call it guano. Of still older date are the *Commentaries of the Incas*, written by Garcilaso de la Vega, who died in 1568. Garcilaso gives a very interesting account of the manner in which the birds producing the guano were protected by the laws of the Incas, by which it was made a crime punishable by death to kill the sea-fowl, gather their eggs, or even to visit the islands during the breeding-season. Humboldt called attention to the great value of guano, and the sample analyzed by Foureroy and Vauquelin was sent to France by that savant in 1805. He stated that "the guano is deposited in layers 50 to 60 feet thick upon the granite of many of the South Sea islands, off the coast of Peru. During 300 years the coast-birds have deposited guano only a few lines in thickness. This shows how great must have been the number of birds, and how many centuries must have passed over, in order to form the present guano-beds."

About 1840 Peruvian guano was introduced into Great Britain, and in 1842 the Government began to export guano on its own account. From a few thousand tons that were at first imported annually the amount rapidly increased to 500,000 tons per annum. Before the civil war the importation of Peruvian guano into the U. S. had reached 80,000 tons per annum, the greater portion being consumed in the Southern States. At the beginning of the war this demand ceased, but at its close the trade at once revived. The high price which guano commanded soon led to the search for and the discovery of similar deposits in other parts of the world. Large deposits were found on the coast of Chili and Peru, in South Africa, and on numerous islands in the Pacific Ocean and Caribbean Sea, and the importation into Great Britain caused the price to fall to £9 10*s.* per ton. Yet the consumption increased, and the superior quality of the Peruvian over the other varieties being established, its price advanced, and Chincha islands guano was sold in Europe for £13 10*s.* per ton of 2,240 lb., and in the U. S. for $67.50 gold. The Chincha islands, after yielding from 12,000,000 to 15,000,000 tons of guano, became exhausted in 1874. In 1868, when the exportation from the Guañape islands began, the amount of guano upon these and the other Peruvian islands was estimated at 5,000,000 tons. It is probable, therefore, that at an early date these sources of guano will

be exhausted. In various localities upon the west coast of South America, in Bolivia, Chili, and Peru, there are extensive deposits of guano, but of a quality inferior to that obtained from the Peruvian islands. Guano of low grade is supplied by many islands of the Pacific, several of which are in the Auckland group. An act of the U. S. Congress, passed in 1856, granted protection to citizens who should occupy and operate unclaimed deposits of guano, and in 1859 no less than forty-eight islands had been thus secured. "Bat-guano," consisting of the dung of bats and birds, is formed in the caves of many warm countries, and may yet become important. The so-called "fish-guano" is the refuse of fishes caught for their oil. It has a high but unequal value as a fertilizer, and is prepared chiefly in Norway and on the Atlantic coast of the U. S.

*Composition of Guano.*—The composition of guano varies, as may be seen by inspecting the subjoined tables of analyses. The first table represents the composition of guanos containing more or less ammonia-producing compounds, and the second the composition of guanos in which these compounds are quite wanting. (See APATITE.) Of the former class, the Guañape and Ballista only are found in the markets of the U. S. to any extent; and of the latter class, the South Carolina and Florida phosphates have usurped the markets by reason of their cheapness. Extensive deposits of phosphates occur in various parts of the world, and are largely used in the manufacture of the class of fertilizers termed superphosphates. The Guañape islands are situated a few miles off the coast of Peru, in latitude 8° 27′ S., and the Chinchas about 300 miles farther S. These islands, as well as Ballistas, Lobos, and Macabi islands, all of which are situated off the same coast, are the property of the Peruvian Government.

West Indian deposits, where ammonia-producing compounds are mostly wanting. Between these extremes the various grades of guano range. Peruvian and African guanos are white and pungent in odor; that from the Pacific islands is brown and inodorous.

The constituents in guano of value to the agriculturist are ammonia and ammonia-forming compounds, soluble and insoluble phosphoric acid, and potash.

*Adulteration of Guano.*—This practice is by no means uncommon, and consists in adding to a genuine guano of established reputation earth, such as apatite, which resembles the original guano in appearance. Imitations of Peruvian guano have been frequent, this article being the best-reputed of the kind in the market. In purchasing guano, therefore, one must patronize reliable dealers, as it is not possible by any examination within the scope of a practical farmer to distinguish the genuine from the adulterated article. As serious variations in the composition of the genuine Peruvian guano have been noticed, its market price is based on the amounts of nitrogen, phosphoric acid, and potassium oxide they contain, and its sale is subjected to the State laws for the regulation of the sale of commercial fertilizers.

*Application of Guano.*—No definite rules can be given for guano as to what soils will be most benefited, or the necessary quantity. This must be determined by experiment. Peruvian guano should not be applied to crops in its pure state, but should be previously mixed with four times its weight of good soil, thus avoiding the danger of injury to the seed. The amount required per acre depends on its composition, the condition of the soil, and the requirements of the crops, and must for this reason vary considerably. The increasing scarcity of high-grade Peruvian guano

AMMONIACAL GUANOS.

| PARTS, ETC. | Chincha islands. | | | | | Guañape islands. | | | Ballistas isl. | Elide. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |
| Date of shipment | 1804 | 1852 | 1853 | 1857 | 1870 | 1869 | 1870 | 1870 | 1870 | 1858 |
| Ammonia | 10·54 | 15·24 | 16·25 | 16·39 | 15·97 | 11·24 | 13·18 | 11·92 | 10·74 | 10·03 |
| Phosphoric acid, soluble | 11·35 | 9·70 | ..... | 4·17 | 5·02 | 13·58 | 6·09 | 3·35 | 2·95 | 5·19 |
| " " insoluble | ..... | 10·00 | 8·11 | 10·37 | 7·90 | ..... | 8·24 | 13·18 | 13·59 | 6·35 |
| Potash | 2·96 | 3·24 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 5·52 |
| Water | ..... | 8·50 | ..... | 12·68 | 14·35 | ..... | 19·72 | 19·32 | 12·85 | 27·47 |

1. Carried to Europe by Humboldt, and analyzed by Fourcroy and Vauquelin. 2, 3. Imported into Great Britain, and analyzed by Dr. Andrew Ure. 4. Average of analyses of four lots of guano imported into the U. S., analyzed by Prof. S. W. Johnson. 5. Average of analyses of two cargoes imported into New York, analyzed by Prof. C. F. Chandler and F. A. Cairns. 6. Analyzed by Prof. S. W. Johnson. 7. Average of analyses of nine cargoes imported into New York, analyzed by Prof. C. F. Chandler and F. A. Cairns. 8. Average of analyses of six cargoes imported into Savannah, Ga., analyzed by Dr. A. Means and F. Bruckman, M. E. 9. Imported into Savannah, Ga., analyzed by Dr. A. Means and F. Bruckman, M. E. 10. From the coast of California, analyzed by S. W. Johnson. Analysis of Lobos island guano shows 13 per cent. of ammonia.

PHOSPHATIC GUANOS.

| COMPONENT PARTS. | Sombrero isl. | Swan island. | | | Redonda isl. | So. Carolina. | Baker's isl. |
|---|---|---|---|---|---|---|---|
| | 1. | 2. | 3. | 4. | 5. | 6. | 7. |
| Lime | 49·82 | 44·77 | 19·46 | 0·61 | 0·57 | 35·71 | 42·74 |
| Magnesia | ..... | 0·70 | 1·57 | 0·14 | ..... | ..... | 2·54 |
| Sesquioxide of iron | ..... | 1·42 | 5·17 | 9·04 | 14·40 | 15·01 | ..... |
| Alumina | ..... | 1·91 | 10·12 | 14·04 | 16·60 | ..... | ..... |
| Phosphoric acid | 37·83 | 33·38 | 25·39 | 31·05 | 43·20 | 24·95 | 39·70 |
| Sulphuric " | ..... | 0·12 | 0·03 | ..... | ..... | 2·40 | 1·30 |
| Carbonic " | 5·04 | 3·08 | 0·38 | 0·10 | ..... | 2·55 | ..... |
| Silica and insoluble matter | 0·40 | 5·68 | 21·16 | 24·80 | 1·60 | 11·67 | ..... |
| Water expelled at 212° F. | 2·62 | 2·58 | 2·87 | 3·62 | 24·00 | 9·15 | 2·92 |
| " " above 212° F. | 3·50 | 2·70 | 8·30 | 13·81 | | | 8·32 |
| Organic matter | | 2·57 | 5·02 | 1·74 | ..... | ..... | |
| Undetermined matter | 0·79 | 1·09 | 0·53 | 1·05 | ..... | ..... | 2·48 |
| | 100.00 | 100·00 | 100·00 | 100·00 | 100·37 | 101·44 | 100·00 |

1. From Sombrero island, West Indies, lat. 18° 36′ N., lon. 63° 27′ W. from Greenwich, imported into the U. S. in 1859, analyzed by S. W. Johnson. 2, 3, 4. From Swan island, West Indies, lat. 17° 22′ N., lon. 83° W., imported in 1866, analyzed by C. F. Chandler and F. A. Cairns. 5. From Redonda island, West Indies, imported in 1869, analyzed by C. U. Shepard. 6. From Ashley river, S. C., analyzed by C. U. Shepard in 1868. 7. Baker's island, lat. 0° 13′ N., lon. 176° 22′ W., analyzed by J. D. Hague, 1862.

Navassa guano belongs to this class, and has yielded as high as 37 per cent. of insoluble phosphoric acid. This island is situated in the West Indies, E. of Jamaica, lat. 18° 25′ N., lon. 75° 5′ E.

In the tables of analyses the ammonia is calculated as dry ammonia gas ($NH_3$), the phosphoric acid as phosphoric anhydride ($P_2O_5$), and the potash as oxide of potassium ($K_2O$).

Deeply imbedded in the guano are well-preserved remains of aquatic birds and other animals of the present epoch. The phosphatic character of these deposits is due to the fact that these animals feed largely upon fish. The ammoniacal compounds are most abundant in the guanos found in situations where the rainfall is very light and the subsoil of a compact, clayey nature. When the rainfall is abundant these substances are decomposed and leached out, and the earthy constituents remain. Such is the condition of the and variations in its composition have tended to lower its consumption. See FERTILIZERS. Revised by C. A. GOESSMAN.

**Guanta**: See the Appendix.

**Guantanamo**: a town in the province of Santiago de Cuba. Its bay is one of the largest on the south coast. Pop. (1900) 7,137.

**Guarana**, gwăă-răă-năă′: a substance prepared from the seeds of *Paullinia sorbilis*, a climbing shrub of Brazil, order *Sapindaceæ*. The seeds are dried, powdered, then moistened and made into a paste; this, mixed with more of the seeds, either whole or merely bruised, is rolled into cylinders, which on drying form a strong, hard, mottled, reddish-brown mass.

The essential ingredient of guarana is a crystallizable principle apparently identical with caffeine. It is prepared principally by the Indians of the river Tapajós, and is largely used in preparing a drink by the people of Central and Western Brazil. Its physiological effects resemble those of tea, but are stronger. Taken in excess it brings on nervous prostration. Revised by H. H. Smith.

**Guaranine**, gaă-raă-neen′: See Caffeine.

**Guarantee Companies**: business corporations which carry risks where investigation into moral and legal conditions removes largely the element of chance from the company's liability to loss. They thus differ materially from fire, life, and accident insurance companies, where chance practically determines the risk.

The insurance principle was first applied as a matter of pure speculation. In fire-insurance still it is a matter of chance whether there will be a fire. In life-insurance, when and how the insured may die is a pure speculation, but that he will die is certain. In marine-insurance risks are taken even on long overdue vessels, entirely on the theory of chances as to the vessels reaching port in safety. As the virtues of the insurance principle became appreciated, it was applied to other fields where chance had less to do with the liability of the company than other considerations which could be guarded against by previous investigation, and where, with proper care, loss might never come. The companies entering these fields have adopted generally the designation "guarantee" as distinguishing their business in the respects stated from the more hazardous business of the insurance companies.

They have in some cases developed from the prevailing tendency to substitute corporate responsibility for individual responsibility, as in the case of fidelity guarantee or rent guarantee; in other cases, not so much to protect against loss as to save from annoyance and delay, and often from vexatious legal contests, as in the case of title guarantee. In all of these companies the fundamental theory is that proper care exercised at the right time will go far to prevent all loss; in the matter of fidelity, that an investigation into the man's habits, history, and associations will enable the company to determine whether he is, and will be, honest or not; in the matter of title, that a careful investigation by the company at the hands of its own skilled advisers will enable it to pick out with certainty the good titles and run practically no risk whatever in guaranteeing them; that in the matter of rent, a proper investigation into the proposed tenant's career will accurately determine whether the payment of the rent by him is certain or not. So, too, the true province of the investment guarantee companies is not to guarantee against loss on dubious or speculative investments, but to pick out with great care the good ones, those on which there can be no loss, and having done so, to put their stamp upon them so that the inexperienced and the unwary can buy them without risk of deception and loss.

*Fidelity guarantee* was the first development. It originated in London in the year 1840. It provides the protection of corporate capital to employers of every class, against loss by dishonesty and breaches of trust in officers and employees. It takes the place of individual bonds. The guarantee is issued only after careful investigation by the company into the character, habits, and record of the person for whom the guarantee is given, and in practice proves a help both to the employer and the employee. The employer gets a permanent guarantor which renews its guarantee annually and responds promptly on any breach by the employee; and the employee is relieved of the difficulty of securing friends to go on his bond, feels the support which a good record with the guaranteeing company gives him, and feels also the certainty of having to reckon with the company in case of fraud on his part. The business has grown to large dimensions in Great Britain and her colonies, and in the U. S. The expenses of management are large because a force sufficient to make careful, extensive, and rapid investigations has to be maintained; and the losses are also heavy, because even after the most careful investigation the company may be deceived as to the character and trustworthiness of some of the insured. When loss comes it is generally for substantial amounts. The premiums charged, however, are from a half of 1 per cent. to 1 per cent. per annum on the amount of the bond, and furnish a gross income sufficient to stand substantial losses and heavy expenses, and leave satisfactory net incomes for the corporations. The Guarantee Society of London was the first company organized to do this business. The business was introduced into the U. S. in 1872 by the Guarantee Company of North America, a Canadian corporation. The Legislature of the State of New York in 1853 passed the first act enacted in the U. S. authorizing the formation of such companies, but it was not until 1875 that the first company was organized and actually undertook the business under a charter from that State.

*Title guarantee* originated in Philadelphia in 1876. Its fundamental object was the protection of holders of real estate and lenders thereon against loss by reason of defective titles. Previously, titles to real estate had been examined by individual attorneys, and on the strength of their opinions as to title clients had invested their money. If there was a mistake in that opinion, or some misinformation as to the facts of family history or other facts, and the title proved defective, the loss usually fell upon the client. The expenses of the legal examination were heavy, and were repeated from the beginning with each new transaction in the property, because no new purchaser or lender would rely upon the opinion of the lawyer for the previous owner. Experience had shown that the losses were small in comparison with these burdensome and ever-repeated legal expenses. The title-guarantee companies proposed to make a single examination of the title at the hands of their own counsel, and, on approval, to issue an absolute guarantee, which could be reissued to the successive owners or lenders, protecting all equally against loss and saving a large portion of the legal expenses previously involved in each transaction. To facilitate them in their work and to increase their safety, the title-guarantee companies in the large cities make their own copy of the real-estate records, arrange them ordinarily according to the pieces of property affected, and obtain practically a correct ledger account of the record of each lot of land in the city or county. When requested to guarantee the title to a lot, this record of the lot is passed through the law department of the company, investigated by lawyers skilled in the work, and if approved and guaranteed, so marked, and the record never again examined back of that point. As the business of the company increases and gradually covers the county, it meets more and more in its law work routes previously traveled in great part before, and reduces, to the manifest advantage of the community, the time required to put through a transaction. After the formation of the original company in Philadelphia, companies were formed in Washington, Baltimore, Boston, and New York in the order named, and thereafter rapidly in all of the principal cities of the U. S.

The system has not been introduced into other countries largely because their land laws are different from those of the U. S. The business of a company in a city like New York or Philadelphia results in guarantees in the course of a year to the amount of from $30,000,000 to $50,000,000.

The title-guarantee companies have done much to change real estate from dead capital, or capital not available in emergencies, into negotiable and available capital. A property with title guaranteed can at once be mortgaged without the delay required under the old system for a re-examination of the title, and a mortgage with title guaranteed can be at once transferred, and is available as collateral at bank or trust company.

The experience of the title-guarantee companies has been that their expense account is heavy because their work is professional work, and increases very much as their business increases; but their losses are small. In the large cities they are less than 2 per cent. of their premiums. The premium charged for the guarantee is paid once and not annually. For an original guarantee it ranges from a little more than a half of 1 per cent. on the small transactions to a little less than a half of 1 per cent. on the large ones. On a transfer of the property or the making of a mortgage upon it, the examination is brought down to date and the policy reissued to the new owner or lender for about a third of the first premium.

*Credit guarantee* brings to a merchant corporate protection against loss on debts due by customers. It is applied on two different systems: one where the merchant submits particular bills of account for guarantee; and the other where the company guarantees the merchant on his whole line of accounts against loss up to an agreed amount named in the policy, after the merchant has himself borne a certain fixed percentage of loss. The former plan was first tried by a company organized in New York in 1887. It was not successful, largely because the merchant under any such plan naturally submitted only his poorest accounts, and the

business proved so hazardous for the company that it was obliged to go out of business. The second plan above mentioned has proved safer and more practicable. It was first put into practice in Newark, N. J., where the United States Credit System Company was organized in 1889. Inasmuch as the merchant stands the losses up to a certain fixed amount, and is interested to lose not even that amount himself, he becomes to that extent an insurer of the guaranteeing company and endeavors to save it from all loss. Under this system the percentage charged is about 3 per cent. per annum on the amount of the guarantee, and the losses are expected to average not much over 1 per cent. per annum. The expense account is large because of the necessity of extensive investigations all over the country.

*Rent guarantee* brings corporate protection to the landlord against loss of rents on leased premises. It originated as an independent business in New York in the year 1892, although it had been previously undertaken to some extent as a department of corporations in Great Britain, formed primarily for other purposes. The principle is applied in two ways, one by guaranteeing to the landlord who has leased his premises that the tenant will pay the rent provided for in the lease; another by guaranteeing to obtain for the landlord a certain net rental, and find the tenant or tenants to pay the rent. The former course is the one adopted by most companies. The premium charged is about 2 per cent. of the rent stipulated to be paid. Statistics as to the losses are meager, but as the companies ordinarily take security wherever obtainable, the chance for loss is not great, and the convenience to landlords would seem to be sufficient to justify the business of the companies.

*Investment guarantee* brings to lenders on mortgage and purchasers of bonds the protection of corporate capital against loss by reason of poorly selected investments. The principle was first applied in Berlin in 1862, where a company was formed to guarantee the payment of mortgages on real estate. The practice does not seem to have been adopted by other countries until 1886, when a company was formed in London to guarantee the payment not only of bonds and mortgages, but of municipal and corporate bonds generally. Since then numbers of companies have been formed in the United Kingdom and the U. S. to do a similar business, aside from the various mortgage companies organized to negotiate mortgages on farm lands throughout the Western States of the U. S., which, as incidental to the sale of their mortgages, have been accustomed to guarantee their payment.

Investment-guarantee companies have been successful or the reverse according to the lines of investment which they have undertaken to guarantee. Those which have undertaken to guarantee issues of manufacturing or industrial bonds where the character of the investment necessarily depends on the future management of the issuing corporation, which is beyond the control of the insurance corporation, have not been successful. Those which have guaranteed mortgage investments, like the original company in Berlin, and which have served really to stamp their approval on the good investments, and not to back up the doubtful ones, have prospered. In companies of the latter class, both the expenses and the losses are small. The premiums average from a quarter to a half of 1 per cent. per annum. For guaranteeing issues of corporate bonds, however, the premium is large, and experience shows that the losses are large.

*Employers' liability guarantee* belongs perhaps to the class of insurance where the risk is almost entirely a matter of chance rather than to the class where investigation can eliminate largely the risk; but many of these companies call themselves "guarantee" rather than "insurance" companies. They protect employers against loss by reason of claims for accidents to their employees. Owners of buildings, manufacturers, and railway and steamboat companies use these corporations and pay them large premiums for protecting them against all damage claims on the part of their employees or others. The guaranteeing company adjusts the claims with the injured and pays them, or, if no amicable adjustment can be made, defends the suits and pays the judgments, if any. Their expenses are heavy and their losses are heavy, but their premiums are large, reaching many thousands of dollars per year, often, on a single policy guaranteeing a railway corporation. The business originated in London in 1880, when the Employers' Liability Assurance Corporation was organized. Its organization followed almost immediately upon the passage by Parliament of the Employers' Liability Act of 1880, which very much enlarged the liabilities of employers for accidents to their employees. As against these companies an attempt has been made to form an employees' guarantee company, the purpose of which is to take up in behalf of the employee who has been injured the legal fight against the employer or the employers' guarantee company, and guarantee to a member at least the best of legal ability in aid of a recovery on his claim against his employer. A company for this purpose was formed in New York in 1889, but was not successful. In 1892 a "legal protection guarantee company" was formed in London, with the same object.

CLARENCE H. KELSEY.

**Guar'anty** [from O. Fr. *guarantie*, guaranty, warranty, deriv. of *guarant*, earlier *warant*, surety; from O. H. Germ. *werento*, pres. partic. of *weren*, grant, secure, warrant > Mod. Germ. *gewähren*, grant, assure]: a special promise to be responsible for the payment of some debt or the performance of some obligation or duty in case of the failure of another person, who is primarily liable to such payment or performance. It is less broad in its meaning than SURETYSHIP (*q. v.*), as that term includes implied as well as express promises. It requires all the elements essential to give contracts validity. The party promising must labor under no legal disability, and there must not only be a proposal upon his part, but a sufficient acceptance of the offer by the promisee. It is not necessary that acceptance be expressed in a positive declaration, since it may be presumed from acts evincing a readiness to comply with the request or demand upon which the promise was based, as if a shopkeeper should deliver goods to some person through faith in the guarantor's assertion that he would be responsible for the payment if the receiver of the goods were guilty of default. But unless the offer of the guarantor be absolute in its terms, there must generally be notice of acceptance given him, that he may know that the liability which he was ready to assume has become fixed and definite. The promise must be founded upon a valid and sufficient consideration. This may be of but trifling amount, but must have been operative as the inducement to the guarantor's action. If indebtedness had already been incurred, an engagement to pay it in case it were not satisfied by the one primarily liable would be nugatory, on account of the lack of consideration. In such a case as this a new and independent consideration would be necessary. It would be sufficient if the creditor should agree to postpone the collection of the debt for a specified or a reasonable time. If the giving of the guaranty were contemporaneous with the formation of the contract for which the guarantor proposed to be answerable, the consideration which supported the principal agreement would support the collateral one also. It is not requisite that any benefit be received by the party giving the guaranty. It is sufficient that the person in whose favor it is given receive a benefit, or if the person to whom it is given put himself to some inconvenience, or part with some property, or undertake some obligation on the faith of the guarantor's promise. If a person in the form of a guaranty assume an obligation for a claim which would not be enforceable against the original debtor, as if he should promise to be responsible for articles, other than necessaries, supplied to married women or infants, he becomes himself a debtor. The reason is that as the promise of the infant, etc., is void, there is but one valid promise, and that is his own. A guaranty may be resorted to not only as a means of insuring the satisfaction of pecuniary liabilities, but also to secure the faithful performance of duty on the part of public officials, private agents, etc.

After a valid guaranty has been given the rights and obligations of the guarantor are determined upon somewhat peculiar principles. As his engagement is undertaken for the benefit of others, rather than his own, the law is scrupulous in protecting his interests. Hence if any attempt be made to change materially the nature or extent of his liability by subsequent agreement between his principal and the party to whom the guaranty was given, he is, in general, relieved from liability; thus, in the case of a guaranty of the good conduct of a clerk to a partnership, the introduction of new members into the firm as to all subsequent acts performed by the clerk would ordinarily extinguish all liability.

The contract of guaranty does not impose a primary but only a secondary liability; and it is a just and reasonable requirement that diligent efforts be made to collect the sum due of the principal debtor. A mere delay or indulgence

to his principal would not necessarily be sufficient for the guarantor's discharge, since he might not be injuriously affected in consequence. He might, if he desired, discharge the debt himself, and bring an action against the debtor at any time. There is an important distinction between a guaranty of *payment* and of *collection* of a debt or claim. In the case of a guaranty of payment the creditor may proceed at once against the guarantor without any reference to the principal debtor. In a guaranty of collection he must, as the term imports, strive to *collect* the debt from the debtor before resorting to the guarantor, and will be bound to proceed with diligence in his efforts to make such collection. If there should be in any case a valid agreement, without the guarantor's assent, between the creditor and the debtor for indulgence, preventing a resort to legal proceedings for a certain length of time, the guarantor would be discharged. If a guarantor should at any time pay the debt, he would be entitled to be substituted in the creditor's place as to the right to retain any property which the latter held in pledge to secure the claim. This is called in law the doctrine of SUBROGATION (*q. v.*). Sometimes a guaranty is extinguished or discharged because the creditor gives no due notification to the guarantor that the debtor has refused to pay on demand. The rule requiring notice is not, however, so strict as in the case of indorsers of negotiable paper, and the guarantor would not be discharged unless there was an unreasonable delay. The general principle would be the same as that which has been stated as applying to notice of acceptance of the guaranty by the creditor. If the guarantor had made a positive categorical promise, no notice would, in general, be necessary to bind him, but otherwise he ought to be speedily informed, in order that he might be enabled to take advantage of every available means to secure reimbursement from his principal. On this matter of notice the law of the various States is, however, not uniform.

The British Statute of Frauds, which has been substantially re-enacted throughout the U. S., requires that "upon any special promise to answer for the debt, default, or miscarriage of another person, the agreement, or some memorandum or note thereof, must be in writing and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized." A contract of guaranty must accordingly be in writing to be of any legal validity. But in the determination of the question whether certain promises are to be deemed guaranties or original engagements, which might be enforced even though made orally, very nice distinctions have been taken. The form of the undertaking here becomes important. There must of necessity be two promises—one of the principal debtor; the other, of the guarantor. If the transaction results in only one promise, the apparent guarantor will be in fact the true debtor, and no writing will be necessary. If A should say to B, "Let C have so many goods, and I will pay you," there will be but one promise (that of A), and writing will not be required. If A had said, "Charge the goods to C, and if he does not pay you I will," his promise would be void, as it would be collateral to that of C, who would be the true debtor, and would need to be in writing. It is a further rule that the promise need not be in writing unless it is made to the creditor himself. So it has been considered that a promise apparently collateral is not within the statute whenever the leading object of the promisor is not to discharge the debtor, but to subserve some interest of his own distinct from a payment of the debt. An instance of this kind would occur if any person, A, should pay his creditor, B, by an order upon his (A's) debtor, C, with a guaranty that the latter should discharge the debt. This would be, in effect, but a peculiar method adopted by A of discharging his own obligation. This rule, however, has been sharply criticised in some of its aspects by able jurists as working, in many instances, a practical evasion of the Statute of Frauds. Consult Fell on *Guaranties*; Parsons on *Contracts*; Chitty on *Contracts*; Kent's *Commentaries*, etc.

T. W. DWIGHT.

**Guaranty**: in international law, a compact by which a power not a party to a treaty promises its aid in the event of certain specific promises made in the treaty being violated by one of the powers party to the treaty. Such a guaranty may refer to the promise to pay a sum of money or to cede territory, to one relating to the integrity of a state, the right of succession, religious franchises, etc. (See Woolsey's *Introduction*, § 105.) A guaranty requires the party making it to give the kind and amount of aid promised in a case to which, in his judgment, the promise applies. If the promisee declines his aid, he is under no obligation to give it; but general guaranties are dangerous, because they furnish pretexts for interference. If a debt is guaranteed, and is not paid, Vattel holds that the promisor is not bound to make it good, but only to do his best to induce the party owing the debt to fulfill his engagement. A *surety* would be obliged, says the same author, to do what the principal party has failed to do, but not the guarantying party. In the Middle Ages vassals or towns sometimes attached their seals to a political engagement of their sovereign, and persons watched over the execution of treaties, called conservators. Out of these usages modern political guaranties have grown.

**Guaranys**, or **Guaranís**, gwăă-răă-neez': a great race of South American Indians who at the time of the conquest occupied most of the present territory of Paraguay, with portions of Southern Brazil and Northeastern Argentina, and much of Uruguay. By language and customs they were closely allied to the Tupís of Brazil. They were divided into many hordes with different names, having little or no tribal union. The Guaranys lived in fixed villages; they had made some little progress in primitive arts, had no religion beyond a vague fear of demons and respect for their medicine-men, and the power of their chiefs was very limited. Most of them readily submitted to the Spaniards. The Jesuits established their most powerful missions among the Guaranys of Paraguay, and adopted the language for the general use of the missionaries. Many of the first conquerors formed unions with the Guarany women, and Guarany, in a corrupt form, and with much intermixture of Spanish, became the common language of Paraguay, where it is still generally spoken; many devotional books, and even a newspaper, have been printed in it. The population of Paraguay is mainly derived from the mixture of the Guarany and Spanish races, and Guarany blood, mingled with that of Spanish, Portuguese, African settlers, and of other Indian tribes, is common in the country population of Southern Brazil and Uruguay. A few hordes, as the Ka-ás of the upper Paraná, remain in a wild state, and the Indians of the disputed territory of Missiones, between Argentina and Brazil, are still called Guaranys. See Valle Cabral, *Bibliographia da lingua Tupí ou Guaraní* (Rio de Janeiro, 1880). The best works on the language are those of Montoya (1639, etc.), republished by Porto Seguro with the title *Gramatica y diccionarios de la lengua Tupí ó Guaraní* (Paris and Vienna, 1876).

HERBERT H. SMITH.

**Guaratinguetá**, gwăă-răă-tĕĕn-gwā-taá: a city of the state of São Paulo, Brazil; 3 miles N. of the Parahyba river; on the railway between São Paulo city and Rio de Janeiro (see map of South America, ref. 6–G). It is the center of a rich coffee region, and has a flourishing trade. Pop. about 10,000. H. H. S.

**Guard**: See FENCING.

**Guardafui, Cape**: See CAPE GUARDAFUI.

**Guardi**, goo-aar'dĕĕ, FRANCISCO: a Venetian painter; b. in 1712; a follower of Canaletto, whose drawings he sometimes painted, which accounts for his work being often taken for Canaletto's. He had great facility of invention, and his rapidity was remarkable. He often painted a picture in three days. Many of Guardi's works are in England, but four of the best are in Venice. D. in 1793. W. J. S.

**Guard, National**: See NATIONAL GUARD.

**Guardian** [from O. Fr. *guardien*, deriv. of *garder*, of Teuton. origin; cf. Germ. *warten*, Eng. *warden*, etc.]: the custodian of a minor or of any one who is unable to take care of himself. Guardians are of various kinds, and may be divided into two general classes: I. Those who become so by operation of law, without the need of any specific appointment. II. Those who are appointed by courts or by a parent, either in pursuance of some inherent power residing in the appointing tribunal or in accordance with the provisions of particular statutes.

I. The first class includes those kinds of guardians existing at common law, which were four in number: (1) guardian by nature; (2) guardian by nurture; (3) guardian in socage; (4) guardian by estoppel. These forms of guardianship still have a recognized existence in England, and also in the U. S., so far as the fundamental changes which have been made in the laws of inheritance render them admissible in the latter country. (1) A *guardian by nature* was originally one who

had charge of the person, but not of the property, of an heir-apparent until he became twenty-one years of age. This authority was vested primarily in the father, but in case of his death could be exercised by the mother. As in the U. S. all the children of a family inherit equally, guardianship by nature appertains to no particular one among them, but includes the whole number, and, as regards a parent's authority and duties, constitutes the same legal relation that is usually considered in law under the topic of PARENT AND CHILD (*q. v.*). (2) A *guardian by nurture* had charge of the persons of the younger children, who were not heirs-apparent, but his authority terminated when a child reached the age of fourteen. The laws of equal inheritance in the U. S. cause guardianship by nurture to be identical with guardianship by nature, so that, as a distinct relation, it has virtually become obsolete. (3) A *guardian in socage* had custody not only of an infant's person, but also of his lands. Whenever a child under the age of fourteen acquired socage lands by descent, that one of his relatives who could by no possibility inherit the estate had the right to undertake the control of his person and the management of his inheritance until that age was reached. If the child possessed personal property, the guardian might take charge of this also as incidental to his principal trust. The infant upon reaching the age of fourteen had the right to choose a new guardian, but if he failed to exercise this privilege the previous guardianship continued. In the U. S. this form of guardianship is generally superseded by the appointment of guardians by will or action of the courts, though in default of such appointment it is sometimes retained, with important modifications. Thus capacity to inherit the lands would no longer be regarded as a disqualification in the guardian. (4) *Guardianship by estoppel* takes place when a stranger or a wrong-doer interferes with the management or disposition of a minor's property, as by receiving to himself the rents and profits of land. He will then be compelled in a court of equity to account as a guardian, and will be *estopped* from denying a fiduciary relation to the minor's estate.

II. Guardians who are appointed by courts or parents are much more frequently met with than those just described. When the appointment is made by virtue of an inherent power residing in a particular court, the guardian is either (1) a guardian in chancery or (2) a guardian *ad litem*. Other guardians are selected by virtue of statutory provisions, and when appointed by courts are either (3) guardians appointed by probate or surrogate courts, or (4) those appointed by other courts under special statutes. Statutory guardians who are appointed by parents are termed (5) testamentary guardians.

(1) The English court of chancery assumed the power to appoint guardians as incidental to its general jurisdiction over minors and their estates, and this long constituted one of its important prerogatives. In the U. S., courts exercising equity powers have generally retained the same authority, though in some instances the right has been defined anew by statute or in some degree qualified. The guardianship continues until the ward reaches the age of twenty-one. If the appointment is made when he is over fourteen, his selection is commonly allowed to guide the decision of the court, but when he is under that age the court exercises an independent discretion. The wishes of parents and friends will, however, be considered. The guardian is required to give bonds for the faithful management of the ward's estate. (2) Every court in which an infant is one of the parties to a particular suit has a special and necessary power to appoint a guardian *ad litem* (i. e. for the litigation), to protect the infant's interest during the course of the proceeding. A general guardian will not be permitted to act in such a capacity unless he receives a particular appointment for the purpose. An attorney-at-law is frequently selected, particularly in cases before courts of equity. (3) The ecclesiastical courts of England had no inherent power to appoint general guardians, and it was therefore necessary for the authority to be conferred by statute. Powers of this kind have been quite generally created throughout the U. S. The same principles generally apply to appointments when the infant is above or under fourteen as have been stated in reference to chancery guardians. Courts of equity often exercise a supervisory control over the action of surrogates or probate officers, and may remove guardians appointed by them if good cause be shown, as well as those appointed in other modes. (4) In some States statutes have been passed giving particular courts designated the power to appoint guardians in special instances. Reference must be made to the statutes themselves, and the fact need only be alluded to here for the sake of completeness. (5) Testamentary guardianships are created by the last will of a father, and give the appointee rights superior to the claims of other guardians, and continue until the ward arrives at majority. They are, however, under the control of the court of chancery, may be held to account there, and may be removed if unfaithful. They were introduced by statute in the reign of Charles II. to remedy a defect in the law growing out of the abolition of military tenures whereby children were permitted to enter upon their estates at the early age of fourteen. Statutes have been generally enacted in the U. S. containing substantially the same provisions. The right of appointment is personal to the father, and can not be delegated. It is sometimes qualified, as in New York, by a requirement of the consent of the mother. Testamentary guardians are under the control of courts of chancery in the same manner as other guardians.

The authority of a guardian over the person of his ward is in many respects the same as that which a parent possesses. He has a right to direct the child's education, both in the common branches of learning and in religious training. He may, moreover, act as a parent in changing the child's domicile. If a ward marries, the guardianship of the person terminates, and in the case of a female child the same has been held true of the property. In the management and disposal of personal property a guardian has very extensive powers, but his only right in the control of a ward's real estate is to receive the rents and profits accruing, and to place the land upon lease so that it may continue profitable. All additions to the infant's personal property, as legacies and distributive shares, pass into the guardian's control, and he possesses power to sell chattels without obtaining the consent of the court, but must at the same time exercise prudence and a wise discretion. The erection of buildings or other improvements upon the ward's land with the ward's money is not allowable at the guardian's discretion; and if the guardian uses his own money for the purpose he can have no claim for its recovery. Authority to perform such acts must be derived from the court of chancery. At common law there was no power to sell the infant's land. A special act of Parliament was necessary. But by statute enacted generally in the U. S., authority has been conferred upon the proper court to grant permission of sale upon petition when it appears by judicial investigation that the ward's interests demand such a course. The subject is regulated in detail by statute and by rules of court. The power of a guardian, in all cases, is local, being confined within the jurisdiction of the court by which he is appointed.

The duties of a guardian are the same in nature as those of all trustees, since guardianship is in reality a personal trust. His action must be guided by a constant purpose to subserve the interests of his ward, and not to promote his own advantage. He can not act for his own benefit in any proceedings which he undertakes to enforce his ward's rights or to increase the value of his ward's property, and if he should in such cases receive personal emolument, it would enure entirely to the advantage of the infant. Property must be kept in a productive condition, and if money is received it must not be suffered to lie idle, but should be profitably invested. Rules of court are sometimes established or statutes enacted pointing out the kind of securities in which a ward's money may be invested, and these requirements must be strictly followed. If the guardian is guilty of undue neglect in employing the funds received as his duty demands, he will be charged with simple interest, and in cases of gross delinquency with compound interest. The court of chancery has power to enforce an accounting by a guardian at reasonable intervals in order to exhibit the condition of the estate, and he may also be called to account by the ward when the latter deems it necessary or when he attains majority. Dealings between a guardian and his ward are very carefully scrutinized by the courts, on account of the position of authority which the former possesses and his power to coerce his ward into unreasonable and imprudent bargains. Hence even after the relation has terminated the guardian is permitted to derive no advantage from contracts made with his ward, unless so long an interval has elapsed that the presumption can reasonably be entertained that no unfair advantage was taken. The amount of compensation which a guardian shall receive for his services is usually determined by statute, and is estimated at a certain percentage upon moneys received and paid out. T. W. D.

**Guard Rent**: See the Appendix.

**Guards**: troops whose nominal duty it is to guard the person of a monarch. In the British service the Household Brigade, as it is called, consists of the First and Second Life Guards, the Royal Horse Guards, the Grenadier Guards (three battalions), the Coldstream Guards (two battalions), and Scots Guards (two battalions). The body-guards for special ceremonial occasions are the Yeomen of the Guard, the Gentlemen at Arms, and the Royal Archers. The actual guard of the British sovereign's person is detailed from one of the first three regiments of heavy cavalry.

**Guárico**: See CAPE HAYTIEN.

**Guarini**, GIAMBATTISTA: Italian poet; b. in Ferrara near the end of 1538; d. in Venice, Oct. 7, 1612. He was great-great-grandson of the celebrated humanist GUARINO DA VERONA (*q. v.*). He studied jurisprudence at Padua, then returned as Professor of Belles-Lettres to Ferrara (1557). Here he married Taddea, daughter of Niccolò Bendidio. Little is known of his private life at this time, except that he had a lawsuit with his father over the division of some property. In 1564 he returned to Padua, became a member of the Academy of the Eterei, and a friend of Tasso. In 1567, however, he went back to Ferrara to enter the service of Alfonso II. d'Este, who trusted him and employed him on numerous missions. The most important of these was to Poland (1574–75), when Alfonso tried to obtain the election to the Polish throne. The mission was unsuccessful; but upon his return to Ferrara, Guarini found himself a greater favorite than ever, especially as the court poet, TASSO (*q. v.*), had now become insane and was confined in the hospital of Sant' Anna, and Guarini alone could rival him in poetical abilities. He did not find the life pleasant, however, and in 1583 he withdrew to his country estate, La Guarina, in the Polesine. Here, too, things went far from smoothly, apparently owing to the poet's proneness to lawsuits, though these could not altogether distract him from composition. In 1585 he was in Turin, at the time of the marriage of Charles Immanuel I. to Catherine, sister of Philip III. of Spain. Fearful of losing him to the duke, Alfonso now recalled him to Ferrara as secretary. He did not long remain, and we find him for a number of years hovering about the little courts of Italy, with occasional periods at La Guarina. He became involved in lawsuits with his own sons, and led an embittered life. His fame grew, however, and in 1611 he had the honor of election as Prince of the Umoristi in Rome, of whose number were Marini, Tassoni, and Chiabrera. In a sense, Guarini's poetical impulse may be said to have come from his desire to rival Tasso. This naturally made his relations with the latter somewhat strained at last, though it did not prevent him from seeing through the press the corrected Ferrarese edition of the *Gerusalemme Liberata* (1581) and Tasso's *Rime* (1582). Up to 1580, however, Guarini produced nothing beyond shorter lyrical pieces—sonnets, madrigals, canzonette, etc.—though many of these had great beauty of diction. In this year, when Tasso's *Aminta* saw the light, he began to think of a more serious composition. The result was the *Pastor Fido*, Guarini's most famous work, which gradually took shape during the next ten years. In 1585 he was able to offer it to Charles Immanuel I., but he did not print it till 1590, and he continued to work upon it until the twentieth edition had appeared (Venice, 1602), to which he adjoined his important treatise, *Compendio della poesia tragicomica*. Long before this, however, the work had attracted widespread attention, and had excited a violent literary controversy with regard to its *genre*, in which the poet himself joined, aiming particularly against a professor of ethics in Padua, Giásone de Nores, two treatises entitled *Il Verato* (1588) and *Il Verato secondo* (1593). The controversy continued throughout the seventeenth century. The *Pastor Fido* itself is what its author called a *tragicommedia pastorale*. The original suggestion seems to have come from the story of Coresus and Callirhoe, which is told by Pausanias (vii., 21, 1); but Guarini made all kinds of changes and additions. The success of his piece came, however, not from the theme, but from the novelty of the conception, the delicacies of the style, the poetic unreality of the situations, the veiled but always discernible learning—in short, the conjunction of qualities dear to the later Renaissance. Its charm was felt by all the cultivated nations of Europe, and most of these soon had translations. That into English was made in 1648 by Richard Fanshaw. Besides the works already enumerated, Guarini left several Latin orations connected with his various missions and public employments; a prose comedy, *La Idropica*, composed in 1582, first played in 1608, and printed in Venice in 1613; a prose dialogue, *Il Segretario, dialogo nel qual non sol si tratta dell' ufficio del Segretario et del modo del compor lettere, ma sono sparsi infiniti concetti alla Retorica, alla Loica, ed alle Morali pertinenti* (Venice, 1594); and a *Trattato della politica libertà*, which was first printed, with a *Life* of Guarini by Ruggieri, in 1818. There is no complete edition of Guarini's works, that of Verona (4 vols., 1737–38) never having been finished. The best edition of the *Pastor Fido* is that of G. Casella (Florence, 1866). See V. Rossi, *Battista Guarini ed il Pastor Fido, studio biografico-critico con documenti inediti* (Turin, 1886); A. Saviotti, *Guariniana* (Pesaro, 1888); F. Th. Richter, *Guarini*, in *Ersch und Grubers Allgemeine Encyclopädie* (Leipzig, 1877).

A. R. MARSH.

**Guarino da Verona**, gwăă-ree'nō-dăă-vā-rō-năă: humanist; b. in Verona, Italy, Dec., 1370. At an early age his abilities attracted attention, and in 1388 he was sent to Constantinople to study Greek at the expense of Paolo Zeni, the rich Venetian. The better to carry out this plan he entered the family of the famous Manuel Chrysoloras (see CHRYSOLORAS, MANUEL) as a kind of amanuensis; and perhaps it was to his enthusiasm that his teacher owed his remarkable reception in Italy not long after. After five years Guarino returned to Italy, and possibly lived for a time in Venice. In 1405 or 1406 he went to Florence, where he was received with admiration and delight by the cultivated circle there devoting itself to the study of antiquity. After a time, however, his success as a teacher and lecturer aroused the jealousy of Nicolò Nicoli, and he found Florence an uncomfortable place to live in. In 1414 he left Florence, and from 1415 to 1418, possibly longer, he was settled in Venice. In 1420 or 1422 he transferred his abode to Verona, where he taught with extraordinary success, having among his pupils some who became distinguished scholars. In 1429 he was invited by the Marquis Nicolò d'Este to Ferrara as tutor to his illegitimate son Lionello. In 1436 he was made Professor of Greek and Latin and of Rhetoric in the university, and he continued to live at Ferrara until his death on Dec. 4, 1460. In many ways he is one of the most interesting figures of the humanistic movement. Unlike most of his fellows, he led an exemplary life, and was true to his wife Taddea Cendrata. His influence as a teacher was almost unbounded, and his theories of education are highly interesting. His literary work, however, was mostly confined to school-books and translations. Among the former may be mentioned his Latin version of the *Erotemata* of Chrysoloras, his *Vocabularius Breviloquus*, and his *Grammaticæ Institutiones*. Among the latter were fourteen *Lives* of Plutarch and several treatises from Plutarch's *Moralia*; Isocrates; Basil's *Homilies*; Strabo. See C. de Rosmini, *Vita e Disciplina di Guarino Veronese e de' suoi discepoli* (3 vols., Brescia, 1805–06); R. Sabbadini, *Guarino Veronese e il suo epistolario* (Salerno, 1885); art. *Guarino* in *Ersch und Grubers Allgemeine Encyclopädie*, by F. A. Eckstein.

LUCY A. PATON.

**Guarne'rius**, or **Guarne'ri**, gwăăr-nā'reĕ: the family name of certain violin-makers of Cremona in the seventeenth and eighteenth centuries. The most famous of the family was GIUSEPPE ANTONIO (1683–1745), known as GUARNERI DEL GESÙ, whose best work ranks with the finest Amati and Stradivari instruments. The other Guarneri hardly attained the first rank as violin-makers.

**Guasipati**: capital of the territory of Yuruari, Venezuela; in the district claimed by Great Britain, and in an important mining district on the river Yuruari, a branch of the Essequibo, in about lon. 62° W., lat. 7° 15′ N. Pop. 3,046.

M. W. H.

**Guastalla**, gwăăs-taal'lăă: town; in the province of Riggo nell' Emilia, Italy, which, together with several large villages—so near as to be almost suburbs—formed the little duchy of Guastalla (see map of Italy, ref. 3-C). This duchy was given in dower by Napoleon I. to his sister Paulina. Afterward it was adjudged by the allied powers in 1815 to the ex-Empress Maria Theresa, and in 1860 it annexed itself to the new kingdom of Italy. The town, which is situated on the Po, 19 miles by rail N. E. of Parma, is the see of a bishop and has a school of music. Pop. 2,648.

**Guatemala**, gwăă-tĕĕ-maa'la, rarely **Guatimala**: a republic of Central America. It lies between parallels 14° and 18° N. and meridians 88° and 93° W., and is bounded on the N. by Mexico, on the E. by British Honduras, and on

the S. E. by Honduras and San Salvador. Area, estimated at 48,290 sq. miles. The boundary with Mexico is not yet well settled. It has a full coast-line on the Pacific on the S. W., but reaches the Caribbean Sea only at the head of the Gulf of Honduras.

*Topography.*—Much of Guatemala is incompletely known and the maps are imperfect. The main chain of mountains runs parallel to the Pacific coast, and only 40 or 50 miles distant. Nearly parallel to this and farther inland is another series of lower and roughly parallel ranges, while beyond these come the departments of Vera Paz and Peten, forming the northern half of the state, the geography of which is practically unknown. The general relief of the country is varied and picturesque. There are no less than thirty-one volcanic summits, some of which are surrounded by an extensive *malpais*, and furnish an abundance of sulphur. The most famous of these is the Volcan de Agua, or Water Volcano, which destroyed old Guatemala with a deluge of water in 1841. It is 13,100 feet high. The water was probably derived from a crater lake. The state is well watered. The streams on the west side have only a short course before the Pacific. Those on the N. and N. E. pass into Mexico and British Honduras. The Motagua, on a branch of which is the capital, is the largest of the streams in Guatemalan territory. It rises between the two sierras, and after a course of 250 miles it falls into the Bay of Honduras near the Honduranian frontier. It is navigable to within 90 miles of the capital. To the N. of it lies Lake Izabal, or Golfo Dulce, which is connected with the sea by the broad strait-like Rio Dulce, and, except for the bar at the mouth of the latter, permits free navigation 50 miles inland. Lake Peten, in the department of the same name, is of irregular form, about 27 miles long and 13 in extreme breadth. It is celebrated for the antiquities found about it, especially on an island in its western portion, on which stands the village of Flores, the capital of the department.

*Climate.*—The climate is a healthful one except in the vicinity of the swamps along the Pacific coast. The mountainous character of the surface gives a triple division to the climatal areas, depending on altitude—viz., *tierra caliénte*, *tierra templáda*, and *tierra fría*, or hot, temperate, and cold districts respectively, the middle one being at elevations between 1,300 and 4,900 feet. The rainfall is from 50 to 80 inches, and is greatest on the eastern coast. The rainy seasons are of the usual tropical type—that is, double. They occur in early summer and in autumn, with a short dry season in late summer and a long one in winter. The autumnal rains grow longer and extend into early winter as the east coast is approached. During the summer rainy season the weather is often tempestuous; cold northers, apparently from the Gulf of Mexico and the U. S., are occasionally felt.

*Productions.*—The mines in the republic are of small importance. About 40,000,000 of pesos of silver have been taken from the mines at Alotepeque, but they are practically exhausted. Lead, coal, and marble are known to exist in considerable quantities, and lithographic stone is said to exist in Zacapa. The fauna is more like that of South than North America. The jaguar, cougar, and tapir are common. Bats are so numerous that villages are sometimes depopulated because of them. The alligators are of different species on the Atlantic and Pacific slopes. Insects, especially mosquitoes, are very abundant. Horses are small but excellent; cattle are raised to some extent, but are generally imported. Vegetation is very rich, especially in the *tierra caliénte*, and the country abounds in magnificent forests of valuable woods, the commercial use of which has barely begun. Maize and haricot beans form the chief sustenance, and rice and wheat are extensively grown. The coffee of Guatemala is so excellent that it rarely gets into the general trade, but is bought on the bush for special markets. Indigo and cochineal were formerly important products, but they are being replaced in trade by the anilines and other artificial colors. Cocoa is extensively cultivated. Among the other productions are tobacco, sugar, vanilla, chili, aloes, sarsaparilla, ipecacuanha, castor oil, and colocynth.

*Population* (1900) 1,574,340. About 60 per cent. are Indians, the remainder mostly half-castes. Descendants of pure European blood are rare, the foreign population numbering 11,331 in 1893. About one-third of the births are illegitimate—due chiefly to the scarcity of priests to perform marriage service. The Indian population is quiet and inoffensive except when under political or religious excitement. Cock-fighting and bull-baiting are the common amusements. Roman Catholicism is the recognized religion, but all sects have freedom of worship.

*Administration.*—The republic is divided into twenty-two departments. The government is representative, and the power is vested in a national assembly, the members of which are elected by universal suffrage for four years and a president elected for six years. The net revenue for 1900 was $9,770,000, and the expenditure $9,611,201. Nearly half the revenue is from duties, and most of the remainder from taxes on spirits, tobacco, etc. More than two-thirds of the expenditure is for public debt, education, and war. On Jan. 1, 1900, the total debt was $34,851,190 in gold. Of this indebtedness $9,087,414 is foreign. The army in 1901 consisted of 7,000 officers and men, and there is a reserve militia of 86,900. In 1895 there were 1,266 schools, with an enrollment of 75,020 and an attendance of 64,015. The expenditure, exclusive of the polytechnic school, was in 1895 $95,-062. There is a railway from San José on the Pacific coast to the capital (85 miles), and another from Champerico, another Pacific coast port, to San Felipe. In 1898 133 miles of the 210 of new lines under construction had been completed. Roads are few, and communication over the country is generally by mule paths. The imports were valued at $4,850,835 in gold in 1898, and the exports at $8,370,555 in 1899. The chief imports were spices, cotton yarn and cloth, woolen goods, and railway, telegraph, and electric-light material. The imports from the U. S. amounted to $785,462 in 1900. The chief export was coffee, valued at $7,390,477. The sugar and fruit trades are developing rapidly.

*Weights, Measures, etc.*—The old Spanish weights and measures are in general use. The unit of currency is the *peso*, or dollar of 100 *centavos* of nominal value of $1.00 of the U. S., but in exchange worth about 45 cents.

*History.*—Many ruins exist to show that there was a high state of civilization among the native races, but these remains have been only partially explored, and appear to be not so important as those of Honduras and Southern Mexico.

In 1524 the Spaniards under Pedro de Alvarado entered the country from Mexico; they easily conquered the Quiches, Cachiquels, and Zutugels; and the audience and captain-generalcy of Guatemala was established, embracing in its jurisdiction all of Central America to the bay of Chiriqui and Chiapas. In 1821 the independence of the country was proclaimed; soon after it joined the Mexican empire of Iturbide, but again became independent in Jan., 1823. In 1824 a confederation of Central American states was formed, and slavery was abolished. The confederation finally fell to pieces in 1839. Then, and for many years after, Guatemala was more or less dominated by Salvador. It completely regained its autonomy in 1851, under Carrera, who was made president at first until 1856, afterward for life. Carrera went to war with San Salvador in 1863, and though the latter state was joined by Honduras, he was successful, occupied the capital of San Salvador, and controlled Honduras and Nicaragua. He died in 1865, and was followed by Gen. Cerna, his own nomination. The liberal party deposed Cerna in 1871, drove out the Jesuits, confiscated their property, and in 1873 placed Barrios in the presidential chair. Barrios pursued a progressive policy. In 1886 Barillas was elected president. Since the end of the confederation in 1851 various attempts have been made to unite the Central American republics, but without success. Guatemala has remained the leading republic, but its financial condition and the ambition of its president have made its recent history troubled. In 1890 cholera and in 1891 smallpox made serious ravages. Manuel Estrada Cabrera was proclaimed president by the National Assembly Sept. 25, 1898, for the term ending March, 1905.

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*Movimiento de población . . . durante el año de 1891* (1892); also U. S. and British *Consular Reports*.

MARK W. HARRINGTON.

**Guatemala, Audience of**: See CONFINES.

**Guatemala la Antigua**, -laa-ăăn-tee'gwăă, or **Old Guatemala**, frequently called merely **Antigua**: former capital of the republic of the same name, destroyed by an earthquake in 1773, was situated in a beautiful valley in lat. 14° 33′ N. and lon. 90° 44′ W., 15 miles W. of the present capital. Before its destruction it was one of the richest, most populous, and most beautiful cities of Spanish America, and had about 60,000 inhabitants. The ruins are still very impressive, and some have been reoccupied. The place was seriously damaged by an earthquake in Sept., 1874. Pop. 14,000. A still older Guatemala was washed away by the Volcan de Agua seventeen years after it was founded by Alvarado.

M. W. H.

**Guatemala la Nueva**, -laa-noo-ā'văă, or **New Guatemala**: capital of the republic of the same name; in lat. 14° 36′ N., lon. 90° 30′ W.; elevation above the sea, 4,932 feet; is on the northern end of a large plain, and is surrounded by ravines (see map of Central America, ref. 4–E). It is laid out in wide, regular streets, and has extensive suburbs. The houses are usually of one story, with extensive courts and gardens, and are solidly built. It has several large and attractive open squares or plazas. The principal building is the cathedral, erected in 1780, of simple and elegant design, occupying a space about 450 feet square. The interior decorations include sculptures in wood, and paintings by native artists. There are twenty-four other churches, a hospital, a university, a medical school, the Government buildings, a mint, and other public buildings. The educational advantages are the best in Central America, and include, besides the university, a normal school, a polytechnic, a military college, and several schools for girls. An excellent museum was founded in 1831, and is maintained by the Sociedád Económica. Water is brought from a distance of 8 miles. The city is lighted by electricity, has modern street cars, and an excellent police-force. Its general air of brightness and prosperity has caused it to be called the Paris of America. Pop. (1895) 65,000. MARK W. HARRINGTON.

**Guatemotzin**, gwăă-tā-mōt-zeen', or **Guatemoc**, gwaa'tā-mōk (also written GUATEMOZIN, QUAUHTEMOTZIN, QUAUHTEMOC, CUAUHTEMOC, etc.): the last Aztec sovereign of Mexico; b. about 1497. He was a nephew of Montezuma II.; was one of the leaders against the Spaniards in 1520; subsequently became high priest, and on the death of Cuitlahuatzin (Sept., 1520) was elected sovereign. He defended Mexico against Cortés in the famous siege, May–Aug., 1521; on the fall of the city attempted to escape in a boat, but was captured by one of the Spanish brigantines (Aug. 13, 1521) and brought before Cortés. The latter was pleased with his noble bearing, and at first protected him, but later he permitted him to be tortured in an unavailing attempt to make him tell where treasure had been concealed. Subsequently Guatemotzin permitted himself to be baptized. He and other captive chiefs were forced to accompany Cortés on his march to Honduras 1524; on the way he was accused of inciting a revolt, and was hanged in Tabasco (early in 1525). HERBERT H. SMITH.

**Guavas**, gwaa'văă [from Span. and Portug. *guayaba*, from Brazilian *guayaba*, *guaiva*]: the fruits of *Psidium pyriferum*, *pomiferum*, *cattleyanum*, *pygmæum*, *albidum*, and other species of the genus, which consists of trees and shrubs of the Asiatic and American tropics, mostly natives of the New World, though cultivated in nearly all warm climates, where they yield important dessert fruits, that of *P. pyriferum* (white guava) being the best. From this is made the guava jelly, a conserve extensively exported, and highly prized for its flavor. It is cultivated to a considerable extent in Florida. The guavas belong to the *Myrtaceæ*.

**Guaviare**, gwăă-vĕĕ-aa'rā: a river of South America, western branch of the Orinoco; rising on the east slope of the Andes, S. of Bogotá, Colombia, and flowing easterly through a little-known region of forests and llanos; length about 725 miles. It is navigable through about two-thirds of its course, and must ultimately be a highway of great importance, though it is now little frequented. The lower portion of the territory drained by it is claimed by Venezuela.

H. H. S.

**Guayane**, or **Guayanna**: a former province of Venezuela, corresponding, nearly, to the present state of BOLIVAR (*q. v.*).

**Guayaquil**, gwī-ăă-keel': the principal port of entry and largest city of Ecuador; on the right bank of the estuary of the river Guayaquil, or Guayas; about 40 miles from the gulf and 100 miles from the open sea; 165 miles in a direct line S. W. from Quito, but 236 miles by the nearest practicable route (see map of South America, ref. 3–A). The river forms an excellent port, but very large vessels can only reach it at high tide; they generally anchor in the gulf, 47 miles below. The city, built on low, flat lands, is composed almost entirely of flimsy wooden buildings; the streets are dirty and badly paved, and in what is called the old town very crooked; the new town contains the principal commercial houses and residences of the richer class, and is well laid out. The climate is hot and unhealthful; severe epidemics of yellow fever are common, and bilious or "Guayaquil fever" is almost always present. More than half of the total foreign commerce of Ecuador centers here, the principal exports being cacao, rubber, coffee, hides, and ivory-nuts. A railway, starting from the port of Duran, on the opposite side of the river, runs to the base of the Andes. Guayaquil was founded in 1535, on the site of an Indian town. It has suffered frequently from earthquakes, fires, pirates, and revolutions. The city is the see of a bishop, and has a theological seminary and a national college. Pop. (1890) 44,772. HERBERT H. SMITH.

**Guayaquil**, GULF OF: an inlet of the Pacific Ocean dividing the coast of Ecuador, at lat. 3° S. It is the largest gulf on the Pacific coast of South America, and forms the best and most secure harbor. At its mouth it is 140 miles wide, narrowing gradually and divided within by the island of Puna; large vessels generally anchor on the inner side of this island, and freight and passengers are carried to the city of Guayaquil by small steamers and lighters. The shores are flat and unhealthful. The river Guayas, the most important of Ecuador, flows into this gulf, which may be regarded as its estuary mouth. HERBERT H. SMITH.

**Guayas**, gwī'ăăs: a maritime province of Ecuador; bounded N. W. by Manabi, N. by Pichincha, E. by Los Rios and Oro, S. by the Gulf of Guayaquil, and W. by the Pacific; area, 8,214 sq. miles; pop. (1885) 95,640. Capital, Guayaquil. Guayas lies entirely in the lowland between the Andes and the Pacific, and much of it is covered with thick tropical forest. The climate is everywhere hot and often unhealthful. Agriculture is the principal industry, the most important crop being cacao; coffee, sugar-cane, tobacco, and rice are also raised. *Jipijapa* or so-called Panama hats are made in large quantities by the peasants.

HERBERT H. SMITH.

**Guaymas**, gwī'măăs, or **San José de Guaymas**: the principal coast city and port of entry of the state of Sonora, Mexico; on Yaqui Bay, a branch of the Gulf of California (see map of Mexico, ref. 3–C). It is built on an arid plain, nearly shut in by mountains; the climate is hot, dry, and frequently unhealthful; but owing to its excellent harbor, and to the Sonora railway, which has its terminus here, it has developed a thriving trade, and is growing rapidly. Pop. about 7,000. The name is derived from that of a tribe of Indians. H. H. S.

**Gubbio**, goob'bĕĕ-ō [Ital. < Lat. *Igu'vium*, the ancient name]: town; in the province of Perugia, Italy; about 27 miles from Urbino (see map of Italy, ref. 4–E). It was an Umbrian city before the founding of Rome, by which it was ultimately conquered. During the Middle Ages it was for a time a small independent republic of 50,000 inhabitants; then fell into the hands of the Dukes of Urbino. Dante found refuge here between 1316 and 1318. There are interesting remains of the ancient fortress, of the theater, and of Etruscan tombs. There are some remarkable old churches, and the municipal palace, of the fourteenth century, is one of the finest existing examples of Renaissance architecture. This palace contains the famous Tavole Eugubine, consisting of seven bronze tablets covered with inscriptions in a very ancient Umbrian character. These tablets were found in a temple of Jupiter not far from Gubbio, and their interpretation has been the subject of much discussion among archæologists. (See Lepsius, *Inscriptiones Umbricæ et Oscæ*, Leipzig, 1841; Bucheler, *Umbrica*, 1883.) In the same building are a valuable library and many fine pictures; also a collection of antique vases, coins, etc., together with specimens of the beautiful ware decorated by Maestro Georgio da Gubbio and known to connoisseurs as the "Gubbio majolica." The modern town is supplied with good water by an aqueduct, and a very large and strongly

built reservoir called the Bottacione. It has some commerce, and is a bishop's see. Pop. 5,540.

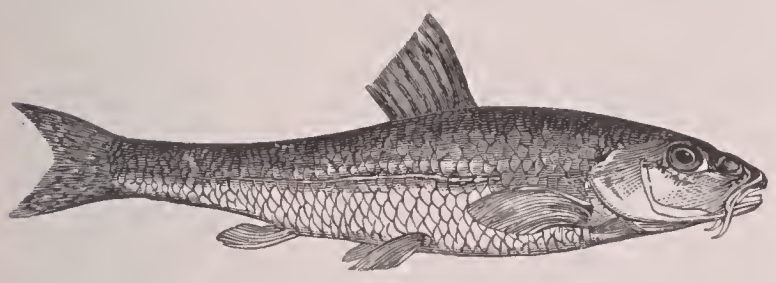
**Guben**, goo'ben: town; in Brandenburg, Prussia; on the Neisse; 28 miles S. of Frankfort on the Oder (see map of German Empire, ref. 4–H). It has extensive manufactures of woolen and linen hosiery and yarn, and a brisk shipping trade on the Neisse, whose banks here are planted with vines. Pop. (1890) 29,420.

**Gubernatis**, goo-bär-naa'tĕĕs, Angelo, Count de: Orientalist and *littérateur*; b. at Turin, Italy, Apr. 7, 1840. He founded the Italian Asiatic Society in 1886. He is a prolific writer, most widely known as the author of *Zoölogical Mythology* (1872), and the editor of the *Dictionnaire International des Écrivains du jour*. C. H. Toy.

**Gubler Waters**: See Châtelguyon.

**Gude**, goo'de, Hans Frederik: landscape-painter; b. in Christiania, Norway, Mar. 13, 1825. He has produced a large number of paintings of Norwegian mountain scenery. In 1854 he was elected to a professorship at the Düsseldorf Art Academy, but in 1880 he accepted a call from the Berlin Academy. He received a gold medal at the World's Exposition in Paris, and another from the Berlin Academy. R. B. A.

**Gudgeon** [M. Eng. *gojon*, from O. Fr. *goujon*: Ital. *gobione* < Lat. *go'bio*, *gobio'nis*, deriv. of *gobius*, *cobius*, gudgeon (whence Eng. *goby*) = Gr. κωβιός]: the *Gobio fluviatilis*, a very common fresh-water fish of Europe. It is of



The gudgeon.

the carp family; is a bold biter, and is taken in large quantities with nets. It seldom exceeds 8 inches in length, and is marketed alive, being kept in water until sold. The Niagara gudgeon (*Rhinichthys cataractæ*) is caught in the Niagara river, and is only 5 inches long.

**Gudgeon**, or **Journal**: the metallic end of a revolving shaft in machinery, or a piece attached to the end of a shaft to receive the wear and tear of friction. Gudgeons turn in journal-boxes, upon brass, Babbitt metal, lignum-vitæ, or other bearings, and are variously lubricated. See Friction.

**Guebers**, gee'bėr, or **Ghebers** [Pers. *Gabr*, a fire-worshiper]: those who belong to the Persian sect of fire-worshipers, and follow the religion taught by Zoroaster. A few thousands are still found in Persia. In Western India the Guebers or Parsees, as they are also called, number about 74,000. See Parsees.

**Guebwiller**: See Gebweiler.

**Gueguetenango**: See Huehuetenango.

**Guelder Rose**: See Snowball.

**Guelph**: city; capital of Wellington County, Ontario, Canada (for location of county, see map of Ontario, ref. 4–D); on the Speed river, and the Grand Trunk and the Canadian Pac. Railways; 47 miles W. of Toronto. It is the center of the greatest cattle-raising region on the continent, and has a large trade, fine water-power, manufactures of woolen goods, agricultural implements, sewing-machines, furniture, carriages, carriage parts, musical instruments, and lime, and 2 daily, 2 weekly, and 2 monthly periodicals. Excellent building-stone is quarried in the vicinity. Pop. (1881) 9,890; (1891) 10,539.

Editor of "Mercury and Advertiser."

**Guelph Fund**: name applied to the property of 48,000,000 marks ($12,000,000) which was granted by Prussia to the deposed King George V. of Hanover, Sept. 29, 1867, but was taken from him Mar. 2, 1868, on his persistent refusal to renounce his title to the throne. The fund was kept by Prussia and the income devoted to combating Guelph intrigues. Beginning with 1879, the widow of George V., Queen Marie, and two daughters received an income of 240,000 marks from this fund. In 1892 the entire income of the fund was restored to the Duke of Cumberland, son of the ex-king. In Germany the fund was often spoken of as the "Reptile Fund," and was supposed by some to have been used by Prince Bismarck in bribing the press. C. H. Thurber.

**Guelphs**, gwelfs, and **Ghibellines**, gib'e-linz [*Guelphs* is from Ital. *Guelfo*, from O. H. Germ. *Welf*, Guelph, liter., whelp; *Ghibellines* is from Ital. *Ghibellino*, from O. H. Germ. *Waiblingen*, a proper name]: names of two mediæval factions. These distinctive appellations were first employed in the twelfth century, and in the contest between the empire and the Church the name of Guelph was equivalent to a partisan of the Church, and the name of Ghibelline to a partisan of the empire. The vulgar tradition says that Guelph and Gibel (called Gibel and Gualef in the chronicle of Pietro Azario in the collection of Muratori) were two brothers who lived in Pistoia, one of whom took the side of the pope, the other that of the emperor, and that hence were formed two great parties in Italy which assumed the names of their separate founders; but this tradition has no historical value. Another states that in the battle near Weinsberg, fought in Germany in 1140 between the troops of Conrad III. of Suabia and those of the Duke of Bavaria, Welf VI. (Guelfus), the former took for their war-cry *Hie Gieblingen* (Gieblingen or Waiblingen was a Suabian fortress, and the Hohenstaufens and their followers were called Waiblingen); and the latter, on the other hand, had for their cry, *Hie Welf!* It is probable, then, that these two designations passed into Italy, or at least made their way toward it, with the Hohenstaufen Suabians, or Waiblingen, against whom the Italians fought under the guidance or the inspiration of Alexander III. and his successors. The German followers of the Suabians, Waiblingen or Ghibellini, having come into Italy, may themselves have given the name of Guelphs to their new enemies. The fury of partisanship was such that simply to call one's self Guelph or Ghibelline became perilous, and Pope Benedict XII. in 1334 found it necessary to prohibit, under pain of banishment, the employment of these epithets, which excited such furious indignation and such sanguinary conflicts. The Guelphs took for their device an eagle tearing a blue dragon, which, in place of a crown, wore upon its head a red or yellow lily, the badge of the Ghibellines; this lily was sometimes exchanged for the red rose. The towers of a palace indicated the party of the owner; if a Guelph, the battlements were *square*; if a Ghibelline, they were *swallow-tailed*. In Florence the Bianchi united themselves with the Guelph party, and the Neri with the Ghibellines; notwithstanding this, the Neri repossessed themselves of Florence by the aid of Pope Boniface VIII., and the Bianchi, being driven out of Florence, became Ghibellines. The names Guelphs and Ghibellines were afterward generally used to indicate two hostile factions in whose mutual quarrels the person of the pope or the emperor had little concern. They were, for the most part, rivalries between family and family, quarter and quarter, village and village, town and town, and in order to give a specious pretext for their sackings, their plunderings, and their assassinations, they invoked in their defense the imperial cause or the rights of the Church. While the latter had manifested a fierce zeal in the wars against the Suabians in the thirteenth century, now, having taken refuge in Avignon, she showed herself entirely indifferent to the conflicts of the Italian partisans who affected to fight either for or against her. The chronicler Pietro Azario, confessing that he had seen "Guelfs fight against one another more fiercely than against Ghibellines," throws a very sinister light upon the character of these factions, which, far from contending for an idea, were incited by the most vulgar interests and the most savage passions. It would be difficult to show which of the two factions had caused, not the most benefit, but the most mischief to Italy and to civilization; certainly both were very fatal. The Guelphs formed the first Company of the People to oppose the tyranny of the Ghibellines; but when the Guelph party had obtained the ascendency it showed itself even worse than the Ghibellines, by favoring those Guelph princes who desired to acquire dominion over certain towns; by creating plebeian governments, which are the least durable because they are the worst; by converting the political question into a social question; and by often calling in against dangerous nobles a fatal foreign intervention. Dante Allighieri, himself in his youth first with the Guelphs and afterward with the Ghibellines, when verging upon old age boasts in his *Paradiso* "that he had made a party for himself," and declares

"the Guelphs and the Ghibellines to be the cause of all the miseries of Italy" (*Parad.* vi. 97–102).

Revised by C. K. Adams.

**Guelphs, Order of** (usually, but incorrectly, called the **Guelphic Order**): an order of knighthood founded on the anniversary of his birthday, Aug. 12, 1815, by George IV. of England, as regent of Hanover, for his German subjects, but conferred upon many British subjects by George IV. and William IV. Its members are not reckoned as knights in Great Britain, and since the extinction of Hanover the Prussian Government does not recognize its existence.

**Güemez de Horcasitas**, goo-ā′māz-dā-ōr-kăă-see′tăas, Juan Francisco: general; b. in Oviedo, Spain, in 1682. He served in the Peninsula and Africa, and from 1734 to 1746 was captain-general of Cuba; during this period he gained immense wealth by securing commercial monopolies. Promoted Viceroy of Mexico, he ruled that country from July 9, 1746, to Nov. 18, 1755. On his return to Spain he was created Count of Revillagigedo and captain-general of the army. D. at Madrid, 1768. H. H. Smith.

**Güemez Pacheco de Padilla Horcasitas**, -păă-chā′kō-dā-păă-deel′yăă-, Juan Vicente: second Count of Revillagigedo, and better known by his title; b. at Havana, Cuba, 1740. He early adopted the career of arms, and won great distinction in the Peninsular wars. In 1788 he was named Viceroy of Buenos Ayres, but almost immediately was removed to the viceroyalty of Mexico, taking charge of the government of that country Oct. 17, 1789. His term was very prosperous, and he is remembered as one of the best viceroys Mexico ever had; numerous abuses were reformed by him; he cleansed and beautified the capital, established regular mail service, promoted explorations on the Pacific coast, and was beloved because he secured justice to the meanest subject. He was, however, noted for his eccentricities. Revillagigedo was relieved May 15, 1749, and returned to Spain, where he was made director-general of artillery. D. at Madrid, May 2, 1799. H. H. Smith.

**Guerara**: same as Gerrara (*q. v.*).

**Guerciuo**, gwār-chee′nō, Giovanni Francesco Barbieri (called Guercino from a squint he had): an Italian painter; b. at Cento, near Bologna, in 1590. After some residence at Rome he returned to Cento in 1623, and resided thenceforth in the north of Italy. The great frescoes of the Cathedral of Piacenza occupied him for many years, and about 1640 he removed to Bologna, where he lived from that time. His finest works, the *S. Petronilla*, the *Aurora*, the *St. Philip Neri*, are in Rome; the *St. Sebastian* and the *Virgin with the Swallow* are in the Pitti Palace, and there are four in the Uffizi, at Florence; *St. Bruno and his Companions* and several others are at Bologna; a *Cephalus and Procris* and a *Venus Weeping for Adonis* are in the gallery of Dresden. His style varied much at different periods. His best pictures belong to the second period. His large pictures numbered 250; of smaller works in oil and frescoes he painted very many, and he left a vast collection of drawings. D. in 1666. Revised by Russell Sturgis.

**Guereza**, gĕĕ-ree′za: a large, showy monkey (*Colobus guereza*) inhabiting Abyssinia and many parts of tropical Africa. The body is shining black, a band across the forehead, the sides of the neck, the throat, and the end of the short, bushy tail white, as is also the long "mantle" which hangs from the back down the sides and flanks. The fur of this and closely related species is in much demand for muffs and fur collars, but when thus used is dyed a uniform black. F. A. Lucas.

**Guericke**, gā′ri-ke, Heinrich Ernst Ferdinand, Ph. D., D. D.: theologian; b. at Wettin, 10 miles N. W. of Halle, Prussia, Feb. 25, 1803; from 1829, with an intermission of five years (1835–40), was a professor in the University of Halle. He published *De Schola quæ Alexandriæ floruit* (2 vols., Halle, 1824–25); *Handbuch der Kirchengeschichte* (3 vols., 1833; 9th ed. 1866–67), translated by Prof. W. G. T. Shedd (2 vols., Andover, 1860–70); *Allgemeine christliche Symbolik* (Leipzig, 1839; 3d ed. 1861); *Historisch-kritische Einleitung in das Neue Testament* (1843; 3d ed. under title *Neutestamentliche Isagogik*, 1868); *Lehrbuch der christlichen Archäologie* (1847; 2d ed. 1859), translated by A. J. W. Morrison (*Manual of the Antiquities of the Church*, London, 1851); and some minor works. He was a stanch champion of old Lutheranism. D. in Halle, Feb. 4, 1878.

Revised by S. M. Jackson.

**Guericke**, Otto, von: physicist; b. at Magdeburg, Germany, Nov. 20, 1602; was burgomaster of that town 1646–81; invented the air-pump 1650; also first constructed the "Magdeburg hemispheres," and made a rude barometer. His principal works are upon physics, etc. Of these, the *Experimenta Nova* (1672; new ed. 1881) is the most noteworthy. D. at Hamburg, May 11, 1686.

**Guérin**, gā′răn′, Eugénie, de: b. at Cayla, Languedoc, in 1805; devoted her life mainly to the care of her brother, Georges Maurice de Guérin. She was a woman of saintly life and of fine intelligence. Her *Journals and Letters* (Paris, 1862; Eng. trans. London, 1865–66, 2 vols.) are remarkable for the rare genius displayed, as well as for the delightful style and devout spirit in which they are written. D. May 31, 1848. See *Maurice and Eugénie de Guérin*, by Harriet Parr (London, 1870).

**Guérin**, Georges Maurice, de: poet; b. in Languedoc, France, Aug. 4, 1810; entered the Church and joined a religious community at La Chesnaye in Brittany, but left it in 1833; went to Paris, where he became a teacher at the Collège Stanislas, and married a creole lady. He was a poet of rare power and of great original talent. His *Reliquiæ* (2 vols., 1860, with a critical notice by Sainte-Beuve) contains his poetical fragments, letters, etc. D. in Paris, July 19, 1839. See Matthew Arnold, *Essays in Criticism* (1865); Harriet Parr, *Maurice and Eugénie de Guérin* (London, 1870).

**Guérin**, Pierre Narcisse, Baron: historical and genre painter; b. in Paris, May 13, 1774; pupil of Regnault; among his own pupils were Géricault, Delacroix, and Ary Scheffer; Grand Prix de Rome 1797; director French Academy at Rome 1822; created baron 1829; member of the Institute 1819: officer Legion of Honor 1832. His pictures show extreme academical tendencies, and are unsympathetic in style. Among these are *Phædra and Hippolytus* (1802); *Andromache and Pyrrus* (1810); *Dido Listening to the Story of Æneas* (1817); and *Clytemnestra urged by Ægisthus to the Murder of Agamemnon* (1817), in the Louvre; *Napoleon Pardoning Rebels in Cairo* (1806), Versailles Museum; and works in the museums of Bordeaux, Angers, and Valenciennes. D. in Rome, July 16, 1833.

William A. Coffin.

**Guernsey**, gêrn′zĕe: the westernmost and (except Jersey) the largest of the Channel islands (see map of France, ref. 2–B). It has a varied, fertile surface, a fine healthful climate, and a thrifty population, who speak a Norman-French dialect, and, though subject to Great Britain, have their own legislature. Capital, St. Peter Port. Area, 12,605 acres. Pop. (1891) 37,754.

**Guéroult**, gā′roo′, Adolphe: writer on social and political economy; b. at Radepont, France, Jan. 29, 1810; entered the St. Simonian Society 1830; was for years a foreign correspondent of the *Journal des Débats*; French consul at Mazatlan 1842–47, at Jassy 1847–48; became one of the editors of *L'Industrie* 1851; sub-chief of *Le Crédit foncier* 1852; founded *L'Opinion Nationale* 1859; was in the Corps Législatif 1863–69, and was a distinguished opponent of Ultramontanism. Author of *Lettres sur l'Espagne* (1838); *De la question coloniale* (1842); *Discours prononcés au corps législatif* (1869); and other works. D. in Paris, July 22, 1872.

**Guerrazzi**, gwār-răăt′sĕe, Francesco Domenico: patriot and author; b. at Leghorn, Italy, Aug. 12, 1804. While studying law at Pisa he made the acquaintance of Byron, who produced a strong impression upon him. His eulogy of *Cosimo del Fante* caused him to be restricted in residence to Montepulciano, where Giuseppe Mazzini went to visit him and gave him a new political impulse, as Byron had already given a poetical one. In 1827 Guerrazzi published his *La Battaglia di Benevento*, an imaginative romance filled with protests against tyranny. He was imprisoned in 1831, and banished to Portoferraio, in the island of Elba, in 1834. There he wrote his masterpiece, *L'Assedio di Firenze* (1836), which reveals in a remarkable degree all the good and all the bad qualities of Guerrazzi's genius. It is written as if in the heat of battle, and it powerfully incited the Italian youth to rise against the *foreigner*. *Isabella Orsini* (1844), *Veronica Cybo*, and the *Nuove Tartufi* followed; then his *Autobiographical Letter* to Giuseppe Mazzini. In 1848 he was elected deputy, and finally, on the overthrow of the Capponi ministry, he was chosen triumvir with Giuseppe Montanelli and Giuseppe

Mazzini; afterward, on the flight of the grand duke, he was proclaimed republican dictator. As a statesman his violence irritated the people, who, on the restoration of the grand duke, turned against the ex-dictator. He was illegally arrested, iniquitously prosecuted, and, in spite of his admirable *Apology* (1857), was condemned to perpetual exile. He went first to Corsica, where, in a state of hypochondria, he wrote the terrible *Beatrice Cenci* (1854); afterward followed the *Torre di Nonza* and *Fides*. After some time he returned to Genoa, where he wrote *Il Buco nel Muro*, a most graceful and humorous little work, the *Asino*, a bitter political and social satire, and several other smaller stories. After the proclamation of the kingdom of Italy, Guerrazzi was several times elected to Parliament, and he had just finished his romance entitled *Il Secolo che muove*, afterward published, when he died suddenly, on Sept. 23, 1873. See the work on Guerrazzi by Bosio (1877) and the *Letters* edited by Carducci (2 vols., Leghorn, 1880–82).

**Guerrero**, gwăr-rā′rō (named for a popular hero of the revolution; see next article): a southern state of Mexico; bounded N. W. by Michoacan, N. by Mexico, Morelos, and Puebla, E. by Oajaca, and S. W. by the Pacific; area, 22,866 sq. miles. The mountain-chain called the Sierra Madre del Sur runs through the state from end to end, parallel to the coast, with occasional peaks over 10,000 feet high; the whole northern part of the state is high and more or less mountainous; the coast region is low, but much broken by spurs from the Sierra. The mountain slopes are covered with heavy forest; elsewhere there is much open land, in part very fertile, in other places arid. Agriculture and stock-raising are the principal industries. There are numerous mines of silver, some of the ores yielding gold, but only a few of them are now worked; lead, copper, quicksilver, platinum, and coal are reported. The state of Guerrero was erected in 1847 from portions of Puebla and Michoacan. Pop. (1895) 417,621; capital, Chilpancingo; principal port, Acapulco.

HERBERT H. SMITH.

**Guerrero**, VICENTE: general; b. at Tixtla, Mexico, now in the state of Guerrero, Aug. 10, 1783. He was of humble birth, joined the revolutionists of 1810, and speedily won distinction as a guerrilla chief. After Morelos and other patriot leaders had been killed or imprisoned, Guerrero was for some years almost the only representative of the revolution; with a small band he maintained himself in the southern mountains, repeatedly defeating the Spaniards. Iturbide, who was sent against him in 1820, eventually declared for independence. Guerrero at once joined forces with him, and aided in the expulsion of the viceroy; but he was opposed to the crowning of Iturbide, and was one of the leaders of the army which dethroned him in 1823; subsequently he was a member of the executive junta 1823–24, and vice-president in the Victoria administration 1824 to 1828. As leader of the Yorkino party he led an armed resistance to Pedraza, who had been elected president to succeed Victoria; Pedraza was defeated, congress declared his election void, and made Guerrero president Jan. 12, 1829. Revolts against him broke out almost immediately; unable to maintain himself, he retired to the south at the end of a year. There he kept up a resistance to the Government which had supplanted him until Jan., 1831, when he was captured by a ruse; a court martial condemned him to death, and he was shot at Chilapa, Feb. 14, 1831.

HERBERT H. SMITH.

**Guerril'la** [Span., dimin. of *guerra*, war, from Teuton. *wërra*, difficulty, conflict: Eng. *war*]: properly the name of partisan warfare, but applied to men serving in a war in an irregular, unauthorized manner. The name was first given to an irregular partisan soldiery of Spain, especially to that which opposed Napoleon's armies between 1808 and 1815. From Spain the name was carried to Spanish America, and thence to the U. S. In the civil war in the U. S. guerrilla-parties were common at various times and places in the border States. If guerrillas are taken captive in open warfare, they should be treated with the privileges of war, unless they are proved guilty of such special crimes as murder, or the killing of prisoners, or the sacking of places, in which cases they are deemed to have forfeited such privilege. Though often a great annoyance to an invading army, they seldom are of much real service to their own side. In Napoleon's wars in Spain, however, his armies met for a time with much serious trouble from guerrilla-parties, to whom the mountainous nature of the country gave great advantages.

**Guesclin**, BERTRAND DU: See DU GUESCLIN, BERTRAND.

**Guess**, GEORGE, or **Sequoyah**: a Cherokee half-breed; inventor of the syllabic Cherokee alphabet; b. about 1770; known as an ingenious silversmith previous to his invention of the Cherokee alphabet in 1826. The alphabet contains eighty-five characters, all of which are applied to writing and printing with success. D. at San Fernando, Northern Mexico, in Aug., 1843.

**Guest** [M. Eng. *gest* < O. Eng. *gæst*, guest, stranger: O. H. Germ. *gast*: Goth. *gasts* < Teuton. *gastas*: O. Bulg. *gosti*: Lat. *hostis* < Indo-Eur. *ghostis*, stranger, guest]: in law, a transient lodger at an inn or hotel. As the innkeeper's liability is much greater to *guests* than to *boarders*, the legal distinction between the two classes of persons frequently becomes a matter of importance. See INNKEEPERS.

F. STURGES ALLEN.

**Guest**, JOHN: sailor; b. in Missouri in 1821; entered the U. S. navy as a midshipman Dec. 16, 1837; became a passed midshipman in 1843, a lieutenant in 1850, a commander in 1862, a captain in 1866, a commodore in 1873; served on the east coast of Mexico during the war between the U. S. and that republic (1846–48), and participated in several sharp engagements with the enemy on shore; in 1854 was second in command of the seamen and marines of the U. S. steamship Plymouth in a severe but victorious fight with the Chinese rebels at Shanghai, who threatened to plunder the foreign residents. He commanded the Owasco of Porter's mortar flotilla in the bombardment of Forts Jackson and St. Philip prior to and during the passage of Farragut's fleet by the forts on its way to New Orleans (Apr. 24, 1862), and afterward at the bombardment of Vicksburg in the summer of same year; in command of the Iosco, took part in both the Fort Fisher fights. D. at Portsmouth, N. H., Jan. 12, 1879, while in command of the navy-yard.

**Gueux**, gö [Fr., beggars, plur. of *gueux*, poor, beggar]: a name applied at the court of the regent Margaret of Parma in 1566 to the confederated nobles and others of the Low Countries who opposed the tyrannies of Philip II., and especially the establishment of the Inquisition. The malcontents at once adopted the title, and fought long and bravely against the Spaniards, but had finally to yield to superior force. Counts Louis of Nassau and Henry de Brederode were the early leaders of the party, and after hostilities had begun the "sea-beggars," under the noted Admiral William de la Marck, gained many advantages over the Spanish.

**Guevara**, ANTONIO, de: writer; b. about 1490 in the province of Alava, Spain; d. in 1545. Of excellent family, he passed a part of his youth at the court of Queen Isabella. In 1528 he became a Francisean, but continued to live at court, where he enjoyed the special favor of the Emperor Charles V. He accompanied this monarch on various journeys to Italy and other parts of Europe, becoming successively court preacher, imperial historiographer, Bishop of Guadix, and Bishop of Mondoñedo. From a worldly point of view this was an extraordinarily successful life; and as a writer Guevara had hardly less good fortune. Perhaps no Spanish author has had, in his own century at least, greater popularity and influence in all Europe. He was the chief Spanish representative of that phase of Renaissance literature which finds its best expression in *Il Cortegiano* of the Italian Castiglione. The aim of both writers was to set forth in a balanced and artificial style reflections of a politico-moralizing kind, after the supposed manner of Cicero, Seneca, and Plutarch. The most famous of Guevara's works was his *Libro aureo de Marco Aurelio, emperador y eloquentissimo orador* (1529), or, as the title of the enlarged Valladolid edition of the same year runs, *Marco Aurelio con el Relox de principes*. The general character of this work was that of Xenophon's *Cyropædia*; but the worthy author thought to win more credit by asserting that his matter was taken from a certain Greek manuscript sent him from Florence. The fraud was exposed in 1540 by one Pedro de Rua, Professor of Belles-lettres at Soria, and Guevara could only say in his own defense that his history of Marcus Aurelius was as true as any other ancient profane history. For this he has been very severely treated (cf. Antonio, *Bibl. Nova*, i., p. 125; Bayle, *Dict. Hist.*, ii., p. 631); but the popularity of his book was hardly at all diminished. In 1539 another folio appeared at Valladolid, containing a series of new treatises by him, which had only less success than his first work. These are: *Prólogo solemne en que el*

*autór toca muchas histórias*; *Una Década de las Vidas de los X. Césares emperadóres románo, desde Trajano á Alexandro*; *De Menosprécio de la Córte y Alabanza de la Aldéa*; *Aviso de privádos y doctrina de cortesános*; *De los inventóres del mareár y de muchos trabájos que se pasan en las galéras.* In 1539 also Guevara published in Valladolid his so-called *Epístolas familiares*—chiefly remarkable as rhetorical exercises, with hardly a trace of the style of familiar correspondence. These were widely admired, and came soon to be known as the *Golden Epistles*, under which title they were translated into Freneh in 1565, and three times into English: by E. Hellowes (1574), G. Fenton (1575), and Savage (1657). We have further two professedly religious treatises from Guevara's pen: *Monte Calvario* (Salamanca, 1542; Eng. transl. 1598); *Oratório de religiósos y exercicio de virtuósos* (Valladolid, 1542). Of all these works, however, the first retained the palm; and for the English student it has peculiar interest, because, as has been recently shown, it was the chief source and original for that all-important literary movement of Elizabeth's reign which is known as euphuism. (See Lyly). It was translated into English by Lord Berners in 1532, and again by Sir Thomas North (his first work) in 1557, and was speedily the rage among the fine spirits of the English court. Its style was at once imitated, and for a time threatened to determine the development of all future English prose. There came a reaction, however, against this excess of admiration, and what was false and affected in English writing as a consequence of it gradually gave way. It is, however, an influence to be reckoned with in every Elizabethan writer—the greatest not excepted. Besides the English translations mentioned above, there was one of the *Menosprécio de Córte*, by Sir Francis Bryan, Lord Berners's nephew, about 1533 (printed again 1575); of the *Década de los Césares*, by E. Hellowes (1577); of the *Arte de Mareár*, by Hellowes (1578). Guevara's popularity in other countries was no less remarkable, though it perhaps nowhere else had so important consequences. In France translations and imitations were very numerous (cf. Brunet, *Manuel du Libraire*, v.), and from one of these La Fontaine derived the theme of his famous fable *Le Paysan du Danube* (Fables xi., 7). See F. Landmann, *Der Euphuismus, sein Wesen, seine Quelle, seine Geschichte* (Giessen, 1881); *id.*, *Shakspeare and Euphuism*; *Euphuism an Adaptation from Guevara* (London, 1882; extr. from *New Shakspeare Soc. Trans.*, pt. ii., p. 241–276).

A. R. Marsh.

**Guevara**, Luis Vélaz, de: dramatist and story-writer; b. at Ecija, Andalusia, Spain, in 1572 or 1571; d. in Madrid, 1644. Little is known of his life beyond the fact that he was a favorite at the court of Philip IV. by reason of his wit. He was an extremely prolific playwright, Montalván as early as 1632 (in his *Para Todos*) putting the number of his pieces at 400. Of these, however, few have survived. The most famous and the best was *Mas pesa el Rey que la Sángre* (King before Kin), in which is told the story of that Alfonso Pérez de Guzman who, as governor of the city of Tarifa in 1293, saw his own child slain before his eyes by command of Don Juan, rebellious brother of King Sancho IV. el Bravo, rather than surrender the town. Full of poetry and fine pathos also is *La Luna de la Siérra*, which relates the story of a peasant who saved his beautiful wife from dishonor by an appeal to Queen Isabella. The best-known work of Guevara, however, is the short satiric sketch in prose called *El Diablo Cojuelo* (The Limping Devil), which was subsequently copied by Le Sage (*q. v.*) in his *Diable Boiteux*. In this the author imagines a student of Madrid obtaining by chance the good will and services of a deformed spirit, who carries him in ten *trancos* or strides through the air from place to place in Spain, unroofing the houses, as it were, and showing him what in their supposed security the dwellers therein are up to. The opportunities for satire thus afforded are cleverly employed. There is no collected edition of Guevara's works. The *Diable Cojuelo* is printed in Rivadeneyra's *Bibliotéca de Autóres Españoles* (t. xxxiii.).

A. R. Marsh.

**Guiana**, gĕĕ-aa′năă [the name of an Indian tribe; Span. *Guayana*, or *Guayanna*, whence Fr. *Guyane*]: a region in the northeastern part of South America, embracing, in its most extended sense, all the territory bounded by the Atlantic, the Amazon, Rio Negro, Cassiquiare, and Orinoco, or an area of more than 800,000 sq. miles. This is unequally divided between Brazil, Venezuela, and three European colonies, to which the name is applied in a more restricted sense. We shall consider it first as a whole, briefly treating of the colonies in separate paragraphs.

*Topography.*—This is very imperfectly known, large areas, especially in the Brazilian and Venezuelan parts, being unexplored. It is commonly said that Guiana is a large island, because it is cut off from the rest of the continent by the singular union of the Amazon and Orinoco through the Negro and Cassiquiare. Such a view is trivial, but in a truer sense the region is an island because it is a mass of high land separated from other high portions of South America by the great river depressions. At one point only, near the falls of the Orinoco, hills—supposed to be spurs of the Colombian Andes—appear to approach a corresponding range on the Guiana side, but it is by no means proved that there is a continuous line, broken only by the narrow river channel. The hills of Guiana are visible from the edge of the Brazilian plateau across the Amazon. But a continental depression of a few hundred feet at most would leave Guiana entirely surrounded by salt water, and in most places widely separated from adjoining land.

The surface of this great island is generally described as a table-land with a core of mountains; it is rather a plateau, rising toward the northwest into a huge dome, but so cut up and modified that mountain-like forms have been left in some places, and in others extensive plains and long slopes. The Brazilian portion appears to be a very regular table-land, about 2,000 to 2,500 feet high westward, gradually subsiding to 500 or 600 feet near the Atlantic; it is bordered by low lands with isolated hills adjoining the Amazonian flood-plains, and outlying portions can be seen from the river in the table-topped hills called the Serras of Parú. Near the divide, between rivers flowing to the Amazon and to the Atlantic, it is cut down suddenly northward to the level of about 800 feet; these cut edges are the so-called Acaraí Mountains. From their base there is a long slope to the Atlantic, but this slope is broken by many hills and by two east and west ranges having a mountainous appearance, near latitudes 3° 25′ and 5° N.; these are both W. of the Essequibo, and they are nowhere more than 2,000 feet high. If the main plateau is followed westward, it is found to extend farther north and to be much higher, forming the Parima Mountains on the frontiers of Brazil and Venezuela; these extend eastward into British Guiana, where they are known as the Pacaraima Mountains, and the culminating point is Roraima, an isolated mass with precipitous and inaccessible sides on the extreme western frontier of the colony; this is said to be 7,500 feet high, and is probably the loftiest point in all Guiana. But Roraima is flat-topped and apparently composed of horizontal sedimentary strata; it must therefore be regarded as a higher and outlying portion of the plateau, while others of the Pacaraima range are also portions of the plateau, much cut up and assuming strange, mountain-like forms. Probably the Parima range has the same structure. N. of Parima the territory of Venezuelan Guiana is much broken, gradually falling to the *llanos* of the Orinoco. The Atlantic coast lands are everywhere low and flat; in parts the spring tides would extend 10 or 12 miles inland were they not kept back by artificial sea-walls.

*Geology.*—Near the Amazon extensive beds of Palæozoic rocks, characterized by fossils, rest on gneiss and granite; over these are sandstones, presumably Cretaceous. All these beds are more or less disturbed, but above them are horizontal sandstones and clays, forming, in part at least, the top of the plateau. The geological survey of British Guiana, made by Messrs. Brown and Sawkins, did not bring to light any fossils, and the age of the beds studied is conjectural, but the structure seems to be the same as that of the Amazonian side—disturbed older rocks, with intrusions of diorite resting on granite and gneiss and capped by horizontal beds, probably Tertiary, which form the top of the true plateau. By the denudation of these upper beds over large areas, the older rocks have been exposed, with extensive sheets of granite, and these often appear to have a mountain structure. Beyond the observations of Crevaux in the French colony, the geology of other parts of Guiana is unknown. Along the coasts and river valleys there are extensive alluviums.

*Hydrography.*—Guiana has numerous rivers of considerable size; as they flow down from the plateau they form rapids and falls, and hence none of them is navigable for a great distance. The most important on the Atlantic side are the Oyopock, Maroní, Surinam, Corentyn, Berbice, and Essequibo (the latter the largest of all); the Caroní, Caura, and others flow to the Orinoco; the Branco to the Rio Ne-

gro; and the Jamundá, Trombetas, Curuá, Mãecurú, Jary, and others to the Amazon. Some of these Amazonian tributaries form shallow lakes as they flow into the lowlands. On the highlands there are no lakes of considerable size, though large tracts of grass-land are often flooded during the rains. One of these swamps probably gave rise to the report of a great lake called Parima, which is represented on old maps.

*Climate.*—Warm, and in parts unhealthful near the sea-coast and on the river plains; yellow and bilious fevers have frequently been very destructive in the colonies; intermittent fevers are common only in swampy lands and near the river rapids. In the interior the heat is nowhere excessive, and the climate of the table-lands is temperate and agreeable. Rains, though less profuse than in the Amazonian depression, are abundant. From July or August to the end of November there is a dry season, varied only by occasional showers. Near the northern coast a second short dry season is observable in March. The heaviest rains are generally in April. Hurricanes and very destructive winds are unknown.

*Vegetation and Soil.*—The lowlands of the coast and river depressions are covered with luxuriant forest, which extend far up the river valleys; and generally the flanks of the hills and of the plateau are heavily wooded. But the top of the main plateau, so far as is known, has only a scattered low growth of trees and bushes, resembling the *campos* of Central Brazil, and on the long Atlantic slope there are vast tracts of grass-land, known in the colonies as savannas. The Parima and Pacaraima Mountains seem to be in great part devoid of forest. On the Amazonian side the *campos* extend over the lowlands in places quite to the river, and there are extensive open tracts near the Orinoco, continuations of the *llanos*. All the low forest lands appear to be fertile, but the richest portions yet utilized are the tide-plains along the Atlantic. By a system of dikes and sea-walls, first used by the Dutch, large portions of these have been reclaimed, and most of the colonial sugar plantations are on them. Their fertility is practically inexhaustible. The savannas, *campos*, and *llanos* doubtless will be utilized in time for cattle-raising.

*Fauna and Flora.*—These resemble those of other parts of the Neotropical region. (See AMERICA, SOUTH.) A certain proportion of species, but not of larger groups, appear to be peculiar, whence some naturalists are inclined to regard Guiana as a sub-province, but it is generally united with Brazil.

*Minerals.*—Gold is the only metal thus far developed in paying quantities. The gold mines of British Guiana and the neighboring parts of Venezuela, discovered about 1866, have attracted thousands of miners, and there can be no doubt of the richness of the deposits. There are vague reports of gold from the other colonies and from Brazilian Guiana.

*Inhabitants, History, etc.*—Of the numerous Indian tribes which formerly inhabited Guiana only a few remnants remain in a wild state, occupying small villages in the interior. The Arawaks of the Atlantic coast are partially civilized; a few hundred or thousand half-wild Caribs are still found in the colonies, and along the great rivers the surviving Indian population has submitted to the whites; including these, the whole Indian population probably does not exceed 30,000. The white and half-breed population is also very scanty, and Guiana, as a whole, is one of the most thinly peopled regions in the world. Probably the entire population of this tract of 800,000 sq. miles does not exceed 450,000, and of these 250,000 are gathered in a comparatively small part of British Guiana. Before the extinction of slavery numerous fugitive Negroes formed settlements in the interior, and these became a terror to the whites. In the colonies these runaways were known as bush Negroes, and in Brazil as *mucambistos*. In Surinam, during the eighteenth century, they waged a long and bloody war on the Dutch, and at length made peace on condition that they might hold a large tract in the interior without molestation. It is said that their descendants number over 25,000. One of the largest and most recent of these Negro colonies was on the river Trombetas, a branch of the Amazon; in 1875 it was reported to have a population of 2,000, fugitives from Brazilian plantations.

Columbus had a glimpse of Guiana as early as 1499, and the Atlantic coast was soon after explored by various captains, but the region was long neglected. Sir Walter Raleigh, in 1595, made a vain attempt to penetrate to the interior in search of El Dorado. It appears that the first Spanish settlement was made on the Orinoco at the mouth of the Caroní in 1576; Spanish missionaries penetrated S. of the Orinoco in the eighteenth century, but the few settlements of Venezuelan Guiana are mostly of very recent origin. The Dutch made their first attempt to settle the coast in 1581, and the English and French a little later, but the first colonies were all failures, and the English and French attempts were repeatedly abandoned. Dutch Guiana was first settled by the English, and British Guiana by the Dutch. (For the history of the colonies see below.) The Dutch early entered the Amazon, but were driven out by the Portuguese about 1620, and this part of Guiana fell to Brazil. The boundary between Venezuela and British Guiana was finally determined by arbitration in 1899. The division of the region is now well recognized, but, except the boundaries between the French and Dutch and the Dutch and British colonies, all the limits are very uncertain. The French claim that their colony, on the coast, extends to Cape North, but Brazil holds as far as the Oyopock. Brazil claims, and will probably hold, the territory which includes all the rivers of Guiana flowing into the Amazon and the Rio Negro, except its extreme upper course, but the divide which should constitute this boundary has never been explored, and the claim is not supported by treaties with Great Britain, the Netherlands, or France.

*British Guiana* lies on the Atlantic coast, approximately between lats. 1° and 9° N. and lons. 57° and 61° W. Area officially claimed, 109,000 sq. miles, over a third of which is claimed by Venezuela; the southern boundary, with Brazil, is not fixed, and is practically unknown; eastward the river Corentyn separates it from Dutch Guiana. Pop. (1891) 288,328, including 105,465 East Indians or "coolies," mainly contract laborers, and 99,615 Negroes; the aboriginal population is small. British Guiana is a colony of Great Britain, formed of the three settlements (now counties) of Demerara, Essequibo, and Berbice; capital, Georgetown. The governor and lieutenant-governor, appointed by the crown, are assisted by a court of policy of seven official and eight elective members, and a combined court containing, in addition to the above, six elected financial representatives. The suffrage is restricted to about 2,000 voters. The Roman-Dutch law, modified by orders in council, is in force for civil cases; the criminal law is based on that of Great Britain. Revenue for the financial year 1899–1900, £538,838; expenditure, $525,542. Sugar-planting is the most important industry. Since 1888 the gold mines have been steadily increasing in importance, and nearly 10,000 miners are employed in them. The principal exports are sugar (82 per cent.), molasses, rum, timber, and gold. Total exports for 1899–1900, £1,788,987; imports, £1,318,701. About half the trade is with Great Britain. The money in ordinary use is English, with a small circulation of "guilders" and "bits," local coins. The colony has three short railways (40·5 miles, 1901), about 450 miles of regular river navigation, and 1,567 miles of postal telegraphs and cables, with 71 post and 75 telegraph offices. The ordinary language is English, and nearly all the population is gathered near the coast.

The Dutch attempted to form a settlement on the Demerara in 1581; driven out by the Spaniards and Indians, they returned in 1596, and, gaining strength, gradually spread along the coasts. In 1796 the colonies were taken by the British; they were given up to the Batavian republic in 1802, but retaken by the British in 1803, and by subsequent treaties were confirmed to Great Britain.

*Dutch Guiana*, or *Surinam*, lies on the coast immediately to the E. of British Guiana, between lats. 2° and 6° N. and lons. 53° 50′ and 58° 20′ W. It is separated from British Guiana on the W. by the river Corentyn, and from French Guiana on the E. by the Marowijne, or Maroni; the southern boundary, with Brazil, is unsettled. Calculated area, 46,072 sq. miles. Pop. (end of 1896) 68,972, exclusive of the bush Negroes, said to number 25,000, and a few Indians. Capital, Paramaribo. Dutch Guiana is a colony of the Netherlands, with a crown-governor, who, with the attorney-general and three crown members, forms the council for executive business. There is an assembly of "states" of four members chosen by the governor, and one for every 200 electors. The laws are those of the Netherlands. The country is divided into sixteen districts and numerous communes. The official language is Dutch, but English is in common use in the larger towns. The prevailing sects are the Moravian Brethren and Reformed Lutheran (Protestant). Revenue, 1900, $922,992; expenditure, $974,448. Agriculture is almost the only industry, and sugar is the

principal product; also cacao, bananas, coffee, rice, corn, etc. The exports for 1898 amounted to $2,094,871.45, and the imports to $2,292,777.65. There are no railways, and the telegraph system is of small extent. The interior is little known.

The territory of Dutch Guiana was settled by the English in 1652, and received the name Surrey-ham, corrupted to Surinam. At the Peace of Breda, 1667, it was given to the Netherlands in exchange for the New Netherlands (New York). Taken by the British in 1799, it was given up to the Batavian republic in 1802; it was again in the power of the British from 1804 to 1816, when it was restored by the Peace of Paris.

*French Guiana*, often called *Cayenne*, lies between Dutch Guiana, the Atlantic, and Brazil. The boundary dispute with Brazil was settled by the award of the Swiss Court of Arbitration in Dec., 1900; the boundary being placed at the Oyopock river to its source, thence the line of the watershed of the Tumuc Humac mountains to the frontiers of Dutch Guiana. The area not in dispute is estimated at 46,840 sq. miles. Pop. estimated 30,300, exclusive of a few wild Indians. The capital, Cayenne, has 12,300 inhabitants, and there were about 7,000 confined or ticket-of-leave convicts. The country is held as a colony and penal settlement of France. It has a governor, appointed at Paris, and sends one deputy to France. The climate of the low coast region is hot and very unhealthful, and there have been many severe epidemics of yellow fever; it has proved especially fatal to the prisoners, hence since 1864 white convicts have been sent elsewhere. The interior is healthful. But little of the land is cultivated, and that poorly; the principal product is sugar; gold is obtained in small quantities. The exports in 1899 amounted to $1,320,906.67; the imports, $1,949,248.08. In 1900 the local budget balanced at $482,198.15. The French expense budget for 1901 was $1,323,412, chiefly for the support of the penal establishments.

The French attempted settlements here as early as 1604, and again in 1624; Cayenne was founded in 1634. But all the efforts made to establish a strong colony ended disastrously, and several times the country was abandoned. It was in the hands of the Dutch 1654–64; was ravaged and abandoned by the English 1667, and again by the Dutch in 1676. In 1763 15,000 colonists were sent out from France, and within two years 13,000 of them died of disease and hardship. During the French Revolution some 600 royalists and political prisoners were sent to Cayenne, where two-thirds of them perished. The colony was taken by the British in 1809 and restored to France by the Peace of Paris; the penal settlement was then established. The present population consists almost entirely of Negroes and Asiatics, with a few Indians. See GUIANA in the Appendix.

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HERBERT H. SMITH.

**Guicciardi'ni**, gwĕĕt-ehăär-dee'nĕĕ, FRANCESCO: statesman and historian; b. at Florence, Italy, Mar. 6, 1482; became Professor of Jurisprudence there in 1505; ambassador to Spain 1512; to Leo X. 1513; governor of Modena 1518; defended Parma, as the pope's lieutenant-general, against the French 1421; was made president of the Romagna 1523; governor of Bologna 1531–34; was a partisan of the Medici family. He is chiefly memorable for his *History of Italy* (1561–64; best edition, 10 vols., Pisa, 1819–20), which by common consent occupies the first place among Italian histories. It has been translated into English by Sir G. Fenton (1579) and by A. P. Goddard (10 vols., 1755–59). D. at Arcetri, May, 1540.

**Guicowar's, or Gaikwar's, Dominions**: See BARODA.

**Guido d'Arezzo**, gwee'dō-dăă-ret'sō: See GAMUT.

**Guido Reni**, -rā'nĕĕ: painter; b. at Calvenzano, near Bologna, in 1575. He was the son of a musician, who, finding him uninterested in his own art, placed him in the school of Denis Calvart, whom he left to become a pupil of the Caracci. Here, in opposition to Caravaggio, then becoming famous for his vehement mannerisms, Guido learned the gentle, sweet, harmonious style to which he owes his reputation. His fame having reached Rome, Guido was invited there, and went at the age of twenty-one. Here he painted the *Crucifixion of St. Peter* and the celebrated *Aurora with the Chariot of the Sun*, afterward engraved by Rafael Morghen. He returned to Bologna, where he painted several pictures, the most celebrated of which are *The Murder of the Innocents*, for the Church of St. Domenico, now in the Pinacoteca, and the *Repentance of St. Peter*, for the Casa Sampieri. Again he went to Rome at the solicitation of the pope. His most eminent works of this period are the *Fortune*, now in the Capitol Museum, the *Rape of Helen*, and the *Magdalen*, in the Barberini Palace. A short visit to Naples, whence he was driven by his jealous rivals, intervened between his second stay in Rome and his final return to Bologna, where he passed the remainder of his years, till his death in 1642. Guido was an artist of immense productiveness, but of unequal merit. His manner changed at different periods. His earliest works were done in the style of Caravaggio, with strong effects of light and shade. The productions of his later life were marked by gentleness, grace, and beauty, by sweetness of tone and harmony of color. He excelled in the treatment of pathetic and devout subjects, and in treating others brought their more gracious aspects into prominence. Even in his best works there is some lack of vigor in drawing and color; his average work is tame, monotonous, at times insipid, redeemed, however, by elegance of tone and delicacy of touch. His numerous *Madonnas* have a sameness of expression that is wearisome. Guido, besides painting on canvas and in fresco, modeled in clay, and is said to have executed statues. He etched a number of plates, which are esteemed. The so-called portrait of Beatrice Cenci, at the Palazzo Barberini, Rome, is one of the most remarkable of his portraits. The galleries of Europe contain very many of his canvases, especially the public galleries of Bologna, Dresden, Florence, Madrid, the Pinakothek at Munich, the Louvre, the Hermitage at St. Petersburg, and the new museum at Vienna.

Revised by RUSSELL STURGIS.

**Guienne**, gee-en', or **Guyenne**: one of the old provinces of France, lying N. of Gascony, with which it formed the ancient Roman province of Aquitania, of which its name is supposed to be a corruption. It is divided into the departments of Gironde, Lot-et-Garonne, Dordogne, and Aveyron, and includes parts of Tarn-et-Garonne and of Landes.

**Guignes**, geeñ, JOSEPH, de, F. R. S.: Orientalist; b. at Pontoise, France, Oct. 19, 1721; obtained early distinction as a Chinese scholar; became F. C. S. (London) 1752; was chosen to the Academy of Inscriptions 1754; became Syriac Professor in the Collège de France 1757; keeper of the antiques in the Louvre in 1769. D. at Paris, Mar. 19, 1800. The *Histoire générale* (of the Huns, Turks, Mongols, etc.) is his principal work. The elder De Guignes was a man of noble and exalted character. This can not be said of his son, CHRÉTIEN LOUIS JOSEPH (1759–1845), a distinguished Sinologist, who published as his own a Chinese, French, and Latin dictionary, taken mainly from the manuscripts of Father Basile de Glemona, a Franciscan missionary, whose papers were deposited in the Vatican library.

Revised by C. H. TOY.

**Guignet's** (gĕĕn'yāz') **Green**: See CHROMIUM.

**Guigniaut**, gĕĕn'yi-ō', JOSEPH DANIEL: b. at Paray-le-Monial, France, May 15, 1794; studied at the Lycée Impé-

rial, at the École Normale (1811–13), and the Lycée Charlemagne (1813–17); was *maître des conférences* in history at the Normal School 1818–22; held the corresponding chair in Greek letters 1826–28, and then became director of the same school and Professor of Greek in the faculty of letters. In 1835 he left the Normal School, and became Professor of Geography in the faculty; was chosen to the Academy of Inscriptions 1837, and in 1847 received the cross of an officer of the Legion of Honor; was secretary-general of the council of the university 1845. He wrote much upon Greek literature and antiquities; published texts and variations of the *Prometheus Bound* of Æschylus (1829) and *Les religions de l'antiquité* (1825–51, 10 vols.). based upon the *Symbolik* of F. Creuzer. In 1862 he became honorary Professor of History, a commander of the Legion of Honor, and perpetual secretary of the Academy of Inscriptions. D. in Paris, Mar. 12, 1876.

**Güija**, goo-ee'hăă: a lake of Central America, on the confines of Guatemala and Salvador; 3,300 feet above the sea. It is 19 miles long, varying in width from 3 to 12 miles, and several hundred feet deep. The waters abound in fish. The small Lagúna de Metapan is separated from it only by a narrow isthmus. These two lakes occupy the center of a great hollow, surrounded by a dozen volcanic peaks. They have no outlet. H. H. Smith.

**Guild**, Reuben Aldridge, LL. D.: librarian and author; b. at West Dedham, Mass., May 4, 1822; graduated at Brown University 1847, and was its librarian 1848–93. Author of *The Librarian's Manual* (1858); *Life, Times, and Correspondence of James Manning, and the Early History of Brown University* (1864); *A Biographical Introduction to the Writings of Roger Williams* (1866); *History of Brown University, with Illustrative Documents* (1867); *Chaplain Smith and the Baptists* (1885).

**Guildford**: town; capital of Surrey, England, on the Wey; 30 miles S. W. of London (see map of England, ref. 12–J). It is a quaint old town, and has a considerable trade in grain. It has a hospital founded in 1619, a county hospital, a county-hall, and a grammar school. Pop. (1891) 19,448.

**Guildhall**: the town-hall of London, and the place of meeting of several municipal courts. It was built in 1411; was nearly destroyed by the Great Fire 1666; rebuilt in its present form 1789. Its main hall is 153 feet long, 48 broad, and 55 high, and has a very fine open timber roof and rich windows; but the Gothic front dates from a later restoration, about 1865. The two colossal wooden figures called Gog and Magog are kept here. There are several interesting monuments and portrait-busts. The lord mayor's and other civic feasts have been held here since 1500.

**Guilds** [M. Eng. *gilde* > O. Eng. *gild*, payment, tribute (but with meaning derived from *gildscipe*, guild); deriv. of *gildan*, offer > Eng. *yield*]: associations formed for a common object, originally of a religious, protective, or social nature, but afterward including among their purposes the promotion of the economic interests of their members. Theories have assigned the origin of these associations to the common banquets of the Scandinavians or to the *collegia* of the ancient Roman artisans, but neither is adequate to account for their existence since similar institutions have flourished in countries where the guild has never made its appearance. The origin should rather be sought in a complex of causes of the same general nature as those at the basis of all organization in society. The religious guilds were probably the earliest of these fraternities in England, where from the sixth century associations of priests were formed to further the cause of religion and promote the welfare of their members, for which objects each member was bound to contribute a fixed sum, or gild, as it was originally called. Similar objects marked the social guilds, which, however, were distinguished from the former by being made up of laymen, and in their later history devoting themselves more exclusively to the material interests of their members. No species of misfortune affecting the health, liberty, or property of a guild brother, provided it was not brought on by his own fault, was beyond the scope of the purposes of these fraternities, which thus were not unlike the friendly societies or mutual relief associations of modern times. The religious and social guilds spread throughout England and the Teutonic countries of the Continent, but in Protestant states did not, as a general rule, survive the Reformation, being abolished on the ground that they fostered superstition. In England the property of the religious guilds was sequestrated by Henry VIII. Institutions bearing the same name and having similar objects have been formed in the nineteenth century. The first attempt of the kind was the formation of the Guild of St. Alban at Manchester, 1851. It was followed in 1861 by the organization of the Society of the Love of Jesus in Plymouth, and the Sisterhood of St. Peter at Kilburn. Since that time the idea has become very popular, and organizations of the kind have been formed in both Great Britain and the U. S. The object of these organizations is purely religious. Their principal aim is to institute a more effective carrying out of parish work and to impart more dignity to the layman's labors.

In both of these classes of mediæval guilds provision was sometimes made for bringing criminals to justice, and distributing among the guild brothers the fines paid by the offenders. This, however, was the especial characteristic of the protective or frith guilds which flourished in the north of Europe during the Middle Ages, when an organization for mutual defense was needed to supplement the defective civil administration. In addition to the usual obligations of mutual charity, care of the sick, and relief of the unfortunate, the brethren of the frith guilds were bound to pay certain contributions for the purpose of protecting property, punishing crimes committed against members of the guild, and aiding guild brothers to pay the fines imposed in consequence of their own offenses. Thus, recognizing the principle of the responsibility of the guild for its members, they became an important factor in keeping the peace. In England they can be traced from the seventh to the tenth centuries, but on the Continent their origin belongs to a later period, probably to the eleventh and twelfth centuries.

These three classes of associations show the attempt to realize the ideal of Christian brotherhood taught by the Church, and in each of them the religious feature is conspicuous. The economic guilds, of a later and radically different origin, have attracted more general attention. These were of two kinds—merchant guilds and craft guilds. The former can be traced in England as far back as the period of the Danish supremacy, but it was not till the conquest that they began fairly to develop. Their privileges, obtained upon application to the king, and embodied in the town charters, gave them the exclusive right to carry on trade in the city or suburbs, and to buy and sell freely without payment of tolls and customs. This amounted to a monopoly of internal trade. They existed as independent organizations from the eleventh to the thirteenth or fourteenth centuries, and during the greater part of that time performed important functions in the municipal administration; but gradually they lost their identity as trading associations, and coalesced with the town corporations, or became mere assemblies for admitting strangers to the freedom of the city. More rarely they were transformed into private companies with objects quite dissimilar to their ancient purposes. The origin of craft guilds belongs to the same general period as that of the merchant guilds, and members of the former often secured the privilege of retail trade by becoming enrolled in the latter. The essential purpose of the craft guilds was the monopoly of industry. None but members could carry on the industry in the city or suburbs. It was not, however, an independent organization, but always subject to the general laws and the municipal administration by which it was recognized as an auxiliary in maintaining the peace, and called upon to furnish a military contingent in time of danger. In England the monopoly enjoyed by the craft guilds did not prevent artisans from entering them if they had served the requisite apprenticeship, but merely forbade trading by outsiders whose wares were not guaranteed by guild regulations, designed to prevent fraud and the deception of the public. On the Continent, however, the guilds were subject to tyrannical restraints, and were not open to all citizens. Apprenticeship began between the ages of twelve and seventeen, and lasted from two to ten years. In England the usual term was seven years, after which the apprentice enjoyed a position of independence as shopkeeper and master. The period of the greatest prosperity of the craft guilds was from the twelfth to the fifteenth or sixteenth centuries. In France they were abolished at the time of the Revolution, but in Great Britain many of their privileges lingered till they were swept away by the legislation of 1835. See Toulmin Smith, *English Original Ordinances*, etc. (1870); L. Brentano, *On the History and Development of Guilds*

(1870); Madox, *Firma Burgi* (1726); G. Schanz, *Zur Geschichte der Deutschen Gesellen-Verbände im Mittelalter* (1877); G. Fagniez, *L'Industrie à Paris au 13ème et au 14ème siècle* (1877); Edwin R. A. Seligman, *Two Chapters on the Mediæval Guilds of England* (1887); Charles Gross, *The Gild Merchant* (2 vols., 1891). Revised by F. M. COLBY.

**Guilford**: town (founded in 1639 by an English colony under the Rev. Henry Whitfield); New Haven co., Conn. (for location of county, see map of Connecticut, ref. 12–H); on the N. Y., N. H., and H. Railroad; 16 miles E. of New Haven. It has five churches, high-school building of granite, new town-hall, and a weekly newspaper. There are several very old buildings. The principal industries are farming, iron-casting, and the manufacture of woolen goods. The regicides Goffe and Whalley were secreted here, and Fitz Greene Halleck was born here. The Point, about a mile S. of the town, and Sachem's Head, 3 miles S. W., are favorite summer resorts. Pop. (1880) 2,782; (1890) 2,780; (1900) 2,785; Guilford borough (1900) 1,512. EDITOR OF "ECHO."

**Guilford**, SIMEON HAYDEN: Professor of Dentistry; b. Apr. 11, 1841, in Lebanon, Pa.; educated at Franklin and Marshall Colleges; Professor of Operative and Prosthetic Dentistry in Philadelphia Dental College; author of *Manual of Nitrous Oxide* (1886); *Orthodontia* (1888), both generally used as text-books in the dental colleges in America; contributed the articles on *Orthodoubia*, *Dental Anomalies*, *Malformations*, and *Excementosis* to *System of Dentistry* (Philadelphia, 1885). C. H. T.

**Guilford Court-house, Battle of**: an engagement during the Revolutionary war; occurred Mar. 15, 1781, some 5 miles from Greensboro, N. C. This battle was fought between the armies of Gen. Greene and Lord Cornwallis. The army of Gen. Greene, to which he had succeeded a short time previous, had been re-enforced by militia from Virginia and North Carolina, until it numbered nearly 4,500 men, more than half of this number being inexperienced militia. With this force he started in pursuit of Cornwallis, whose army comprised some 2,500 veteran British troops, and whom he overtook at Guilford Court-house. The North Carolina militia were the first to receive the charge of the British troops, before which they gave way; the Virginia troops, next in line, held out for a time and did effective service, but in turn fell back. The pursuing British were met by the Continentals in the third line, and before a destructive fire of the First Maryland, followed by a charge of the cavalry, were in turn repulsed. Not wishing to risk another attack with his disorganized militia, Greene withdrew his army, but such was the damage inflicted upon the British army that Cornwallis fell back upon Wilmington.

**Guillaume**, gĕĕ′yōm′, JEAN BAPTISTE CLAUDE EUGÈNE: sculptor; b. at Montbard, in the department of Côte-d'Or, France, Feb. 3, 1822; educated at Dijon; studied the art of sculpture in Paris under Pradier; gained the Prix de Rome in 1845 by his *Theseus*, and was in 1863 appointed professor in the School of Fine Art; director of same 1865–75. Those of his works which have attracted most attention are *The Tomb of the Gracchi* (1862); *Napoleon I.* (1867); the monument of Colbert in Reims, etc. Of Napoleon I. he made seven busts. He became head of the French Art School at Rome.

**Guillaume de Champeaux**, shaăń′pō: ecclesiastic and author; b. at Champeaux, near Melun, in France; studied dialectics under Anselm of Laon (1030–1117); became Archdeacon of Notre Dame; founded in 1113 the Abbey of St. Victor, which became a famous scholastic center; was made Bishop of Châlons-sur-Marne in 1113; was a realist, and the instructor, and afterward the adversary, of Abelard. He wrote a number of treatises.

**Guillaume IX.**, COUNT OF POITIERS and DUKE OF AQUITAINE: See WILLIAM IX. OF POITIERS.

**Guillaumet**, gĕĕ′yō′mā′, GUSTAVE ACHILLE: landscape and genre painter; b. in Paris, Mar. 26, 1840. Pupil of Picot and Barrias; second Prix de Rome 1863; medals, Salons, 1865 and 1872; third-class medal, Paris Exposition, 1878; Legion of Honor 1878. A painter of great merit, whose pictures of Eastern subjects are finely composed and beautiful in color. Among these are *Evening Prayer in the Sahara* (1863) and *Lagouat* (1879), in the Luxembourg Gallery, Paris. D. in Paris, Mar. 14, 1887. W. A. C.

**Guillemet**, gĕĕ′ye-mā′, JEAN BAPTISTE ANTOINE: landscape-painter; b. at Chantilly, France, in 1842. Pupil of Corot and Oudinot; second-class medals, Salon, 1874, and Paris Exposition, 1889; Legion of Honor 1880. His pictures are remarkably truthful, and generally incline to fine grays in their color schemes. One of his best works, *Bercy in December* (1874), is in the Luxembourg Gallery, Paris. Studio in Paris. W. A. C.

**Guillemot**, gil′le-mot [Fr.; Breton, *gwelan*, gull (: Corn. *gullan*, whence Eng. *gull*) + Fr. *mouette*, sea-mew]: popular name for several of the auks (see AUK), but preferably restricted to those of the genus *Cepphus*. The guillemots are birds from 12 to 15 inches long, and in full plumage are almost completely black. The common guillemot (*Cepphus grylle*), found in high latitudes on both sides of the Atlantic, has a conspicuous white patch on the wing; the sooty guillemot (*Cepphus carbo*) has a white ring about the eye. This species is somewhat rare, being restricted to a limited area on the coast of northeastern Asia. The mottled black and white plumage, borne in winter and by the young, has suggested the name of sea-pigeon, which has been applied to these birds by the fishermen. F. A. LUCAS.

**Guillotine**, gil′lō-tēen [= Fr., named from Dr. J. I. Guillotin, who first proposed a more speedy method of execution]: a machine for inflicting capital punishment by decapitation, which acquired a terrible fame during the first French Revolution. A somewhat similar instrument had, however, been employed at times in various parts of Europe (Naples, Germany, Holland, Scotland) for more than 500 years. In Scotland it was called the "maiden," in France the "demoiselle." In this machine a heavy blade of steel falls in a grooved frame upon the neck of the victim. The inclined edge of the blade constitutes mainly the superiority of the guillotine over its predecessors. As a machine, the guillotine does its work with more certainty than the axe of the headsman.

**Guilmaut**, gĕĕl′maăń′, FÉLIX ALEXANDRE: organist and composer; b. at Boulogne, France, Mar. 12, 1837; when sixteen years old was organist of the St. Joseph church there. In 1871 he became organist of La Trinité in Paris. He is one of the leading French organists, and an able composer of organ music. In 1893 he visited the U. S., playing in New York, Chicago and other cities with great success. Among his vocal compositions are a fine mass and a lyric cantata entitled *Balthazar* (Belshazzar). D. E. HERVEY.

**Guimarães**: town of Portugal; in the province of Minho; 12 miles S. E. of Braga (see map of Spain, ref. 14–B). It is one of the oldest and most beautiful cities of Portugal, interesting for its architectural monuments and for the beauty of its surroundings. Its most remarkable buildings are a church dating from the fourteenth century and the palace or castle from the twelfth. In the neighborhood are several warm springs much used for bathing. Pop. 8,205.

**Guinea**, gin′ĕe [named from the country *Guinea*, on the west coast of Africa, because first coined of gold brought from there]: a coin struck in England in 1664 and issued from the mint until 1817. Subscriptions, professional fees, and the like are still estimated in guineas. The guinea was coined for twenty shillings, but passed for twenty-one up to twenty-eight shillings, the value varying considerably.

**Guinea**: the large gulf of the Atlantic washing the western coast of tropical Africa, between lat. 4° N. and 1° S. The western part is called the Bight of Benin, and lies between the Slave Coast and Calabar river; the eastern portion is called the Bight of Biafra. (See BIAFRA, BIGHT OF.) The name Guinea is found on a map as early as 1351, and is said to be derived from an interior city in the Niger valley called Jinni. As applied to the coast it is somewhat vaguely used, and is falling into disuse. In general, Upper Guinea was the Atlantic African coast from the equator northward to 10° or 15° N. lat., and Lower Guinea the same coast southward from the equator to 15° or 20° S. See ANGOLA, CAMEROONS, CONGO FREE STATE, DAHOMEY, GABOON-CONGO, GOLD COAST, LIBERIA, NIGER TERRITORIES, SENEGAMBIA, SIERRA LEONE, and TOGOLAND. M. W. HARRINGTON.

**Guinea-fowls** [named from *Guinea*, on west coast of Africa, whence they were first taken to Europe]: various gallinaceous birds, found with one or two exceptions in Africa. The exceptions are residents of the adjacent island of Madagascar. The birds are mostly of a blue-gray color, spotted with white. The common species, *Numida meleagris*, has been extensively domesticated both in the Old and New World, and is said to protect other poultry from hawks. Their eggs are very good, and so is their flesh when young. Their cry is harsh and disagreeable. F. A. L.

**Guinea-pig** [prob. changed from *Guiana pig* by analogy of *Guinea* and *Guinea hen*]: the "restless cavy" (see CAVY), the *Cavia aperea* of Linnæus; or, more strictly, the domesticated variety of the same species, known to some systematists as *C. cobaya*. It is a rodent, and has no affinity with the pig, which it very faintly resembles in its grunting voice. Neither is it a native of Guinea, but is found wild only in South America, where its range is extensive. It is bred for its gentleness and for the pretty coloring of some examples. It is quite defenseless, and seems too stupid to fear anything, but its unpleasant odor may protect it to some slight degree, although its chief defense against extermination lies in its marvelous fecundity. The time of gestation is three weeks; there may be a dozen young at a birth, and in about six weeks the young may be fecundated. There is an incorrect belief that the guinea-pig kills or drives away rats. Its flesh and fur are useless, and the principal use thus far found for guinea-pigs is as subjects for vivisection; for this they are extensively used, being cheap and non-resistant; and it is probable that their sufferings under the knife are small, since during and after extensive mutilation they commonly give little evidence of pain.

**Guinea-worm** [named from *Guinea*, on west coast of Africa]: the female of *Filaria medinensis* or *F. drunculus*; a nematode entozoic worm inhabiting the flesh of men and other animals, as dogs and horses. It is from 6 inches to 4 feet in length, and about one-ninth of an inch in diameter. It prevails in many parts of Africa, India, Sumatra, Persia, Arabia, and the island of Curaçoa. Probably it enters the flesh through the skin, where it lives till its young are matured, which takes from eight weeks to two years. Small ulcers appear on the surface of the skin, caused by the inflammation, and when these open the worm may be extracted, though with great difficulty. As many as fifty have been known to infest a single person. In some cases they cause much pain and inconvenience, in others none. Death has sometimes resulted from them. The little tank-worm of East Indian fresh waters and of wet soils is believed to be the larval form of the guinea-worm.

**Güines**, or **San Julian de los Guines**, saan'choolĕc-ăan'-dā-lōs-gweenās': a city of Cuba; on a plain, 29 miles S. E. of Havana (see map of West Indies, ref. 3–B). It is a station on the railway from Havana to Matanzas and Cardenas, is the center of an important grazing and agricultural district, and has a considerable trade. Güines dates from the eighteenth century, but only became important after the building of the railway. Pop. (1899) 8,149. H. H. S.

**Guinicelli**, gwĕĕ-nĕĕ-chel'lĕe, GUIDO: Italian poet. Little is known of his life beyond the facts that he belonged to the noble Bolognese house of the Principi, begins to be mentioned as early as 1266 in public documents, later with the title *judex* (i. e. jurisconsult), and died young in 1276. He seems to have taken an active part in the public life of Bologna, and in 1274 he was banished with other Ghibellines of the party of the Lambertazzi. He is chiefly important for the decisive *rôle* he played in the history of early Italian poetry. Dante calls him

> il padre
> Mio e degli attri miei miglior, che mai
> Rime d'amore usâr dolci e leggiadre.—*Purg.*, xxvi., 97.

This is another way of saying that Guinicelli was the first to point out that new, deeper, and more spiritual manner of singing of love, which Dante elsewhere (*Purg.*, xxiv., 57) calls *il dolce stil nuovo*—a style that was adopted by the group of Florentine poets to which Dante belonged, and that Dante himself carried to its highest perfection. When Guinicelli began to write, Italian lyrical poetry was little more than a pale and tiresome reflection of the forms and ideas of the Provençal troubadours. The so-called Sicilian poets had nothing original to say, and consequently their artificial phrases about *madonna* and love and courtesy and service and reward are frigid in the extreme. In his early youth Guinicelli wrote in the same fashion, and a considerable part of his verse is as dull as any ever penned by amatory versifier. Later, however, he became interested in the philosophical revival brought about in Italy by the great scholastics, notably St. Thomas Aquinas and St. Bonaventura; and the speculations of these men he undertook to introduce into poetry. He began to work out a new mystical theory of love, explaining its effects upon the spirit in essentially philosophical terms, as best appears in the famous canzone beginning *Al cor gentil ripara sempre amore*. This was the conception that so powerfully attracted Dante and his friends, and that is carried out to its logical consequences in the *Vita Nuova* and the *Divina Commedia*. See Casini, *Le Rime dei Poeti Bolognesi del secolo XIII.* (Bologna, 1881); Grion, *Guido Guinicelli e Dino Compagni*, in *Propugnatore*, ii. 2, p. 274, *seq.*; Fantuzzi, *Notizie degli Scrittori Bolognesi*, vol. iv. (1784), p. 345, *seq.*; Lamma, *Saggio di un commento alle rime di Guido Guinicelli con un discorso sugli scrittori bolognesi del secolo XIII.*, in *Propugnatore*, xvii. 2, p. 174, *seq.*; Gaspary, *Geschichte der italienischen Literatur*, vol. i., p. 102, *seq.* (Berlin, 1885). A. R. MARSH.

**Guipuzcoa**, gwĕĕ-pooth'kō-ăă: the smallest but one of the most densely peopled provinces of Spain; bordering on the Bay of Biscay, and traversed by several branches of the Pyrences. It is one of the Basque provinces, and is rich in minerals. Mining and fruit-culture are the chief industries. Area, 728 sq. miles. Capital, San Sebastian. Pop. (1887) 181,856.

**Guirand**, gĕĕ'rō'. ERNEST: opera-composer; b. at New Orleans, La., June 23, 1830; received his first musical education from his father. His first opera, *Le Roi David*, was produced in New Orleans when he was fifteen years old. He then went to Paris and entered the Conservatory, gaining the Prix de Rome in 1859. His first work there was the one-act opera *Sylvie*, produced May 11, 1864. He followed this with many works, among which the most noticeable were *Gretna Green*, ballet (1873); *Piccolino* (1876; this is considered his best work); and *Le Kobold* (1870). He was decorated with the cross of the Legion of Honor in 1878; appointed Professor of Advanced Composition in the Conservatory in 1880, succeeding Victor Massé, having been a professor since 1876. He composed many orchestral works, and at his death, on May 6, 1892, left unfinished an opera, *Brunehilde*. D. E. HERVEY.

**Guiscard**, gĕĕs'kăăr', ROBERT: Duke of Apulia and Calabria; sixth son of Tancred of Hauteville, a Norman baron with twelve sons; b. about 1015; went with his brothers about 1053 to Apulia in Italy; captured Pope Leo IX. at Civitella 1053, and in 1057 succeeded his brother Humphrey as count. In 1059 his new title of Duke of Apulia and Calabria was confirmed by Pope Nicholas II. He assisted his younger brother Roger (1031–1101), afterward Grand Count of Sicily, in his conquests. In 1074 Gregory VII. excommunicated him for trespassing upon the papal rights in Benevento, but in 1080 the pope was reconciled by Robert's submission. He next (1081–82) gained a series of victories in the Epirus over the Byzantines, but led the forces by which (1082–84) the pope resisted Henry IV., the emperor; delivered the pope from the Castle of St. Angelo and sacked Rome 1084; carried the pope to Salerno 1084; defeated the combined Greek and Venetian fleet and raised the siege of Corfù 1084. D. at Cephalonia, July 17, 1085. Robert and his brother Roger founded the kingdoms of Naples and Sicily. Revised by C. H. THURBER.

**Guise**, geez, or gweez: a fortified town of the department of Aisne, France; on the river Oise; 23 miles N. of Laon (see map of France, ref. 2–G). It has woolen and cotton manufactures, and a large foundry for manufacturing stoves, conducted on the profit-sharing plan. Pop. (1896) 8,082.

**Guise**, gweez, CARDINALS OF, or **Cardinals of Lorraine**: members of the Guise family, whose devotion to the Roman Catholic religion caused their promotion to the cardinalate. Prominent among them was CHARLES OF GUISE, b. at Joinville, Feb. 17, 1524; became Archbishop of Reims in 1538, and cardinal in 1547; went to the Council of Trent in 1562; was learned, affable, and politic, but cowardly, hypocritical, and licentious. His great ambition was to become pope, and to make his brother, the second Duke of Guise, King of France. He founded the University of Reims, and died at Avignon, Dec. 26, 1574.—JEAN OF GUISE, b. in 1498, was made cardinal in 1518, and died May 18, 1550. He held three archbishoprics, six bishoprics, and many abbeys, and was famous for his large charities and his many amours; and when a beggar in those days received large alms, he would say to the giver, "Thou art either Christ or the cardinal."—LOUIS I., brother of Cardinal Charles (1524–74), b. Oct. 21, 1527; d. at Paris, Mar. 24, 1578. He became cardinal in 1553, and was chiefly noted for convivial habits, on account of which the people called him "the bottle cardinal," but he possessed fine natural abilities.—LOUIS II., a brother of the third Duke of Guise, b. at Dampierre, July 6, 1555; became Archbishop of Reims in 1574 and cardinal in 1578. He was put to death by order of Henry III. (who

feared his power) on the same day that the Duke of Guise, his brother, was murdered, Dec. 24, 1588. The cardinal left a natural son, Louis de Guise, Prince of Falzburg.—Louis III., brother of the fourth duke, b. Jan. 22, 1575; became Duke-Archbishop of Reims without consecration, and was made a cardinal in 1615; was fond of military pursuits, and once attempted to settle a difficulty about an investiture by a duel, but was arrested on the field, and sent for a time to the Bastile. He left five children by the Countess of Romorantin, mistress of Henry IV. D. at Saintes, June 21, 1621.

**Guise**, Dukes of: a cadet branch of the house of Lorraine. The first duke was Claude, Duke of Aumale, b. Oct. 20, 1496; married Antoinette de Bourbon 1513; wounded at Marignano 1515; became Count of Guise 1520 (the first count was Charles of Anjou, 1414); fought the Germans under Charles V. successfully, and became Duke of Guise 1527; conquered Luxembourg in 1542, and died at Joinville in Apr., 1550.—Francis, second duke, b. at Bar, Feb. 17, 1519; rose by his own abilities as a general and the aid of his niece Mary, afterward Queen of Scots, to a high place in public affairs; became lieutenant-general in 1552, and won renown by his defense of Metz 1552–53, and by his conduct at Renti 1554; unsuccessfully commanded in Italy 1557; served brilliantly in command against the English and Germans 1557–58, taking Calais, Guisnes, Ham, and Thionville; exercised the chief power under Francis II.; renewed the war with the Protestants by the massacre of Vassy, Mar. 1. 1562; defeated and captured Condé at Dreux Dec. 19, 1562; was assassinated by a Huguenot named Poltrot de Méré, and died Feb. 24, 1563.—Henry (*Le Balafré*), third duke and Prince de Joinville, b. Dec. 31, 1550, gained great distinction in the service against the Turks and the Huguenots; was the leading spirit in the massacre of St. Bartholomew, and was afterward "head and soul" of the League; was forbidden to come to Paris by Henry III., who well knew the ambition of Guise, but he entered the city in triumph, virtually imprisoned the king in the Louvre, and demanded of the States-General the office of constable. He was assassinated by order of the king Dec. 23, 1588, and on the same day the Cardinal Guise, brother of the duke, was also murdered by the king's command.—Charles, the fourth duke, Prince de Joinville and Duc de Joyeuse, b. in 1571, became governor of Provence, and was an able general; banished by Richelieu in 1631. D. at Cuna, near Siena, 1640.—Henry, fifth duke, Prince de Joinville and Comte d'Eu, b. at Blois, Apr. 4, 1614, became Archbishop of Reims when fifteen years old; entered upon a life of licentiousness; in 1640 abandoned the Church: in 1641 was banished as a conspirator by Richelieu; married and became a soldier of fortune, distinguished for reckless valor. In 1647 he made himself generalissimo of Naples, but was given up to the Spaniards, and kept a prisoner four years; in 1655 became grand chamberlain of France. D. at Paris, June 2, 1664.—Louis Joseph, sixth duke, was born Aug. 7, 1630, and died of smallpox July 30, 1671.—Francis Joseph, seventh and last duke, Prince de Joinville, Duke of Guise, Alençon, Joyeuse, Angoulême, and Count of Aleth, son of the preceding, was born Aug. 28, 1670, and died Mar. 16, 1675.

**Guitar** [from Fr. *guitare* < O. Fr. *guiterre* (also *guiterne*, whence Eng. *gittern*) < Lat. *cithara* = Gr. κιθάρα, kind of lyre, whence Eng. *cithara*, *zither*]: a stringed instrument in size between the violin and the violoncello, and in shape similar to them. Its construction is simple: it consists of a hollow body like a violin, but flat in floor and cover, the latter having in the center a large round hole for resonance; a long wide neck, serving as a keyboard; and six strings of wire and catgut, attached to a low wooden bridge below the sound-hole, are stretched along the instrument, and are slackened or tightened by screws at the end of the keyboard. Across the neck, beneath the strings, are ridges of metal at unequal distances, pressure on which modulates the tone. The instrument is played with the fingers, the right hand touching the strings, the left making the modulations. In 1788 the Duchess Amalia of Weimar introduced it in Germany as a new Italian instrument. The Italians had it from the Spaniards; the Spaniards had it from the Moors; and they brought it from the East, where it, or something very much like it, had been known from a great antiquity. Instrument-makers have attempted improvements on the guitar. A German artist in London invented a method of keys by which the instrument could be played more easily, and be made to produce a fuller and steadier tone. Staufer of Vienna devised the guitarrencello and the guitarre d'amour; Birnbach tried to combine the guitar and violin by substituting a bow for the twanging of the strings. There have been other modifications, but none have met with favor, and the instrument remains essentially unchanged. As a distinct instrument the guitar is seldom used, although difficult pieces may be performed on it, and as an accompaniment to the voice it has been generally superseded by the piano.

**Guittone d'Arezzo**, goo-ĕĕt-tō′nā-daă-ret′sō: poet; b. at Santa Firmina, near Arezzo, Italy, between 1220 and 1230. The hints of Dante (*Purg.*, xxiv., 56, and xxvi., 124; *Vulg. Elog.*, i., 13, and ii., 6) show that he was generally esteemed one of the chief of Italian poets before the rise of the *dolce stil nuovo*. (See Italian Literature.) His life and his poems fall into two sharply marked divisions. As a young man he was enamored of the service of Love after the fashion of the troubadours, studied the poetic art under the older poet Bandino, and wrote verses full of the most conventional sentiments. When about thirty years old, however, he suddenly abandoned all he had before affected, and, leaving his wife and three children, he became a member of the Ordine de' Cavalieri di Sta. Maria, the so-called *frati gaudenti*. From this time on he bitterly condemned all he had hitherto praised, and in harsh verses and in letters uttered his opinions upon the political and religious questions of his time. He acquired great influence, however, becoming provincial of his order. In 1293 (1295?) he gave a large part of his property for the establishment of the monastery Degli Angeli in Florence. D. 1294 (1296?). See Valeriani, *Rime di Fra Guittone d'Arezzo* (Florence, 1828; reprinted Florence, 1867); Bottari, *Lettere di Fra Guittone d'Arezzo* (Rome, 1745); Romanelli, *Di Guittone d'Arezzo e delle sue opere* (Campobasso, 1875); Koken, *Guittones von Arezzo Dichtung und sein Verhältniss zu Guinicelli von Bologna* (Leipzig, 1886); A. Bartoli, *Storia della Letteratura italiana* (vol. ii., Florence, 1879). Lucy A. Paton.

**Guizot**, gĕĕ′zō′, François Pierre Guillaume: statesman and historian; b. at Nîmes, France, Oct. 4, 1787. His father, an eminent lawyer, was a victim of the Revolution in 1794. His mother had him educated in the Protestant faith and in classical learning at Geneva. He established himself in Paris in 1805, and began writing for the public in 1809. In 1812 he married Mlle. Pauline de Meulan (1773–1827), author of several books and editor of *Le Publiciste*, and the same year was appointed Assistant Professor of History at the Sorbonne. His political career began with the fall of Napoleon in 1814, when he was appointed Secretary-General of the Interior. In 1815 he was transferred to the Department of Justice, was made master of requests in 1816, and Councilor of State in 1817. He belonged to the constitutional party, and in his writings represented the views of the Doctrinaires, so called. On the fall of the Decazes cabinet in 1820 he resigned the position of director-general of the communal and departmental administration, and, having lost his seat in the Council of State, resumed his historical lectures at the Sorbonne. His course on the *History of Representative Government* attracted great attention, and in 1822 his lectures were suppressed on account of their radical tendencies. He then gave himself to literary work, and in 1828 established the *Revue Française*. The same year he married his second wife, a niece of the first, and also an author, by whom he had one son, who survived him. In that year also he was restored to his chair at the Sorbonne and to his seat in the Council of State. His lectures during the next two years on the *History of Civilization in Europe* and the *History of Civilization in France* were received with great favor, and gained for him his highest distinction. In Jan., 1830, he was elected to the Chamber of Deputies, and favored the measures which led to the revolution of July. Louis Philippe called him into his first cabinet as Minister of the Interior, but he soon resigned and resumed his place in the Chamber. In 1832 he took the Department of Instruction in Marshal Soult's ministry, and for four years did much to organize the system of primary education. On the dissolution of that ministry in 1836 he retired, and except for a few months, when he again occupied his post in connection with the ministry of Molé, acted with the opposition party. In Feb., 1840, he was sent as ambassador to England, where he was received with marked attention on account of the favor with which in his lectures he had spoken of the Brit-

ish constitution. In October of the same year he entered the cabinet again as Minister of Foreign Affairs, and for more than seven years was really the head of the Government. In that position he maintained steadily and persistently the policy of resisting the revolutionary spirit prevalent in the country, and establishing on a secure basis a constitutional monarchy like that of Great Britain. His wise and able administration did much to form a healthy political sentiment in the nation, and to secure the largest liberty compatible with a stable government. But his policy favored peace with all other European states. This was interpreted by the opposition as involving a subordination to the influence of Great Britain and Russia, and the party which had inherited the ideas and spirit of the Great Revolution, restless and active, though comparatively small in numbers, used this plea effectively to make the ministry unpopular, especially in Paris. Yet Guizot had the full confidence of the king, and was sustained by the Chamber of Deputies to the end.

In the latter part of the year 1847 an agitation for electoral reform created excitement throughout France. So-called reform-banquets, in which the Government was insulted and defied, were organized to discuss the proposed measures. Guizot proposed to the king that the cabinet should retire and open the way for a change of policy. But to this the king objected so long as the administration had the support of the Chamber of Deputies. The attempt subsequently made to suppress the banquets brought on the Revolution of 1848, when Louis Philippe was dethroned and Guizot took refuge in England. After a year's absence he returned, and as a candidate for the Chamber of Deputies was defeated. The remainder of his life was passed in retirement from direct concern with politics. He was, however, an interested observer of passing events, and occasionally gave public expression to his opinions. Thus in 1861 he startled his Protestant friends by declaring himself in favor of continuing the pope's temporal power; and in 1870 he sustained the administration of Ollivier. During his later years he published many volumes embodying his mature judgment on religious and historical subjects. He died at his villa in Valricher, near Paris, on Sept. 13, 1874.

As a statesman Guizot must be ranked among the great and good men of France. He was a consistent advocate of constitutional monarchy, but the nation, especially as represented by the population of the capital, was not prepared to adopt his views. His highest and most enduring reputation rests on his historical writings, in which he evinced accurate knowledge of facts, clear discernment of causes and governing principles, and great power for comprehensive and well-balanced generalization. The purity of his private life and the simplicity and strength of his Christian faith add a crown of solid worth and shining grace to his noble character. He was honored with membership in three of the five academics which make up the Institut de France. He was elected to the Academy of Moral and Political Science in 1832, to that of Inscriptions and Belles-Lettres in 1833, and to the French Academy in 1836. In 1872 he received the chief prize of the Academy.

The following is a list of Guizot's most important published writings: *A Dictionary of French Synonyms* (1809); *Annals of Education* and *The State of the Fine Arts in France* (1810); an annotated translation of Gibbon's *Decline and Fall of the Roman Empire*, *Lives of the French Poets of the Age of Louis XIV.* (1813); an *Essay on Representative Government* (1816); *Conspiracies and Political Justice*, *Means of Government in France* (1821); *History of Representative Government* (lectures at the Sorbonne, 1822); *An Introduction to a Revised Translation of Shakspeare*, *Essays on the History of France from the Fifteenth to the Eighteenth Centuries*, *Notes to Memoirs respecting the English Revolution*, *Notes to Memoirs respecting the History of France down to the Thirteenth Century*, *History of the English Revolution* (1827); *General History of Civilization in Europe* (1828); *General History of Civilization in France* (1830); *Fall of the Republic and Restoration of Monarchy in England* (1850); *Corneille and his Times*, *Shakspeare and his Times* (1852); *History of the English Republic and the Protectorate of Cromwell* (1854); *History of the Protectorate of Richard Cromwell and the Restoration of the Stuarts* (1856); *Memoirs on the History of my Own Time* (1856–68); *The Church and Christian Society* (1861); *Meditations on the Essence of the Christian Religion* (1864); *Meditations on the Present State of the Christian Religion* (1865); *History of France, for my Grandchildren* (1870, *seq.*); *History of Four Great French Christians* (1873–74). His *Study of Washington*, written as a preface to the life and writings of the great President, is a charming monograph. Most of his works have been translated into English. Revised by C. K. Adams.

**Gujarat**: See Guzerat.

**Gujranwa'la**: a district and city of Lahore division, the Punjaub, British India. The district is between the parallels 31° 32′ and 32° 33′ N., and the meridians 73° 11′ and 74° 28′ E., just S. of the river Chenab. Area, 2,587 sq. miles. It is the central part of the region called Rechna Doab, intermediate between the fertile foot-hills and plains of Sialkot and the deserts of Jhang. It is bare of trees, tame, and monotonous, but is fertile where it can be reached by water. The chief product is wheat, but other grains, oil-seeds, and sugar-cane are raised. The railway from Lahore to Peshawar passes through the district. The climate is healthful; the rainfall 24 inches. A great religious fair is held at Dhonkal. In mediæval times this district contained a metropolis called Taki, the ruins of which have been identified. At the time of the Mohammedan invasions it had disappeared. Under Mohammedan rule it revived, but later was abandoned. It revived again under Sikh rule, but is now of little importance. Pop. upward of 600,000, mostly Mohammedans. The chief town and capital is Gujranwala, in lat. 32° 10′ N., lon. 74° 14′ E., on the Grand Trunk and Northern State Railway, 40 miles N. of Lahore (see map of North India, ref. 4–D). It was the capital during the Sikh power. Pop. about 25,000. M. W. Harrington.

**Gujrat**: a district and town of Rawal Pindi division, Punjaub, British India. The district is between the parallels 32° and 33° N., and meridians 73° 20′ and 74° 31′ E. It is S. W. of Kashmir and between the rivers Jhelum and Chenab. Area, 1,973 sq. miles. It is a submontane district, and is fertile where supplied with water. Wheat is the staple product, but other grains, oil-seeds, and cotton are raised. The climate is healthful; the rainfall is 28·5 inches. The Northern State Railway traverses the district. Numerous relics of antiquity stud this area. Among them are the ruins of Nicæa, built by Alexander the Great on the field of his victory over Porus. Gujrat was the seat of bloody battles during the Sikh war. Pop. 700,000, mostly Mohammedans. The chief town and capital is Gujrat, in lat. 32° 34′ N., lon. 74° 7′ E., and is, according to tradition, the third city on this site (see map of North India, ref. 3–C). The trade is inconsiderable. Pop. 19,000.

M. W. Harrington.

**Gules** [M. Eng. *goules*, from O. Fr. *gueules*, gules, liter., plur. of *gueule*, mouth, jaws, referring to the color of the inside of the mouth]: in heraldry, a tincture; the color red. In modern engravings and drawings it is represented by fine perpendicular lines.

**Gulf of Carpentaria**: See Carpentaria, Gulf of.

**Gulf of Guinea**: See Guinea.

**Gulf Stream**: the best known of the ocean currents. The oceanic circulation of the Atlantic is of two kinds, one part consisting of a general drift at the surface from the equator toward the poles, compensated by a reflux of water from the poles toward the equator, chiefly below the superficial stratum. The other portion comprises limited bodies of water, whose motion, relatively to the general mass, is so rapid and whose direction is, on the whole, so constant, that they become individualized as currents of the ocean, comparable to rivers on the land. The most widely known and most thoroughly studied of all ocean currents is that which forms the subject of this article. It has received its name from the important part taken by the waters of the Gulf of Mexico in its formation, but in popular usage the name has been employed to designate not merely the Gulf Stream proper, but much of the oceanic drift of the North Atlantic which moves in harmony with the stream throughout its course, but at a much slower rate, and is extended over a vast area eastward and northward from the Gulf Stream, where the latter is unknown. The differences of opinion which appear in the literature as to the limits of the Gulf Stream are chiefly due to such a confusion of terms.

*Origin.*—The origin of the Gulf Stream, as of other great ocean currents, is due to the reaction of the atmospheric upon the oceanic circulation; that is, it is caused by the winds and modified by the form of the continental shores and the differences of rotational diameter of the earth between the equator and the poles, which last, as shown by

Ferrel, tend to deflect to the right any moving body in the northern hemisphere. Minor modifications of its force and volume are brought about by differences of atmospheric pressure at different portions of its course and by the solar and lunar tides.

*Course.*—In the tropical regions of the Atlantic the northeast and southeast trade-winds are continually blowing, with a belt of calms between them. The southeast trades impel upon the coast of South America a mass of water which is divided at Cape San Roque, that portion which follows the coast northward being known as the Guiana current, which sets toward the Windward islands northward from Tobago with a course about N. N. W. S. W. of Barbados this is re-enforced by the current due to the northeast trades, and the flow thus originated pours through the passages between the islands, being strongest in that just S. of Santa Lucia and weakening in those northward. In addition to this, a vast body of even warmer water, due to the northeast trades, passes outside the West Indian islands, and later joins the Gulf Stream after it issues from the Straits of Florida. Having entered the Caribbean Sea, the current is in a measure confined by the adjacent shores, and the force exerted by the wind being for the most part steadily in one direction, the water acquires a constantly increased velocity, and in the western part of the sea is running more strongly than anywhere in the previous part of its course. This water enters the Yucatan channel between that peninsula and the island of Cuba, and from that channel is discharged into the Gulf of Mexico, raising the level of the surface above that of the Atlantic. The currents in the gulf proper are feeble and variable; in general the motion of the water is from the northern end of the Yucatan channel directly toward the Straits of Florida across the southern margin of the gulf. With a high declination of the moon, inducing stronger tidal influences, the tendency toward the straits is from a more northward region of the gulf. Passing through the straits the axis of the stream is at first near its southern edge, but after turning the Florida reefs this axis shifts to the westward, being there from 5 to 12 miles seaward from the 100-fathom curve along the continental shore. At the northern entrance of the Straits of Florida, between Gun Cay and Fowey Rocks, a careful study has been made by the U. S. Coast Survey of a section of the stream through which, according to Lieut. J. E. Pillsbury, U. S. navy, the hourly flow is 89,872 million tons of water, the rate at the surface being more than 3½ miles per hour in the axis of the stream, with a gradual diminution laterally and vertically. The mind can better appreciate the immensity of these figures by considering that if one hour's flow were evaporated, the salt thus produced would require more than 100 times the number of sea-going vessels now afloat to carry it. The water of the Gulf Stream is characterized by a deep-blue color, great clearness, and high temperature. When it meets the greener ocean water of the north the line of distinction is often absolutely distinct.

After leaving the strait the stream is re-enforced by the Windward current from the eastern margin of the Antilles, which, by passing over many shoals, has become very warm, but is not of great velocity. The resulting stream pursues a general northeasterly direction, passing close to Cape Hatteras and thence in a northeasterly direction between Bermuda and Nova Scotia, eastward of which it gradually loses its distinct character and becomes merged in the general oceanic drift promoted by the constant westerly winds known as the anti-trades.

*Secular Variations.*—The velocity, direction, and temperature of the Gulf Stream vary almost as regularly as do the tides in a harbor, being dependent as they are upon the influence of the sun and moon. The tidal wave, passing at right angles through the Gulf Stream toward the coast, temporarily checks the velocity of the current, and during this diminution of rate the temperature tends to fall and the directions of the marginal parts of the stream become less regular. There are diurnal variations corresponding in succession (though not in actual time) with the tidal variations, and a monthly series due to the changes in lunar declination. These changes, especially the diurnal ones, are more marked when the current runs near the shore; in the more open sea the solar influence is more distinct, and the monthly fluctuations more prominent.

*General Characteristics.*—The width of the Straits of Florida near the exit of the Gulf Stream, between Jupiter Inlet and Little Bahama Bank, is 48 miles, the greatest depth 439 fathoms, the area of the cross-section about 430 million sq. feet, and at 3 knots, the average velocity here, the amount of water passing through would be about 436 million million tons a day. The width of the stream varies from 45 to nearly 100 miles, the velocity of the axial part being greater than that of the lateral portions. The axis is about the same width off Hatteras that it is where the stream leaves the Florida Straits. The temperature of the current in the early part of its course rarely exceeds 83° F. in June and July, except under a hot sun in very calm weather. The Windward current, being slower and passing over many shoals and banks, is more thoroughly warmed by the sun than the part which comes through the straits; therefore, after the two currents combine, the greatest temperature is not in the axis of greatest velocity. The temperature at different depths preserves about the same relations to that at the surface in different parts of its course, heat being gradually lost as the stream advances northward and eastward. The average rate of flow may be 2½ miles per hour, in many places it is less, and in some it reaches 5 miles per hour. Fluctuations of a pronounced character have been shown to follow barometric changes in the gulf or elsewhere, greater pressure increasing or diminishing the rate of flow according to the point where it is applied; pressure near the sources of the stream increasing its rate and *vice versa*. The Gulf Stream in passing over the submarine border of the land known as the Continental Plateau has its inner edge near, but not rigorously continuous with, the 100-fathom curve. The edge of the plateau drops suddenly to about 2,000 fathoms, and makes its nearest approach to the coast at Cape Hatteras. The cold Labrador current runs outside of and along this bank, and when the Gulf Stream pours over it causes a tumult in the waters. Whether the cold current follows the margin of the plateau to the equator, or whether a portion of it, rising in temperature but retaining its motion, passes over the plateau inside of the Gulf Stream is yet to be determined, but it is not improbable that this is the origin of some of the cooler water found between the Gulf Stream and the southern coast. Marked variations in the temperature at the surface, known as "cold bands," have been noted in the Gulf Stream by many investigators. They form streaks trending with the current, and are apparently formed by cooler water from below displacing the warmer fluid at the surface. This is explained by the fact that while the warm water from its heat is less dense than the polar water, yet its excess of salt makes it of nearly equal specific gravity. If it cools at any time sufficiently to overcome the difference, even though still remaining warmer than the polar water, its weight may cause the stream water to sink below the former. Small differences of density under variable conditions will determine when the waters are adjacent which shall override the other, and thus produce the observed alternations of temperature. Gales, storms, changes in barometric pressure and in the season of the year, besides other factors yet unknown, all combine to produce in direction, temperature, and velocity fluctuations of a minor kind, while the general features of the stream remain fairly constant from year to year.

*Exploration of the Gulf Stream.*—The first navigators who explored the Caribbean and gulf regions necessarily had the strong currents forced upon their attention. Ponce de Leon observed the current in the Straits of Florida in 1513. Sixty years later Sir Humphrey Gilbert wrote in a manner which showed him to be acquainted with the general course of the Gulf Stream in the sub-tropical part of its course. In 1663 Vossius particularly and correctly described its course and the character of the circulation of the currents in the North Atlantic. But in the map of Kircher (1678) and that of Happelius (1685), on which the currents are delineated, no indication of the Gulf Stream proper appears except that portion of it outside of the Straits of Florida which is represented as continuous with the Windward current due to the northeast trades. The first to bring this great current to the notice of the learned world on a chart correctly representing its origin, and to publish the name by which it had already become known to some of the navigators of New England, was Benjamin Franklin in 1770. Attention had been called to the fact that the mail-packet ships between Falmouth, England, and New York were generally a fortnight longer in crossing than the private merchant vessels between London and Newport, R. I.; Franklin, being concerned in the management of the North American postal system and at that time in London, was consulted, and found that the difference was due to the knowledge of the Gulf

Stream possessed by the Rhode Island navigators, which, though brought to the attention of the masters of the royal packets, was disregarded by them. He therefore had the position and rate of the current engraved on a small chart, which was afterward reprinted in France. He also correctly referred the generation of the current to the action of the trade-winds. From the time of Franklin to 1845 numerous observations were made on the Gulf Stream, and its extent, direction, and force became generally known to hydrographers, while the whole question of its origin, characteristics, and variability, though much discussed, was still involved in great obscurity. In 1845 Prof. Bache, the head of the U. S. Coast Survey, inaugurated systematic exploration of the stream under Lieut. C. H. Davis, U. S. navy. This investigation was carried on more or less continuously by the hands of various naval officers attached to the survey. It was, however, only when the application of steel wire to sounding work was begun by Sir William Thomson and perfected by Belknap and Sigsbee that accurate observations became possible and genuine progress began. This came about in 1875–82, under Platt, Howell, Sigsbee, and especially Bartlett, of the navy, acting under the direction of the survey, and assisted by Mitchell, Pourtalès, Agassiz, and other men of science. In 1883 the plan of observing the currents from a vessel anchored at sea, first attempted by Platt in 1877, was applied by the survey to the Gulf Stream in the schooner Drift, commanded by Lieut. Fremont. In 1884 a deep-sea current meter, invented by Lieut. J. E. Pillsbury, U. S. navy, was put in use, and observations by that officer during five years in command of the Coast Survey steamer Blake were extremely fruitful in results.

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W. H. Dall.

**Gulf-weed**: the popular name applied to large seaweeds found floating in the ocean, sometimes covering large areas, especially in the so-called Sargasso Seas, the most noted of which is in the mid-Atlantic. Gulf-weeds are species of the genus *Sargassum* of the family *Fucaceæ* and order *Fucoideæ*. (See Fucoids). They are characterized by their branching stems, which bear distinct leaves with a midrib, and stalked one-celled air-bladders. There are about 150 species, which are mainly inhabitants of the warmer waters of the globe. *S. bacciferum* is found floating in great quantities in the tropical and sub-tropical waters of both hemispheres. It is occasionally washed ashore as far north as the coast of New England. Its near relative, *S. vulgare*, is found along the eastern coast of the U. S. from Cape Cod southward to the West Indies, and also on the European and African coasts.

Fig. 1.—Gulf-weed, *S. bacciferum*, somewhat reduced in size.

Fig. 2.—*Sargassum vulgare.*

Charles E. Bessey.

**Gull** [from Corn. *gullan*; cf. E. *guillemot*]: a water-bird of the family *Laridæ*, or rather of the sub-family *Larinæ*, the members of the sub-family *Sterninæ* being popularly known as terns or sea-swallows. Gulls are web-footed birds, having the hind toe rudimentary or small, the horny sheath of each mandible in a single piece, the wings long, and flight protracted and graceful. Of the seventy or more species, some are found in Arctic seas and others in tropical waters, while they are equally at home on the ocean or on inland lakes. They range in size from the great black-backed gull (*Larus marinus*), with a spread of 5 feet or more, to the little *Larus minutus*.

Gulls are gregarious, breed in colonies, and make their nests on the ground, or, like the kittiwake, build on some precipitous rock overlooking the water. The pear-shaped eggs are generally three in number, and are taken in quantities by dwellers in high northern latitudes, where the species of the north temperate zone mostly breed. They feed on fish, crustaceans, cuttle-fishes, and animal matter generally; are tame wherever protected, shy and suspicious where persecuted by man. The gulls form a very compact body of birds, and although they have been divided into numerous genera, *Larus*, *Rissa*, *Xema*, *Chroicocephalus*, etc., the distinctions between them are slight. The great black-backed gull (*Larus marinus*) is white, the mantle, as the back and upper part of the wings are collectively called, of so dark a slate color as to appear black; primaries, secondaries, and tertials tipped with white. This bird is 2½ feet long and 5 feet from tip to tip of wing. It is found on both sides of the North Atlantic, and has the habit of helping itself to the eggs and young of birds nesting in its vicinity. The glaucous gull, or burgomaster (*Larus glaucus*), is as large as the

preceding, but the mantle, as in many other species of gulls, is a beautiful pearly blue. The burgomaster is circumpolar and breeds in the far north. Although the gulls, as a group, are world wide in their distribution, some species are very much restricted in their range. Thus the ivory gull (*Pagophila eburnea*), so called from the pure white color of the old birds, is confined to the Arctic seas, and the fork-tailed gull (*Creagrus furcatus*) is limited to the Galapagos islands, and is so rare that very few specimens are preserved in museums. The rosy gull (*Rhodostethia rosea*) is another Arctic species, and although it has been taken by various polar expeditions, its breeding-place is still unknown, although supposed to be in the vicinity of the north pole. See also Gaviæ, Herring-gull, Kittiwake, Longipennes, Jaeger, and Tern.

F. A. Lucas.

**Gull**, Sir William Withey, Bart., M. D., D. C. L., F. R. S.: b. in Thorpe-le-Soken, Essex, England, Dec. 31, 1816; passed M. B. in 1841 and M. D. in 1846 at the University of London; was Professor of Physiology at the Royal Institution 1847–49, and for many years was a lecturer at Guy's Hospital; won a baronetcy by his skill in attending the Prince of Wales in 1871; published *Gulstonian Lectures on Paralysis*, *Hypochondriasis*, *Reports on Epidemic Cholera*, the Hunterian oration in 1861, and the Harveian oration in 1870; *Alcohol as a Medicine and as a Beverage*, and many addresses and papers. D. in London, Jan. 29, 1890.

**Gulliver**, John Putnam, D. D., LL. D.: b. in Boston, Mass., May 12, 1819; graduated at Yale in 1840 and at Andover 1845; Congregational pastor in Norwich, Conn., and in Chicago 1846–68; president Knox College, Galesburg, Ill., 1868–72; Presbyterian pastor in Binghamton, N. Y., 1872–78, and since 1878 Professor of the Relations of Christianity and Science in Andover Seminary. D. Jan. 25, 1894.

**Gully**, William Court: See the Appendix.

**Gum** [M. Eng. *gumme*, from O. Fr. *gomme*: Ital. *gomma* < Lat. *gummi*, from Gr. *κόμμι*, gum, a foreign word of unknown origin]: a name somewhat vaguely applied to many vegetable juices and to some animal juices, chiefly to such as are neither oily nor resinous. The gums proper consist (according to Guérin) essentially of arabin ($C_{12}H_{22}O_{11}$, found in gums arabic and senegal), of cerasin (cherry, plum, and peach gum), of bassorin (the mucilaginous principle of Bassora gum and of tragacanth). *Arabin* has mildly acid properties; is soluble in hot or cold water, forming mucilage; is precipitated by alcohol or subacetate of lead; is coagulated by borax; and is believed to exist in gum arabic in combination with small proportions of alkalies and alkaline earths. It is isomeric with cane-sugar. *Bassorin* swells, but does not perfectly dissolve, in water, with which, however, it may be rubbed into a very adhesive paste, which can not be called a solution. *Cerasin* much resembles it, but has somewhat different chemical reactions. The principal gums are the following: Gum Arabic is mainly the product of *Acacia verek*, but is in part the product of *A. nilotica* and other thorny trees and shrubs of the genus, found throughout a very large part of Africa and in portions of Asia. That from the Nile valley is the Turkey gum of commerce; Barbary gum comes mostly from Mogadore, and is of two kinds—one (identical with Turkey gum) grows in Morocco, etc., and the other is brought from the Sudan by caravans. Gum Senegal is closely allied in character to the above, is identical in its uses, and is the product of several trees of the genus *Acacia*, growing in Western Africa. *Galam gum* is a name given to some of the best varieties of gum senegal. Much of the gum arabic of commerce is really from Senegal. *India gum* is mostly produced in Africa and Arabia, and finds its way to Bombay in Arab vessels. *Cape gum* was formerly brought from South Africa, and Australia has supplied some of the gum of commerce. Gum Mezquite, from *Algarobia glandulosa*, a thorny leguminous shrub of the dry regions of Mexico and the adjacent parts of the U. S., is closely analogous to gum arabic, but its principle is not precipitated by borax. Tragacanth is the gummy exudation which appears spontaneously or upon the incised bark of *Astragalus verus* and other species of that genus, family *Leguminosæ*. Bassora gum, from Persia, combines the principles arabin and bassorin. The plant which produces it is not known, but is supposed to be an *Astragalus*. Besides the true gums, many other somewhat similar products are popularly known as gums. See Gum Resins.

*Uses.*—The true gums above enumerated are used in the arts as sources of Mucilage (*q. v.*); in medicine they are demulcent; they are employed in pharmacy in making troches and pills; in confectionery for the basis of many pastes and confections; in calico-printing, in preparing inks, in making sizes, and other stiffening preparations, they have also an extended use; but Dextrin (*q. v.*), or British gum, has in part taken their place. Most experimenters have concluded that the gums are entirely innutritious, but this conclusion is perhaps open to some question.

**Gum Benjamin**: See Benzoin.

**Gumbinnen**, goom-bĕn'en: a garrisoned town of Prussia in the province of East Prussia, on the Pissa; 72 miles by rail E. of Königsberg (see map of German Empire, ref. 1–K). It was founded in 1724, and in 1732 Frederick William I. received and settled here the Protestants from Salzburg who emigrated on account of religious persecutions. It has two gymnasia, a branch of the imperial bank, a hospital, an iron-foundry, machine-works, brick-kilns, and various manufactures. Pop. (1890) 12,213.

**Gumbo** (*Gombaud*, *Okra*): the *Hibiscus esculentus*, a plant of the family *Malvaceæ*; native of the West Indies, and cultivated in the U. S., especially in the Southern States, also in most warm countries, for its mucilaginous pods, which are excellent in soup, and are often cooked and served up with butter or pickled. It is extensively raised in the vicinity of Constantinople, also in Egypt. The seeds are in many places used as a substitute for coffee, and the leaves are put to manifold uses on account of their demulcent qualities. The *Gombo musqué* is the *Hibiscus moschatus*, cultivated in many warm countries, and prized for its reputed medical virtues. Its seed, known as ambrette, is employed by perfumers.

**Gum Dragon**: See Dragon's Blood.

**Gum Elastic**: See Caoutchouc.

**Gum Lac**: See Lac.

**Gumma**: See Syphilis.

**Gummere**, Francis Barton, A. B., Ph. D.: author and teacher; b. at Burlington, N. J., Mar. 6, 1855; educated at Haverford College, Harvard College, and Freiburg University; was teacher of English in the Friends' School, Providence, R. I., 1875–79; instructor in English, Harvard College, 1881–82: head master, Swain Free School, New Bedford, Mass., 1882–87; became Professor of English, Haverford College, 1887. He has published *The Anglo-Saxon Metaphor* (Halle, 1881); *Handbook of Poetics* (Boston, 1885; 4th ed. 1893); *Germanic Origins: a Study in Primitive Culture* (New York, 1892); and miscellaneous essays and papers, mainly in Germanic philology and English literature.

**Gum Resins**: a group of vegetable products consisting of a mixture of gum and resin. They are obtained by allowing milky exudations from certain plants to evaporate spontaneously. Their chief use is in medicine. The principal gum resins are included in the following list:

*Ammoniacum.*—Two varieties are recognized—the *Persian* and the *African*. The former has been an article of commerce for ten centuries. The latter is mentioned by Dioscorides and older writers.

*Asafœtida.*—This is the dried juice of two plants found in Thibet, Afghanistan, and Turkestan. They are *Ferula narthex* and *Ferula scorodosma*. Asafœtida is used in medicine as a nervous stimulant and antispasmodic, and in the East as a condiment.

*Bdellium.*—This is mentioned in the Bible. It is obtained from India, and is used principally to adulterate myrrh.

*Euphorbium.*—This is very little used.

*Galbanum.*—This has been used from the earliest times as an ingredient of incense and in medicine. It is mentioned by the oldest writers. It is not certain from what plant it is derived.

*Gamboge* is obtained from Cambodia, Siam, and Cochin China. It is used in medicine as a drastic purgative.

*Ivy gum resin* is obtained from the old trunks of the common ivy.

*Myrrh* has been used from the earliest times as an ingredient of incense, and also in embalming. It is obtained from a shrub or small tree (*Balsamodendron myrrha*) which grows on the Somali coast of the Gulf of Aden and on the Red Sea coast of Arabia.

*Olibanum*, or *frankincense*, has always been the favorite ingredient of incense and, like myrrh, has been used for embalming from the earliest times.

Other gum resins are *opopanax sagapenum* and *scammony*.

Ira Remsen.

**Gumri**: See ALEXANDROPOL.

**Gums**: See GUM.

**Gum'ti**: two rivers of British India; the larger is an affluent of the Ganges, flowing through Oudh, passing Lucknow, and emptying into the Ganges near Benares. The other rises in Hill Tipperah, flows westward through Chittagong, Bengal, and empties into the Barak near its mouth on the Megnah. M. W. H.

**Gum-tree**: a name given in the U. S. to several trees: (1) The black or sour gum, pepperidge, or tupelo (*Nyssa sylvatica*), a large tree growing in most of the States E. of the Mississippi, produces a firm, hard timber, used for bowls, hat-blocks, windmill shafts, hubs, cart-lining boards, etc. It is grown in Europe. *Nyssa uniflora* and *aquatica*, the water-tupelos of the South, have soft, light wood, and their roots have been recommended as substitutes for corks. The *Nyssa capitata* of the Gulf States bears a sour edible fruit, the Ogeechee lime. The above trees belong to the family *Cornaceæ*. (2) The sweet gum, bilsted, or liquid-ambar (*Liquidambar styraciflua*), of the family *Hamamelaceæ*, grows from New England to Mexico. It is a fine large tree, well known by its star-like leaves and furrowed bark. Its wood is soft, but firm and fine-grained, and used in making furniture. In the warmer latitudes it yields an abundant balsamic resin called American storax. Its bark is very useful in the treatment of diarrhœa and dysentery. This tree grows well in Europe. *L. imberbe* of the Levant yields styrax or storax, and so does *L. altingia*, a very lofty tree of Farther India, having a very hard, heavy, fragrant red timber. (3) Very different from either of the foregoing are the *Eucalyptus*, or gum-trees of Australia (see EUCALYPTUS); (4) in different British colonies still other trees with gummy or viscid juice are called by this name.

Revised by CHARLES E. BESSEY.

**Gun**: See ARTILLERY and SMALL ARMS.

**Guṇa** [Skr. *guṇá-*, property, peculiar quality, used of the properties of vowels]: a technical term of the Hindu grammarians denoting the apparent modifications of vowels by the prefixing of *a*; thus the *guṇa* of *i* is *ē* (*ay*) = *ăi*, of *u* is *ō* (*av*) = *ău*, of *ṛ* is *ar*, of *ḷ* is *al*. This view of the relation between the weaker and stronger form of vowels is based solely upon appearances in Sanskrit. Modern comparative grammar shows that the phenomenon of ablaut which is here involved was of Indo-European origin, and not a product of the individual languages; furthermore that the fuller vowel is not to be regarded as developed from the weaker, but rather the reverse; thus Skr. *bōdh-* (<*bheudh-*): Gr. *πευθ-* are the normal forms of the root, and not the strengthened forms of *budh-* and *πυθ-*. In distinction from *guṇa*, the still stronger form of the root (*āi*, *āu*, *ār*, etc.), was called *vṛddhi*.

BENJ. IDE WHEELER.

**Gun'boat**: a war-vessel of relatively small dimensions, usually propelled by steam and carrying a small number of guns, often of heavy caliber. Gunboats are of especial service on rivers and for in-shore duty, such as blockading service and the like. They are constructed by nearly every naval power of any importance. See SHIP-BUILDING.

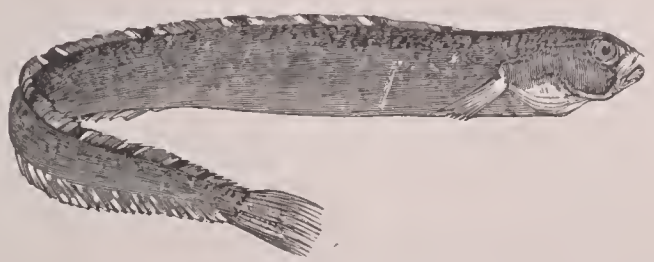
**Guncotton**: See EXPLOSIVES.

**Gunduck**: same as GANDAK (*q. v.*).

**Gundwa'na**, gŭnd-waa'na: a former province of Central India, now mostly contained in the Nagpur district. It takes its name from the GONDS (*q. v.*), one of the most important of the native races. Their portion of this highland region is almost entirely a wild jungle.

**Gunmaking**: See ORDNANCE.

**Gunnel**, or **Butterfish**: popular name of certain small eel-like marine fishes of the blenny family, found often in



The spotted (European) gunnel.

tide-pools and under seaweed along the shore. Among the species are *Murænoides mucronatus* of the Atlantic coast of the U. S., and the *Murænoides gunnellus* of Europe. They are covered with mucus, and are caught for fish-bait.

**Gunnery**: the science which treats of the motion, and the cause of motion, of projectiles fired from cannon or small-arms; also the art of using artillery and the implements pertaining thereto. The motion of a projectile from the instant it starts from its seat in the gun until it strikes the object aimed at, and comes to rest, passes through three distinct stages, giving rise to as many different branches of the subject, called, respectively, *interior ballistics*, *exterior ballistics*, and *penetration of projectiles*. These divisions will be considered separately in the order named.

*Interior ballistics* treats of the phenomena which take place in the chamber and bore of a gun from the time of ignition of the charge until the projectile leaves the muzzle, expelled by the expansion of the highly elastic gas furnished by the combustion of the powder. It determines, among other things, the proper relations of weight of charge to weight of projectile and length of bore; the proper size, shape, and density of the powder-grains which make up the charges for different guns, and the effect of each of these qualities upon the pressures exerted upon the walls of the gun; the velocity of recoil and the strength of the carriage necessary to sustain the strains it suffers. It is by a careful study of all these points that the great superiority of guns manufactured since 1870 has been effected. Among many others who have worked successfully in this department of gunnery may be mentioned Noble and Abel in England and Sarrau in France. The two former, working together, studied the phenomena produced by the explosion of gunpowder in a closed vessel sufficiently strong to resist the expansive force of the gas, thus enabling them to collect the whole of the complex products of combustion and examine them at their leisure. Their results have an important bearing upon interior ballistics, since they help to determine the temperature of combustion of fired gunpowder, the mean specific heat of the products of combustion, the ratio of solid to gaseous products, and what is technically known as the force of the powder—all of which are important factors in determining the work done by the gas in the bore of a gun. Sarrau, in a series of memoirs upon the effects produced by fired gunpowder in the bore of a gun, has deduced practical formulas for calculating pressures and muzzle velocities to a remarkable degree of approximation. In these investigations Sarrau took into account, for the first time, the progressive burning of the charge under the influence of the variable pressure to which it is subjected in the gun, and was thus able to introduce into his formulas the characteristic elements of each powder employed—that is, the density, form, and size of grain—and thence determine the effect which each of these elements produces upon the maximum pressure and muzzle velocity.

Though the time that elapses between the ignition of the powder-charge in the chamber of a gun and the rush of the projectile from the bore is too short for the senses to take cognizance of, yet in this short interval many phenomena take place in orderly sequence within the bore. Imagine a modern seacoast gun—say, the breech-loading 12-inch steel rifle, model of 1891, adopted by the U. S Government—mounted upon its proper carriage, and loaded with the service charge. This gun is 40 feet long, nearly 4 feet in diameter at the breech, and weighs 57 tons. It is loaded with a charge of 520 lb. of brown prismatic powder (see GUNPOWDER), and an oblong, pointed projectile weighing 1,000 lb. (See PROJECTILES.) The charge of powder occupies the chamber—an enlargement of the bottom part of the bore—and completely fills it, though the air-spaces in the interstices between the powder-grains aggregate about two-fifths the volume of the chamber. The piece is discharged by the pulling of a lanyard, or small cord, attached to the eye of a friction primer inserted in the vent, or small cylindrical canal conducting to the chamber, and by a simple arrangement detonates a small quantity of fulminate of mercury placed in the head of the primer, and this in turn ignites a larger quantity of fine sporting powder with which the tubular body of the primer—projecting into the vent—is filled. The combustion of this powder sends an intensely hot tongue of flame downward through the vent into the powder-chamber, igniting at once several of the coarse grains of which the charge is composed, and the inflammation spreading with great rapidity from grain to grain through the interstices of the charge, the whole is almost instantly ignited.

The first gaseous products formed by the combustion of the grains expand into the vacant spaces (air-spaces) of the chamber, and, filling them, soon acquire sufficient tension to start the projectile and force the copper band which encircles it near its base into the grooves. The projectile once in motion encounters no further resistances so great as those which opposed its start; and as it moves along the bore, its velocity rapidly increases under the continued pressure of the gas. The pressure also increases at first, but soon attains its maximum (in the gun selected for illustration) of 37,000 lb. per square inch when the projectile has moved but a short distance, and then decreases, but much more slowly than it increased, until, when the projectile leaves the bore after traveling 30·41 feet from its seat, the pressure is only about one-fourth of its maximum. This variation of pressure is due to several causes. At first the surfaces of inflammation, that is, of the grains of powder, are relatively large, and the emission of gas correspondingly great: and, besides, the combustion of the charge is accelerated by the increase of pressure nearly in the ratio of its square root. Both of these causes raise the pressure in the chamber enormously before the projectile has been forced into the grooves and fairly started. On the other hand, the motion of the projectile along the bore affords an increasing space for the gas to expand in, and this, together with the less abundant disengagement of gas as the grains are more and more consumed, and its cooling by conduction to the walls of the gun, speedily relieves the pressure. As the friction of the projectile against the grooves remains practically constant, and the resistance of the air in front of the projectile rapidly increases with its velocity, it is evident that if the gun were sufficiently long the projectile would not leave the bore; while, on the other hand, if the gun terminated at the point where the velocity of the projectile was greatest, the charge of powder would be best utilized.

In the case of the 12-inch breech-loading rifle under consideration the projectile would emerge from the gun in about $\frac{1}{36}$ of a second from the time it started from its seat with a velocity of translation of 2,100 feet per second, and a rotation about its axis of 84 revolutions per second. These velocities represent energies of 30,610 and 242 foot-tons respectively, or a total of 30,852 foot-tons, to produce which would require a constant effective pressure of about 20,000 lb. per square inch upon the base of the projectile acting through the distance it travels from its seat to the muzzle, which is 30·41 feet; while, as has been seen, the actual pressure varied from zero to a maximum of 37,000 lb. per square inch at a short but unknown distance from the seat of the projectile, and then diminished to about 10,000 lb. per square inch at the muzzle. A constant pressure in the gun represents an ideal condition which could it be attained would render the manufacture of guns a comparatively simple operation, since their outward form would be cylindrical with the trunnions midway between the breech and the muzzle, while the muzzle velocities that could be obtained would be much greater than those given by the best modern guns. But though this ideal can never be reached, great progress has been made toward it chiefly by employing increased charges of large-grained, slow-burning powder in chambered guns of great length.

The work expressed in the motion of a projectile as it emerges from the bore (motion of translation and of rotation) is called the useful work of the powder-charge, and, as is readily seen, is not the whole work done by the gas. It is very difficult to determine the total force of fired gunpowder, since no experiment has given its value directly and with certainty. Indirect methods have been employed, but as they make use of hypothetical data they leave a margin of uncertainty in the result. From a comparison of the work utilized by the best ordnance in the U. S. (taking into account only the powder actually burned in the gun) with the experiments made by MM. Sarrau and Roux at the Dépôt des Poudres et Salpêtres, in France, it would appear that but 77 per cent. of the total force of the powder is expended in doing useful work. The remaining 23 per cent. is wasted in heating the gun, in giving motion to the charge itself and to the gun and carriage, and in overcoming passive resistances, such as the forcing of the projectile and its friction against the grooves, the friction of the gas, and the resistance of the air. Capt. Noble, C. B., F. R. S., determined by experiments made in England with 12-cm. quick-firing guns that the total loss of energy arising from the fouling of gunpowder and from the friction due to rifling (increasing twist) together amounted nearly to 7 per cent. of the whole energy developed.* This leaves 16 per cent. to cover the other sources of waste mentioned above. In making these calculations we are confined to the work done by the gas while the projectile is in the gun; but, as has been seen in the case of the 12-inch breech-loading rifle, the pressure upon the base of the projectile as it leaves the muzzle is 10,000 lb. on each square inch, or about 500 tons on the entire base, and this high-grade motive force can only be utilized by increasing the length of the gun. This may not be practicable for heavy guns, but the quick-firing guns have shown what can be done by lengthening the bore and thus utilizing more of the force of the powder. As an example, take the Canet 2¼-inch quick-firing gun, which at a trial in France gave a muzzle velocity of 3,324 foot-seconds, with a maximum pressure of 36,980 lb. per square inch, which is well within the limit of safety. This gun was 80 calibers long, which is twice the relative length of the 12-inch breech-loading rifle.† On Jan. 23, 1893, a 6-inch gun, which had been lengthened to 100 calibers by screwing an additional piece on the muzzle, was fired at Elswick, England, and gave to a 70-pound projectile the enormous velocity of 3,711 foot-seconds. This is the highest velocity yet obtained.

The most important results furnished by interior ballistics from the known data are the muzzle velocity and the maximum pressure upon the breech of the gun. The formulas chiefly used for computing these elements were deduced by Sarrau, and have already been alluded to. They are the following:

For muzzle velocity.

$$V = 845{\cdot}07\alpha \frac{\hat{\omega}^{\frac{5}{8}} u^{\frac{8}{8}}}{(Cdw)^{\frac{1}{4}}} \left\{ 1 - 0{\cdot}0204\beta \frac{(uw)^{\frac{1}{2}}}{d} \right\}.$$

For maximum pressure on breech

$$P = 493290\alpha^2 \frac{\hat{\omega}^{\frac{7}{4}} w^{\frac{1}{4}}}{Cd^2}.$$

In these formulas—

$\hat{\omega}$ is the weight of powder-charge in pounds.

$w$ is the weight of projectile in pounds.

$u$ is the length of travel of projectile in the bore in inches.

$d$ is the diameter of bore in inches.

$C$ is the volume of powder-chamber in cubic inches.

$\alpha$ and $\beta$ are coefficients called the characteristics of the powder. Their values depend upon the nature and composition of the powder and the size and shape of the grains. Their values must be determined by experiment for each different kind of powder.

$V$ is the muzzle velocity in foot-seconds, and $P$ the maximum pressure upon the breech in pounds per square inch.

The characteristics of any particular powder ($\alpha$ and $\beta$) are generally determined by firing suitable charges of the powder in two guns of similar construction, but of different calibers, and therefore differing from each other in all the elements entering into the equation for the muzzle velocity. The muzzle velocity is carefully measured for each gun and substituted in the above formula, which evidently establishes two equations of the form

$$V = A\alpha(1 - B\beta),$$

by means of which $\alpha$ and $\beta$ can be easily found, since $A$ and $B$ contain only known quantities. In the following tables, taken from *Notes on the Construction of Ordnance*, No. 36 (Washington, April 28, 1886), are given, in the first, the principal data relating to the most important powders made in the U. S., and in the second data relating to a few typical guns required in the velocity and pressure formulas. To these are added columns showing the agreement between the computed and measured muzzle velocities and maximum pressures:

TABLE I.—CHARACTERISTICS OF DIFFERENT POWDERS.

| BRAND OF POWDER. | Form of grain. | N.‡ | Specific gravity. | Log $\alpha$. | Log $\beta$. |
|---|---|---|---|---|---|
| IKD..... | Granulated..... | 2,200 | 1·725 | 0·30115 | 0·13851 |
| LXB.... | Square prism..... | 270 | 1·706 | 0·33940 | 0·17243 |
| KHC.... | Sphero-hexagonal..... | 123 | 1·775 | 0·18257 | $\bar{1}$·89721 |
| EVF.... | Hexagonal..... | 72 | 1·750 | 0·18232 | $\bar{1}$·86937 |
| Cocoa... | Pierced hexagonal prism. | 11½ | 1·863 | $\bar{1}$·95292 | $\bar{1}$·39892 |

* *Notes on the Construction of Ordnance*, No. 60 (Washington, May 11, 1892).

† See London *Engineering*, June 10, 1892, p. 713.

‡ Number of grains in a pound of powder.

TABLE II.*

| CALIBER OF GUN. | Travel of projectile in bore. | Weight of projectile. | Weight of charge. | Volume of chamber. | MUZZLE VELOCITIES. | | MAXIMUM PRESSURES. | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Computed. | Measured. | Computed. | Measured. |
| $d$ | $u$ | $w$ | $\omega$ | $C$ | | | | |
| 3·2.... | 73·2 | 13 | 3·5 | 113·01 | 1,630 | 1,630 | 29,010 | 29,100 |
| 3·2.... | 73·2 | 13 | 3·5 | 113·01 | 1,726 | 1,713 | 34,601 | 36,500 |
| 12..... | 91·6 | 610 | 52 | 1,686·4 | 953 | 993 | 23,574 | 25,000 |
| 8..... | 98·5 | 183 | 45 | 1,572·7 | 1,488 | 1,488 | 32,630 | 32,650 |
| 12..... | 273·5 | 750 | 265 | 8,882·2 | 1,761 | 1,761 | 29,114 | 32,000 |

* The horizontal lines in these tables go together.

The muzzle velocity of a projectile may be determined in two ways:

1. By measuring the projectile's momentum or quantity of motion, from which its velocity may be deduced by the principles of mechanics. The first instruments employed for this purpose were the ballistic-pendulum invented by Robins and the gun-pendulum of Count Rumford. The idea involved in both instruments is the changing of the elements of the projectile's momentum from a small mass and high velocity to a large mass and correspondingly low velocity, which can be more easily measured. These pendulums did good service for gunnery, but were discarded for the less expensive and more accurate electro-ballistic machines.

2. By measuring the time required by the projectile to pass over a certain short but known space. The velocity is then determined by dividing the space by the time. A great variety of instruments have been devised for the purpose of measuring this small interval of time, differing from each other in the more or less indirectness of the measurement. Those in use are classed under the general head of electro-ballistic machines (chronographs, chronoscopes, etc.), and act as follows: Two vertical target-frames or screens are placed perpendicular to the plane of fire, the first as near the gun as possible without being sensibly affected by the blast (from 150 to 200 calibers), and the second a certain known distance farther from the gun, say 150 feet. Each of these targets is connected electrically with the electro-ballistic machine, and these connections are successively severed by the projectile as it passes through the targets. The interruptions thus caused are instantly recorded by the machine in such a manner as to give the interval of time between these occurrences, and this is manifestly the time consumed by the projectile in traversing the distance between the screens.

The electro-ballistic machines most in favor which differ from each other chiefly in their manner of registering the passage of the projectiles through the screens are the Boulengé chronograph, the Bashforth chronograph, and the Schultz chronoscope. The first, invented by Capt. Le Boulengé of the Belgian artillery, is generally employed the world over for determining muzzle velocities. In this instrument the time is measured by the distance a heavy rod falls while the projectile is passing between the screens. This rod, which is suspended vertically from the pole of an electro-magnet, is released when the projectile cuts the first screen, and the distance it has fallen when the projectile pierces the second screen is marked by a cutter on the rod itself, and can be measured by a rule furnished for this purpose.

To ascertain the maximum pressure in the chamber of a gun the Noble crusher gauge, devised by Capt. Noble—already referred to—is universally employed. This consists essentially of a small hollow steel cylinder closed at one end by a steel anvil. At the open end a movable piston fits accurately, any ingress of gas to the space within the hollow of the cylinder being prevented by a gas-check. Between the movable piston and the anvil is placed a small cylinder of pure copper about an eighth of an inch in diameter and four-tenths of an inch long, whose axis is held in the axis of the hollow cylinder by a spring. The apparatus when properly prepared for an experiment is either placed in the bottom of the cartridge bag or screwed into the breech-block with the movable piston flush with its face. It may also be screwed into the base of the projectile when the latter is fired, so that it can be recovered. We may also use two crusher gauges at the same time, one in the breech-block and one in the projectile, and their indications would show the difference between the maximum pressure upon the breech and the base of the projectile, which is supposed to be considerable. When the gun is fired the powder-gas, pressing in all directions, forces the movable piston against the copper cylinder, which yields and becomes shorter longitudinally, expanding laterally, and receives a permanent set. The cylinder on being removed from the gauge is measured, and its compression compared with that given by experiments which have been tabulated for ready reference.

*Exterior ballistics* treats of the circumstances of motion of a projectile from the time it leaves the gun until it reaches the target, or, in case of shrapnel, bursts in the air at any desired point. This branch of the science of gunnery takes the projectile where interior ballistics leaves it—at the muzzle of the gun—with a known velocity, both of translation and of rotation. In one of the most important applications of exterior ballistics to the problems of actual warfare, the given data are the form, dimensions, and weight of the projectile, its muzzle velocity, the density of the atmosphere, and, lastly, the distance to the target—technically called the range. From these data modern ballistic formulas and tables afford a ready means of determining with great accuracy not only the proper elevation and direction to be given to the gun in order that the projectile may hit the target, but also the time of flight, the steepness of descent of the trajectory, and the striking velocity, the two latter determining the effect of the projectile upon the target, and the former the allowance to be made when firing at a swiftly moving object, as a ship.

There are two forces which act upon a projectile during its flight through the air, and which together determine the shape and dimensions of its trajectory. These are the force of gravitation, which is a constant downward pull, and the resistance of the air, which is a variable push against the head of the projectile in a direction opposite to that of its motion. If we ignore at first this latter force, or, what is the same thing, imagine the projectile to be fired in a vacuum with any given angle of projection, the curve or trajectory it will describe is a parabola, having its axis vertical and vertex at the highest point, or summit, of the trajectory. As a parabola is symmetrical with respect to its axis, it follows that the ascending and descending branches of a trajectory *in vacuo* are similar to each other, and that the angle of fall with reference to a horizontal plane passing through the muzzle of the gun is equal to the angle of departure. Moreover, the striking velocity of the projectile—that is, its velocity when it returns to the level of the gun—is the same as its initial velocity, and greater than the velocity at any intermediate point. From this it will be seen that the downward pull of gravity restores to the projectile in the descending branch all the motion it took from it in the ascending branch, but in reverse order, so that at any two points of the trajectory, one in the ascending and the other in the descending branch, at equal altitudes, the velocities are equal; and therefore the velocity at the summit is less than at any other point. Another fact worthy of notice is that the horizontal velocity of a projectile moving *in vacuo* is constant. Introducing now the other force acting upon the projectile—the resistance of the air—which gives in connection with gravity the actual trajectory with which alone gunnery is concerned, all the simplicity and symmetry of the trajectory *in vacuo* disappear, and we have a curve which all the resources of mathematics are unable to express rigorously. There are certain characteristics of this trajectory, however, which are evident without the aid of mathematics. For example, the maximum altitude, the horizontal range, and the striking velocity are less, and the angle of fall greater, than in the trajectory *in vacuo*, while the horizontal velocity continually decreases; and all these on account of the constant and permanent loss of motion given up by the projectile to the air. It can also be shown that, whatever may be the law of resistance of the air—so long as there is any resistance at all—the point of minimum velocity is not at the summit of the trajectory, but at some point farther along in the descending branch.

The effect of the resistance of the air upon the motion of a projectile is greater than is generally supposed. As an illustration, consider the trajectory of a 1,000-pound projectile fired from the 12-inch breech-loading rifle, with a muzzle velocity of 2,100 foot-seconds and angle of projection of 5°. The horizontal range in this case is 6,220 yards—a little more than 3½ miles; the maximum altitude, 457 feet; angle of fall, 6° 15′; striking velocity, 1,493 foot-seconds; and time of flight, 10·6 seconds. *In vacuo* any projectile fired with the same initial velocity and angle of departure as the above would have a horizontal range of 7,937 yards, a maximum altitude of 521 feet, while the striking velocity and angle of fall would be the same as their initial values. That is, the

resistance of the air in this case reduces the horizontal range nearly a mile, and robs the projectile of 607 foot-seconds of velocity. This loss of motion can be better appreciated by reducing to energy. The muzzle energy of this projectile is 30,610 foot-tons, and striking energy 15,463 foot-tons; and the difference, 15,147 foot-tons, has been given up to the air in the short space of 10·6 seconds. For lighter projectiles the shortening of the range by the resistance of the air is still greater. For example, if we suppose the 13·5-pound projectile of the 3·2-inch steel field-gun to be fired with a muzzle velocity of 2,100 foot-seconds and angle of departure of 5°, its horizontal range would be but 3,604 yards and striking velocity 894 foot-seconds.

It has been established by numerous experiments that the resistance of the air to the motion of an oblong projectile moving steadily point foremost (which is practically the case with modern projectiles) is proportional to the normal area presented to the air, that is, proportional to $d^2$, $d$ being the diameter of the base. The resistance is also proportional to some function of the velocity; and we may, therefore, write the expression for the resistance, $\rho$, as follows:

$$\rho = Ad^2 f(v).$$

With regard to $f(v)$ it is impossible with present knowledge to determine its general form. It has been shown, however, by Bashforth and other experimenters that for velocities greater than 1,330 foot-seconds and less than 790 foot-seconds the resistance is very nearly proportional to the square of the velocity, but for velocities between these limits the resistance varies more rapidly than the square. It is customary to assume

$$f(v) = v^n,$$

and therefore

$$\rho = Ad^2 v^n,$$

and then determine the values of the coefficient $A$ and the exponent $n$ by suitable experiments.

The most satisfactory experiments yet made for this purpose are those conducted by the Rev. Francis Bashforth while Professor of Applied Mathematics to the advanced class of artillery officers at Woolwich, England. These experiments were made principally at the English proving-ground, Shoeburyness, between the years 1865 and 1879, with the aid of a chronograph of Mr. Bashforth's own invention, which is probably the most complete and accurate instrument for this purpose yet invented. His measurements of the times occupied by a projectile in passing a series of equidistant screens are fairly correct to the thousandth of a second; but an additional decimal is still a desideratum. For a complete account of his labors, see his work entitled *The Bashforth Chronograph*, published at the University Press, Cambridge, England, 1890.

A discussion of Bashforth's results, made by the author of this article in 1883, gave the following as the most probable expressions for $\rho$, employing only integral powers of the velocity:

Velocities greater than 1,330 foot-seconds:

$$\rho = [4{\cdot}64521 - 10]d^2v^2.$$

1,330 f.-s. $> v >$ 1,120 f.-s.:

$$\rho = [1{\cdot}52912 - 10]d^2v^3.$$

1,120 f.-s. $> v >$ 990 f.-s.:

$$\rho = [2{\cdot}37919 - 20]d^2v^6.$$

990 f.-s. $> v >$ 790 f.-s.:

$$\rho = [1{\cdot}36817 - 10]d^2v^3.$$

790 f.-s. $> v >$ 100 f.-s.:

$$\rho = [4{\cdot}23607 - 10]d^2v^2.$$

In these expressions $d$ is the diameter of the projectile in inches, $v$ the velocity in feet per second, and $\rho$ the resistance in pounds. The logarithms of $A$ (inclosed in brackets) are given for convenience.

The reader must not infer from these expressions that the resistance actually varies as the square of the velocity from 100 foot-seconds up to 790 foot-seconds, and then passes *per saltum* to the third power of the velocity, and then at 990 foot-seconds to the sixth power, and so on. There is undoubtedly a law of resistance which is a continuous, though very complicated, function of the velocity, having variable exponents as well as coefficients. But owing to the difficulties with which the subject is surrounded, both experimental and analytical, the most that can be done is to express the resistance by integral powers of the velocity so chosen as to best represent the mean resistance over a certain range of velocity determined by experiment.

The elevations given to modern high-power guns are generally quite moderate, rarely exceeding 5°, though the carriages upon which the guns are mounted usually admit of elevations up to 20°, or even more. But most engagements between ships and forts, or between ships, will be fought at distances not exceeding 3 or 4 miles, and for these (and indeed for much longer) ranges the ballistic tables and formulas now in use give very accurate information to the artillerist. The ballistic formulas universally employed were first published by Maj. F. Siacci, of the Italian artillery, in the *Giornale d'Artiglieria e Genio* (Rome, Apr., 1880), and within a year were adopted by the artillerists of the U. S. and of most of the leading nations of Europe. The most important of these formulas—those relating to the fighting range—as modified by Capt. Braccialini Scipione, also of the Italian artillery, are the following:

$$C = F\frac{w}{cd^2}. \tag{1}$$

$$X = C[S(v) - S(\mathrm{v})]. \tag{2}$$

$$\sin 2\phi = AC. \tag{3}$$

$$\tan \omega = \frac{B}{A}\tan \phi. \tag{4}$$

$$T = C\,[T(v) - T(\mathrm{v})]. \tag{5}$$

In these equations—

$w$ is the weight of the projectile in pounds.

$d$ is the diameter of the projectile in inches.

$c$ is a coefficient depending upon the form of the projectile.

$F$ is a factor depending upon the density of the air, as shown by the thermometer and barometer.

$C$ is called the ballistic coefficient, and expresses the ability of the projectile to overcome the resistance of the air. It has been called the "ranging power" of the projectile.

v is the muzzle velocity in feet per second.

$v$ is the striking velocity in feet per second.

$X$ is the horizontal range in feet.

$T$ is the time of flight in seconds.

$\phi$ is the angle of departure.

$\omega$ is the angle of fall.

$S(\mathrm{v})$ and $S(v)$ (called space-functions) and $T(\mathrm{v})$ and $T(v)$ (called time-functions) are functions, respectively, of the muzzle and striking velocities.

$A$ and $B$ are functions of the range divided by the ballistic coefficient, and of the muzzle velocity.

All these functions have been tabulated, and will be found in Ingall's *Handbook of Problems in Direct Fire*.

As a simple illustration of the use of these formulas, consider the following example:

What is the horizontal range and what the time of flight of a service projectile fired from the 8-inch breech-loading rifle with a muzzle velocity of 1,950 foot-seconds and angle of departure of 5°?

The given data for this example are: $d = 8$ inches; $w =$ 300 lb.; $c = 0{\cdot}9$; $\mathrm{v} = 1{,}950$ foot-seconds; and $\phi = 5°$, with which to compute $X$ and $T$. The first step is to compute $C$, which depends upon the projectile and the density of the atmosphere. By equation (1)

$$C = \frac{300}{0{\cdot}9 \times 64}F = 5{\cdot}20833F.$$

For simplicity, suppose the temperature of the air to be 60° F. and height of barometer 30 inches, in which case the factor $F$ is unity, and therefore $C = 5{\cdot}2083$. For other atmospheric conditions the value of $F$ must be taken from the ballistic tables above cited. Next, from equation (3),

$$A = \frac{\sin 10°}{5{\cdot}2083} = 0{\cdot}03334,$$

and with this, table $A$ gives $\frac{X}{C} = 2{,}923$, and therefore

$$X = 5{\cdot}2083 \times 2{,}923 = 15{,}224 \text{ feet}.$$

Equation (2) and the ballistic tables give

$$S(v) = 2{,}923 + S(\mathrm{v}) = 5{,}469{\cdot}4,$$

and therefore $v$ or the striking velocity $= 1{,}287$ foot-seconds.

Lastly, from equation (5) and the tables,

$$T = 5{\cdot}2083\ [2{\cdot}954 - 1{\cdot}096] = 9{\cdot}68 \text{ seconds}.$$

By means of the ballistic formulas and tables, *range tables*, or *tables of fire*, as they are sometimes called, may be easily and accurately prepared in advance for each gun in service, showing for any range how the gun must be aimed in order to hit the target, and also the probable effects of the shot.

In what precedes the term "angle of departure" has been used whenever the initial direction of the projectile with reference to a horizontal plane has been referred to. This

angle is always greater than the angle of elevation given to the gun in aiming by a small angle called the "jump," so called because at the instant of firing, and before the projectile leaves the bore, the muzzle apparently jumps upward slightly, but enough to vitiate the aim and cause the projectile to pass over and beyond the target, unless the jump had been provided for in aiming. The maximum pressure upon the bottom of the chamber of the gun, already referred to, is more than 1,800 tons, and this pressure is generated in less than the one-hundredth part of a second, and has therefore much the effect of a blow. This tremendous shock is taken up by that part of the cheeks of the carriage in rear of the trunnions, which transmits it to the chassis-rails upon which the carriage slides during the subsequent recoil. Before the enormous friction of the carriage upon the chassis-rails can be fairly overcome and sliding motion begin, the "give" of the rails under the rear part of the carriage where the pressure is much the greatest, together with the compression of the rear part of the cheeks, and possibly a slight elevation of the front part of the carriage, all conspire to tilt the carriage to the rear and downward, with the effect of momentarily increasing the angle of elevation of the axis of the gun, by depressing the breach. At the moment of maximum pressure on the bottom of the bore the projectile has moved but a short distance, and therefore the elevation of the axis must take place before the projectile reaches the muzzle.

The jump of a gun must be determined experimentally in each case. One way to do this is to prolong the axis of the bore until it pierces a paper screen placed perpendicular to the plane of fire, and far enough in front of the gun to avoid the blast. This can easily be done with a breech-loader by placing in the muzzle and breech cross wires accurately centered—in other words, making a telescope of the gun. Through the point thus determined, draw a horizontal line across the screen as a datum line. Since we know the muzzle velocity of the projectile, its ballistic coefficient, and the distance to the screen, the time of flight can be computed by equation (5), and then the distance through which the projectile falls while passing from the gun to the screen. Draw another horizontal line across the screen at this computed distance below the first one. Now if there were no jump the center of the round hole made by the projectile in passing through the screen would be on this second horizontal line; but it is found in practice that it is nearly always above the *first* line. The data secured in this way is easily reduced to angular measure with reference to the axis of the trunnions. The jump has not been determined experimentally for any of the new guns adopted by the U. S. Government. Some experiments made by the author at Fort Monroe in the summer of 1890 show that the jump of the 8-inch converted rifle varies from 15 to 30 minutes of arc, increasing with the angle of elevation up to 6° elevation, the limit of the experiments.

An oblong projectile fired from a rifle gun has a rapid rotary motion about its longer axis imparted to it by the spiral grooves, or rifles, cut in the walls of the bore. Thus the 12-inch projectile, with a muzzle velocity of 2,100 foot-seconds, makes eighty-four revolutions per second as it emerges from the gun, and this rapid rotation is undoubtedly kept up during the whole period of its flight. The effects of this rotation are to give stability to the projectile by overcoming the perturbating effects of the resistance of the air-variations of density, winds, etc., and to keep it moving point foremost, that is, in the direction in which it meets with the least resistance from the air, and does the greatest damage on striking. Another effect of the projectile's rotation is to cause it to move out of the plane of fire with an increasing velocity toward the side corresponding to the direction of rotation, a phenomenon called drift. Nearly all modern guns have what is termed a right-handed twist—that is, the rifles are cut in such a way as to give the projectile a rotation from left to right, or in the direction of the hands of a watch, as seen by a person standing in rear of the gun, and therefore the drift is to the right. For moderate ranges the drift is comparatively small, but it increases rapidly for longer ranges. For example, the drift of the service projectile fired from the 8-inch converted rifle is 1 yard for a range of 1,500 yards, 4·4 yards for a range of 3,000 yards, and 15·1 yards for a range of 4,500 yards. In aiming a rifled gun the drift, which is constant for the same gun and range, is allowed for by pointing to the left of the target by a distance equal to the drift.

The most troublesome deviation to which a projectile is subject is caused by the wind, on account of its varying and uncertain character, and its modifying effect upon the drift. Fortunately the effect of a moderate wind upon the flight of the heavier projectiles is slight for all ranges for which superior accuracy of fire is expected, both on account of the great mass of the projectile and the short time to which it is subject to the action of the wind. The amount of deviation due to the wind and drift combined can generally be inferred from the observed deviations of lighter and less expensive projectiles fired from the quick-firing guns. These shots, in connection with a range table, can also be utilized for determining the range in the absence of range-finders.

The laws which govern the penetration of projectiles are still very obscure, and little has been done save the determination of empirical formulas, which satisfy with more or less exactness the observed penetrations upon which the formulas are based.

The most reliable experiments for determining the penetration of spherical shot into different kinds of wood, masonry, and earth were made at Metz in 1834 and 1835 by a commission appointed by the French Minister of War. The conclusions arrived at were that the resistance of the same substance to spherical shot of different diameters varies as the square of the diameter; and that the resistances of different substances to the same shot vary as $\lambda + \mu v^2$, where $\lambda$ and $\mu$ are constant for each substance, and $v$ is the velocity at any instant after striking. The retarding force is therefore expressed by $\frac{g}{w} d^2(\lambda + \mu v^2)$. We therefore have the differential equation,

$$\frac{v dv}{ds} = -\frac{g d^2}{w}(\lambda + \mu v^2),$$

whence integrating between the limits v, the striking velocity, and zero, we have for the depth of penetration $S$,

$$S = \frac{1{\cdot}1513 w}{d^2 g \mu} \log_{10} \left\{ 1 + \left(\frac{\mathrm{v}}{u}\right) \right\},$$

in which

$$u = \left(\frac{\lambda}{\mu}\right)^{\frac{1}{2}}.$$

The following are the values of $\lambda$, $\mu$, and $u$ as given by Didion, and adapted to English units—that is, $d$ is in inches, $w$ in pounds, v in feet per second, and $S$ in feet.*

| SUBSTANCES. | $\lambda$ | $\mu$ | $u$ |
|---|---|---|---|
| Oak, beech, and ash | 2,329·4 | ·004328 | 734 |
| Elm | 1,787·5 | ·003322 | 734 |
| Fir and birch | 1,296·0 | ·002408 | 734 |
| Poplar | 1,217·7 | ·002263 | 734 |
| Sand, mixed with gravel | 486·0 | ·009031 | 232 |
| Earth, mixed with sand and gravel | 670·3 | ·012456 | 232 |
| Clayey soil | 1,167·5 | ·003799 | 554 |
| Earth from an old parapet | 782·0 | ·004360 | 424 |
| Damp clay | 297·2 | ·002209 | 367 |
| Moistened clay | 102·4 | ·000762 | 367 |
| Masonry of good quality | 6,166·9 | ·008595 | 847 |
| Masonry of medium quality | 4,915·7 | ·006851 | 847 |
| Brickwork | 3,530·4 | ·004920 | 847 |

Many formulas have been given for computing the penetration of oblong pointed projectiles into wrought iron and steel armor. Those generally employed in France and the U. S. were deduced by Capt. Jacob de Marre, of the French naval artillery. They are as follows:

For wrought-iron plates—

$$e^{0{\cdot}65} = [7{\cdot}03738 - 10] \frac{w^{\frac{1}{2}} v}{d^{\frac{8}{4}}}.$$

For mild steel plates—

$$e^{0{\cdot}7} = [6{\cdot}99066 - 10] \frac{w^{\frac{1}{2}} v}{d^{\frac{8}{4}}}.$$

In these formulas $e$ is the penetration in inches, $w$ the weight of projectile in pounds, $d$ its diameter in inches, and $v$ the normal striking velocity in feet per second. The logarithms of the numerical coefficients are given for convenience, placed in brackets. JAMES M. INGALLS.

**Gunnison**: city; capital of Gunnison co., Col. (for location of county, see map of Colorado, ref. 4–C); on the Gunnison river and the Denver and Rio Grande, and the Union Pac. Railways; 170 miles W. by N. of Pueblo. It is in an agricultural, mining, and stock-raising region, and its prin-

* From Bashforth's *Motion of Projectiles*, p. 75.

cipal industries are gold, silver, iron, and coal mining. Pop. (1880) 888; (1890) 1,105; (1900) 1,200.

**Gunny**, or **Gunny Cloth** [from Hind. *ganni*, from Bengalese *gonī*, gunny-bag, sacking]: a kind of coarse, strong sacking made of jute, and used for covering cotton-bales and as bags for wheat, rice, coffee, pepper, saltpeter, and many other commodities. Gunny cloth is manufactured chiefly in Southeastern Bengal. But little machinery is used in the business, which employs vast numbers of people during their leisure from other employments. The work is very largely domestic in character. Immense quantities are exported to all parts of the globe; indeed, few articles of commerce are so widely diffused as the gunny-bag. When worn out the material makes a good stock to be used for the manufacture of wrapping-paper. See FIBER.

**Gunong**, or **Gunung**: a Malay word for mountain, often applied to volcanoes and to the islands on which they exist, or the town or district near them. Thus the village Gunung Agong, in Sumatra, is at the foot of the volcano Gunong Dempo. Gunung Api is the name of three separate Malayan islands with volcanoes. M. W. H.

**Gunpowder**: an explosive substance, formed by an intimate mechanical mixture of potassium nitrate (niter), sulphur, and carbon (in the form of charcoal), in certain proportions, called its *composition*, depending upon the use for which it is intended. It is principally used in firearms and for mining purposes, though for the latter object it has been to a great extent superseded by other explosives of greater power, such as guncotton and the various preparations of nitroglycerin. For more than five hundred years gunpowder has been used almost exclusively as the propelling agent in firearms; but there is good reason to believe that it may yield its supremacy to other explosives, differing widely in their composition, which will give to projectiles velocities greatly exceeding those produced by gunpowder, and with less strain upon the gun. Prominent among the explosives of the future stand the various kinds of smokeless powders, and those having nitrocellulose as the active principle. Among the valuable qualities of gunpowder for war purposes may be mentioned the following: It ignites easily without deflagration, burns quickly, leaves but little residuum, and liberates a large quantity of gas at a high temperature. Its effects are regular and sure, its manufacture economical, rapid, and comparatively safe. Finally, it keeps well in transportation, and indefinitely in properly ventilated magazines. It is on record that experiments made with gunpowder more than two centuries old showed that it had lost none of its ballistic qualities. The earliest known composition of gunpowder corresponds nearly to that of the best modern powders, and differs but little from that called for by the theory of combining equivalents, as shown in the following table (see EXPLOSIVES):

| | | | | | | |
|---|---|---|---|---|---|---|
| By atomic theory..... | 74·815 | niter, | 13·333 | carbon, | 11·852 | sulphur. |
| For U. S. military service. | 76·000 | " | 14·000 | " | 10·000 | " |
| For sporting..... | 78·000 | " | 12·000 | " | 10·000 | " |
| For blasting ..... | 62·000 | " | 18·000 | " | 20·000 | " |

In blasting-powder the proportion of niter is reduced both to make it cheaper, and also because a weak or slow-burning powder is the most effective in removing large masses of earth or rock. Moreover, the residuum resulting from the incomplete combustion that follows a variation of the theoretical composition is not so objectionable in mining as in firearms. A very strong and cheap powder can be made by substituting sodium nitrate for potassium nitrate; but as it has a strong affinity for moisture, it will not retain its strength long. The most important ingredient in the composition of gunpowder is the niter, which is a compound substance consisting of one equivalent of potassium, one of nitrogen, and three of oxygen ($KNO_3$). It decomposes readily by heat giving off a large volume of oxygen which unites with a portion of the carbon of the charcoal, forming carbon dioxide ($CO_2$). The potassium unites with the carbon and sulphur, forming solids, while the nitrogen, having but feeble affinity, does not enter into new combinations. The mechanical effects are produced chiefly by the expansion of the carbon dioxide and nitrogen, whose elastic force is enormously increased by the high temperature of combustion, which, according to the experiments of Noble and Abel, is about the melting-point of platinum.

The principal source of the supply of niter is India, where it occurs as an efflorescence on the surface of the ground. In the condition in which it is imported it is called "grough" niter, and contains about 4½ per cent. of impurities, consisting chiefly of the chlorides of potassium and sodium, and the sulphates of potash, soda, and lime, together with sand and organic matter. These impurities are separated from the niter at the powder-mills by the process of refining. Nations whose supplies of niter are cut off during war are mainly dependent on artificial niter-beds, as was the case during the French Revolution and in the Confederacy during the civil war in the U. S. These beds are formed of a collection of earth, ashes, calcareous matter, refuse from stables and slaughter-houses, etc., piled in heaps exposed to the sun and air, and moistened from time to time to assist the change. Niter is also made from sodium nitrate, an extensive natural product of the district of Tarapaca, Northern Chili, by the action of potassium chloride.

*Charcoal* for gunpowder is obtained by charring certain kinds of wood in iron retorts. The woods most used in the U. S. are willow and alder. In Europe dogwood or alder-buckthorn is generally used for all military small-arm powders as well as for the best sporting powders. For gunpowders for heavy ordnance alder and willow charcoal is generally employed, as the action of these powders is less violent than that made from dogwood charcoal. The sticks should be of small size, from 1 to 5 inches in thickness for military powder, while still smaller sticks are employed for sporting powders. The wood should be cut in the spring when filled with sap, that the bark may be peeled off easily, and it should be well seasoned before charring. The quality of charcoal for powder depends upon the temperature at which the wood is charred. If the temperature be about 1,800° F., or sufficiently high to drive off all the volatile matter in six hours, the result is *black* charcoal; while if the wood is charred at a temperature of 500° F., or only sufficient to drive off the volatile products in twelve hours, the result is a *brown* charcoal. Brown charcoal makes a stronger and more inflammable powder than black charcoal, but it is a powder more liable to absorb moisture and can not be so well preserved. Black charcoal is generally used for all military powders.

*Sulphur* is mostly procured from Sicily, where it occurs as a volcanic product. It is imported in a crude state, containing some 6 or 8 per cent. of earthy matter. It may be obtained, but not as cheaply, in the U. S. from metallic ores. For powder crude sulphur is purified by distillation and melting, and appears in the form of roll brimstone. The flowers of sulphur produced by sublimation contain more or less sulphurous and sulphuric acids, and are consequently not suited to the manufacture of powder. The tests for sulphur as a suitable ingredient for gunpowder are (1) burning a small quantity on porcelain, when the amount of residuum should not exceed 0·25 per cent.; (2) boiling with water and testing with blue litmus-paper, which it should only very feebly redden. Prof. Bloxam states that "sulphur is valuable as an ingredient in gunpowder on account of the low temperature (560° F.) at which it inflames, thus facilitating the ignition of the powder. Its oxidation by niter appears also to be attended with the production of a higher temperature than is obtained with charcoal, which would have the effect of accelerating the combustion, and of increasing by expansion the volume of gas involved." Sulphur also favors the preservation of the powder, as it has less affinity for water than the other components and gives hardness to the mixture, and consequently more body to the grains.

The necessary operations in making gunpowder are: (1) *Refining and pulverizing the ingredients.* The charcoal and sulphur are first broken up in mills. The charcoal is pulverized by rolling it in cast-iron barrels with zinc balls. The same method is pursued with sulphur, except that the barrel is made of leather stretched over a wooden frame. The niter is generally sufficiently pulverized as it comes from the refinery.

(2) *Incorporation*, the object of which is to bring the particles of the ingredients into close contact with each other, thus producing a homogeneous mass in which the decomposition of the constituents of the powder shall be complete. The process consists of two operations—mixing the pulverized materials in a rolling barrel, and then grinding them under two heavy cast-iron wheels, following each other in a circular cast-iron trough. The quantity of mixture constituting a charge varies with the size of the wheels and duration of the operation. In Great Britain the charge is limited by law to 50 lb., in order to prevent accidents; but in the U. S. a charge of 150 lb. is not uncommon. The time required for thorough incorporation varies from three to four hours,

though for certain fine sporting powders the operation is continued as long as twelve hours. This operation is one of the most important in the manufacture of powder, since the more thoroughly the ingredients are mixed the more complete will be the combustion.

(3) *Compression*, to give the necessary density to the mass and strength to resist the shocks of transportation. The fragments of mill-cake as they come from the incorporating mill are broken up into fine meal by passing between two pairs of gun-metal rollers set in a strong frame of the same material. The meal is then spread out into layers about 4 inches thick, separated by copper or brass plates. These are brought under a powerful hydraulic press, which compresses the layers to a thickness of an inch, forming what is called press-cake.

(4) *Graining*, the operation of breaking up the press-cake into small fragments or grains for the purpose of regulating the combustion. It is performed in what is called a corning or granulating machine by passing the cake between fluted rollers, and separating the fragments thus produced by means of sieves.

(5) *Glazing*, effected by rolling the grains in a barrel. The attrition of the grains against each other and the sides of the barrel wears away the sharp corners and hardens the surfaces, thereby preventing the formation of dust during transportation. A high polish is sometimes given to the grains by adding powdered blacklead to the charge; but this is objectionable, as it retards ignition and inflammation.

(6) *Drying*, the object of which is the removal of the moisture that is purposely introduced during the several stages of manufacture. It is done by spreading out the powder on shelves in a room heated by steam to a temperature of from 140° to 180° F.

(7) *Dusting*, the object of which is the removal of the dust and fine grains, which would otherwise fill up the interstices and retard inflammation. It is done by means of fine sieves and bolting-cloths.

The *explosion* of a charge of powder may be divided into three distinct stages, viz., *ignition*, *inflammation*, and *combustion*. Ignition is the setting on fire of a particular grain; inflammation is the spreading of the flame over the surface of the grain from the point of ignition, or, in the case of a charge made up of many grains, it is in addition the spreading of ignition from one grain to another; combustion is the burning up of each grain. Ignition is produced by the sudden elevation of the temperature of a grain or part of a grain to about 570° F., either by contact with a heated body, by mechanical shock or friction, or by detonation of a fulminate. Small angular grains ignite more easily than large, round grains. The velocity of inflammation of a charge of powder depends not only upon the inflammability of the grains of which the charge is composed, but also upon the facility with which the gas first generated is able to penetrate the charge. This velocity is therefore small in mealed powder, and generally increases with the size of the grains. The velocity of inflammation of a charge also depends upon the pressure to which it is subjected. Thus while the velocity is about 8 foot-seconds in a train of powder laid loosely upon a board, it is 28 foot-seconds when confined in a canvas hose placed in a trough. It is believed that in firearms the velocity of inflammation of the charge is as great as 80 and even 100 feet per second, which is practically instantaneous. Too much compression or ramming of a charge of powder retards the inflammation. If compression be carried to the extent of reducing the charge to a single mass, the case becomes one of simple combustion. The combustion of a grain takes place in successive concentric layers, and in free air equal thicknesses are burned in equal times. The velocity of combustion is independent of the section of the grain, and is inversely proportional to its density. It varies with the composition of the powder and with the process of manufacture. It is greater with black charcoal than with brown; greater the more perfect the incorporation; and, finally, it increases with the dryness of the powder. For most military powders the velocity of combustion in free air is about 0·4 inch per second. If a grain of powder is angular the salient parts burn up more quickly than the plane or rounded parts, and thus an angular grain soon takes a spheroidal or ovoidal form similar to a water-worn pebble, which it retains until consumed. Thus it may be assumed that an angular grain is consumed in the same time as its inscribed sphere; and therefore all the grains of a charge may be considered as equal grains provided they have the same minimum dimension—that is to say, if they were made from press-cake of the same uniform thickness. The velocity of combustion also increases with the pressure of the surrounding medium. If this were not so only a small portion of the charges of cannon would be consumed during the very short time the projectile remains in the bore after the gun is fired. Sarrau considers that the velocity of combustion varies with the square root of the pressure; thus if the velocity of combustion in free air is 0·4 inch per second for the maximum pressure in a gun of 37,000 lb. per square inch, the velocity would be about fifty times as great, or about 20 feet per second.

The most complete experiments upon the explosion of gunpowder were made in Great Britain by Noble and Abel, and were published to the world in two memoirs, which were read before the Royal Society in the years 1874 and 1879. They fired by electricity, in a closed vessel made of mild steel and sufficiently strong to resist the expansion of the gases, many charges of gunpowder, varying in weight from 3½ oz. to 1 lb. 10 oz.* The following are some of the more important of their deductions from these experiments. Only 43 per cent. by weight of the powder is converted by explosion into gas, chiefly carbon dioxide ($CO_2$) and nitrogen. The remaining 57 per cent. is inert, solid matter (probably in a liquid state at the temperature of combustion), and consists principally of potassium carbonate ($K_2CO_3$), potassium sulphate ($K_2SO_4$), and potassium sulphide ($K_2S$). When the charge of powder completely fills the vessel without pressure save by its own weight the mean tension of the gases at the temperature of explosion is 43 tons (96,320 lb.) per square inch. In this case the density of loading is said to be unity, while if the charge fills but one-half the chamber the density of loading is one-half, and so on. If the density of loading is represented by $\Delta$, and the corresponding pressure on the sides of the closed vessel by $p$, then, according to Noble and Abel,

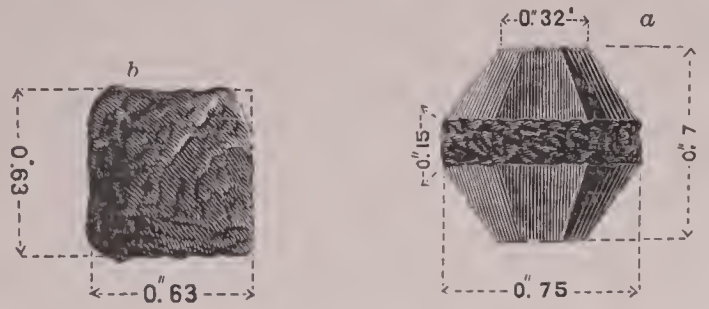
$$p = \frac{41{,}418\Delta}{1 - 0{\cdot}57\Delta},$$

a formula showing that the pressures in a closed vessel for densities of loading of $\frac{1}{20}$, $\frac{1}{10}$, and $\frac{1}{2}$ are 2,028, 4,390, and 28,960 lb. per square inch respectively; while the absolute force of the powder—or the force which it exerts when it exactly fills the space in which it is exploded—is, as has been stated, 96,320 lb. per square inch. This is what the expression for $p$ gives when $\Delta = 1$.

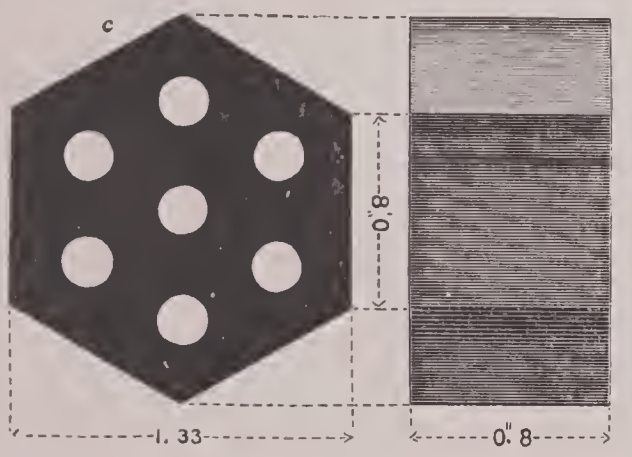
If the combustion of a charge of powder in the chamber of a gun were instantaneous, the initial pressure upon the walls of the chamber evidently would approximate toward that which obtains in a closed vessel, and probably would burst any gun yet made. Such would undoubtedly be the fate of most large guns if they should be loaded with a full charge (density of loading approximately unity) of fine sporting powder. In this case the powder would be consumed and the whole expansive force of the gases brought to bear upon the walls of the chamber before the projectile had had time to move sufficiently to relieve the pressure materially. The most obvious way to overcome this difficulty and reduce the initial pressure is to increase the size of the grains, and thus diminish the area of burning surface and consequently the emission of gas. Gen. Rodman, of the U. S. Ordnance Department, was the first to bring this idea into practice by the adoption of what is called mammoth powder, consisting of large and irregular-shaped grains from 0·6 to 0·9 of an inch in diameter, and of increased density, by which the rate of combustion was retarded. Lately a very great improvement has been made in mammoth powder by pressing it into grains of uniform size. In shape they are composed of the frustra of two hexagonal pyramids separated at their bases by a prismatic space left rough. The illustration *a* on page 82 represents the full size of the grain. In other forms of this powder the hexagonal frustra are changed to hemispheres, in which form it is known as sphero-hexagonal powder. A powder much used in Great Britain for heavy guns is known as "pebble powder." Its normal shape is that of a cube, about 0·63 inch on the edge for the smaller guns and 1½ inches for the largest guns. In breaking down the press-cake to form the grains the edges of the cube are left in a more or less broken condition, as shown in the illustration *b*. The improvements in the powders above described materially lessen the initial strain by giving time for the projectile to move a

* In their latest experiment the authors succeeded in absolutely retaining the products of combustion of a charge of 23 lb. of gunpowder. See Capt. Noble's *Greenock Lecture*, p. 12, Apr., 1892.

certain distance down the bore before an unsafe volume of gas has been disengaged. But they have one radical defect due to the shape of the grains, which is that they burn with a rapidly decreasing surface of combustion, and therefore




the emission of gas is very much greater at the beginning of combustion than toward the end, which is just the reverse of what it should be, since by the motion of the projectile along the bore the space occupied by the gases continually increases. These considerations led Gen. Rodman as early as 1860, when he was experimenting with his 15-inch cast-iron gun, to use disks of compressed powder from 1 to 2 inches thick and of a diameter to fit the bore, pierced with holes parallel to the axis of the gun. "He showed mathematically that such an arrangement of the charge would relieve the initial strain by exposing a minimum surface at the beginning of combustion, while a greater volume of gas would be evolved from the increasing surface of the cylindrical holes as the space behind the projectile became larger; this would tend to distribute the pressure more uniformly along the bore. The results of experiment perfectly bore out his theory, but he found it more convenient for several reasons to build up the charge in layers of hexagonal prisms of comparatively small size, fitting closely to one another, instead of having the cakes or disks as large as the bore." Prismatic powder, as the foregoing is now called, was first made on a large scale in Russia, and in the form and dimensions given in the accompanying figure (*c*). Each cake is 0·8 inch thick, and has seven holes,




each 0·2 inch diameter, extending through it in the direction of its axis. This grain has only about one-seventh the initial surface of combustion that it would have if made up into spherical grains a tenth of an inch in diameter. An objection to this form of grain is its liability to break up in the gun in consequence of the weakening effect of so many perforations. To avoid this objection prismatic grains are generally made with but one central perforation.

All gunpowder made for the U. S. Government is subjected to rigid inspection and proof, and must meet certain specified requirements before it is accepted. Rules for the inspection and proof of granulated powder for the military service require that the grains should be rounded and of uniform size, that they should be hard, have a certain density and strength, and be free from dust. The size of the grains is determined by passing a certain quantity through two or more sieves, which gives the proportion of different sized grains. The density is ascertained by the "densimeter," an apparatus which utilizes the property of mercury of filling the interstices between the grains without penetrating into the pores. The strength of powder was formerly determined by firing a given charge and ball of given weight from an *éprouvette*, or small mortar, at an angle of elevation of 45°, and noting the distance to which the ball was thrown. But this method has been abandoned, and the powder to be tested for strength is now always fired from the gun for which it was manufactured and with the service projectile. The muzzle velocity is ascertained by the Boulengé chronograph and the maximum pressure by the pressure gauge. See GUNNERY. JAMES M. INGALLS.

**Gunpowder Plot**: a conspiracy entered upon by several Roman Catholics to put to death King James I. of Great Britain, and his ministers, and to blow up the Parliament building by gunpowder, which they had stored in the vaults under the Parliament House. The plot was to be executed Nov. 5, 1605, but was detected on the preceding day by means which are not now well understood, though it is commonly stated that one of the conspirators, Francis Tresham, gave a clew to the plot by a letter to his relative, Lord Monteagle, whom he warned not to attend Parliament on the fatal day. The famous Guy Fawkes was to be the immediate agent of the conspirators. Nov. 5 is still celebrated in many English towns by the burning in effigy of Fawkes.

**Güns**: a free city of Western Hungary; on the Güns; 57 miles S. S. E. of Vienna (see map of Austria-Hungary, ref. 5–F); famous for the persistent and successful defense of its fortifications against the Turks in 1532. It contains a castle of Prince Esterházy, a military school, a Roman Catholic sub-gymnasium, a school for teachers, a Benedictine convent, an orphan asylum, and manufactures of cloth, leather, wine, brandy, and potash. Pop. 7,305.

**Gunsaulus**, FRANK WAKELEY, D. D.: clergyman; b. at Chesterville, O., Jan 1, 1856; graduated at Ohio Wesleyan University 1875; pastor of the Brown Memorial church, Baltimore, for four years; since 1887 pastor of the Plymouth church (Congregational), Chicago. He is the author of *The Transfiguration of Christ* (1886); *Monk and Knight* (a novel, 1890); *Phidias and other Poems* (1892).

GEORGE P. FISHER.

**Gunshot Wounds**: wounds produced by balls or other projectiles propelled by the force of an explosive, such as gunpowder, guncotton, or the like. They differ in some essential points from other wounds; generally they are accompanied by shock, and complicated by the presence of foreign bodies in the wound, such as the ball or projectile itself and pieces of clothing or accoutrements which the ball had carried with it and before it. Another element of their danger consists in the fact that they generally occur in large numbers—i. e. in war—when the accumulation of a large number of suppurating wounds gives rise to dangerous complications, such as erysipelas, pyæmia, and hospital gangrene; besides, in protracted wars the constitution of the men has already suffered by camp-life, bad diet, and exposure, producing typhus, dysentery, scurvy, etc. When, after the discovery of gunpowder, gunshot wounds first became known, surgery being then in its infancy, these wounds were looked upon as the result of some supernatural and maleficent agency, and were often treated by incantations and the like, or they were looked upon as poisoned either by the powder or the ball, and were treated with a view to destroy the poison—for instance, by pouring boiling oil into the wound. The treatment of gunshot wounds has become more simple and rational; even the extraction of the ball is no longer looked upon as of absolute necessity. At one time it was maintained that the wound of exit of a ball was always larger than that of entrance—a question which might be of importance in a legal point of view, whereas the converse is true, the wound of entrance often being larger than that of exit. Another mistaken idea prevailed with regard to what was called the "wind of the ball." A round shot frequently will crush the parts under the skin without wounding the skin; this was ascribed by some writers to the compression of the air, by others to the vacuum which the ball leaves behind it in its passage, and again by others to electricity, thought to be acquired by the ball by friction through the gun and its rapid passage through the air. Investigations have proved that a spent round shot may roll over a part of the body when it touches at an obtuse angle, crushing everything beneath the skin without breaking or wounding the skin itself.

The practice of the best informed modern surgeons with regard to gunshot wounds is quite at variance with older methods. It is now regarded as not only unnecessary but usually injurious to probe for a bullet; it is not usually thus found; it has done all the harm it is capable of before the case comes under treatment; if it has done any serious harm this will be manifest by other signs or symptoms; and the very act of probing disturbs protective blood-clot and often serves to introduce septic germs from without. Con-

sequently the best treatment of gunshot wounds is simply to protect and lightly occlude them, unless fracture, bleeding, paralysis, or indications that some of the hollow viscera (bowels, etc.) are wounded make it necessary to intervene at once and perform some serious operation.

The number of those killed outright on the field of battle to those wounded is about in the proportion of 1 to 5; of the wounded about 14 to 15 per cent. die of their wounds. Thus the number of killed in battle in the U. S. army during the civil war was 59,850. The number of gunshot wounds from May 1, 1861, to June 30, 1865, was 235,585; of the latter, 33,653, or 14·2 per cent., died of their wounds. The Confederate army lost 57,425 killed in battle, and had 227,871 wounded. In protracted wars internal diseases incidental to warfare carry off a by far larger number of men than all the engines of death. See WOUNDS and SURGERY.

Revised by ROSWELL PARK.

**Gun'ter**, EDMUND: mathematician; b. in 1581 in Hertfordshire, England; educated at Westminster and Christ Church, Oxford, where he passed M. A. in 1606; in the same year invented the sector; took orders in the Church, and in 1619 became Professor of Astronomy in Gresham College, London; made use of a logarithmic scale before 1624. His works best known are *Canon triangulorum* (1620); *Of the Sector, Cross-staff*, etc. (1624); *Description of His Majesty's Dial* (1624). He is best known by the chain, scale or lines, and quadrant which bear his name. D. in London, Dec. 10, 1626.

**Gunter's Chain**: the invention of Edmund Gunter; a chain 66 feet in length, used in land-measuring. It is composed of 100 links; consequently, 10 square chains, or 100,000 square links, are contained in an acre. See CHAIN.

**Günther**, gün'ter, ALBERT CHARLES LEWIS GOTTHILF, M. D., F. R. S.: zoölogist; b. at Esslingen, Würtemberg, Oct. 3, 1830; educated at Tübingen, Berlin, and Bonn, and in 1858 became connected with the zoölogical department of the British Museum. He is author of several valuable works on fishes, reptiles, and batrachians, of which the most important is the catalogue of the fishes in the British Museum (8 vols., 8vo, 1859–70), and edited the *Record of Zoölogical Literature* from 1864 till 1870.

**Günther**, MARTIN: Lutheran theologian; b. in Dresden, Germany, Dec. 4, 1831; educated in the institutions of the Missouri Synod; Professor of Theology in the Seminary at St. Louis, Mo., since 1873. Author of a widely circulated *Populär Symbolik* (1872, 1881). H. E. J.

**Guntur'**: the capital of the Kistna district, Presidency of Madras, British India; 252 miles N. of Madras; on the Grand Trunk Railway (see map of S. India, ref. 4–F). It has a considerable trade in grain. Pop. 20,000.

**Gurdaspur'**: a district of the Amritsar division, Punjaub, British India; between 31° 36′ and 32° 30′ N. lat., and 74° 56′ and 75° 45′ E. lon., forming the submontane district between the Bias and Raví rivers, and bounded on the N. by Kashmir. Area, 1,822 sq. miles. It is one of the most fertile parts of the Punjaub, and requires the least irrigation. The staple productions are wheat, rice, barley, cotton, and sugarcane. The average rainfall is 31 inches, and large swamps make certain districts unhealthful. Within the district is the sanitary station of Dalhousie, 7,687 feet above the sea. Pop. nearly 1,000,000, comprising Mohammedans and Hindus in nearly equal numbers, with a less number of Sikhs and pagans. It contains six towns with a population exceeding 5,000. The town Gurdaspur is the capital, but has a pop. of only 4,700. It is on a branch railway from Amritsar. MARK W. HARRINGTON.

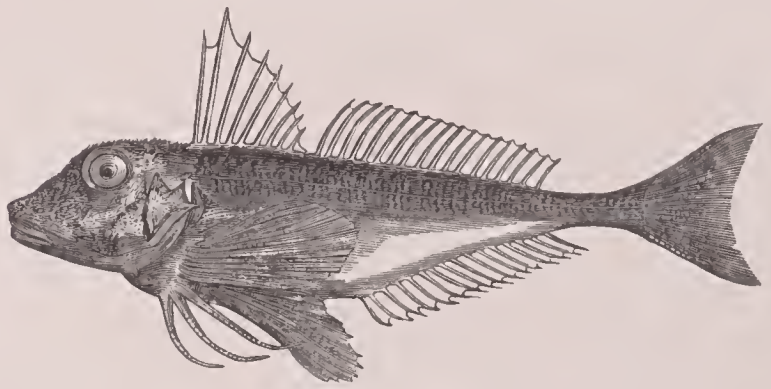
**Gurgaon**, goor-gaa'on: a district of the Delhi division, Punjaub, British India, forming the S. E. angle of the Punjaub, W. of the Jumna river and S. of Delhi. Area, 1,938 sq. miles. It is nearly all under cultivation, but owing to the deficieney of irrigation it is subject to drouth, seven periods of which have occurred since 1783, some of them very destructive. The principal productions are wheat, barley, other grains, oil-seeds, cotton, and tobacco. The average rainfall is 24 inches. The Rajputana State Railway passes through the district. Pop. 650,000. The capital is Gurgaon, with a pop. of about 4,000. The trade center is Rewari (24,000), in the western part of the district. This is one of the chief trading emporiums in the Punjaub.

MARK W. HARRINGTON.

**Gurhwal**: same as GARHWAL (*q. v.*).

**Gurnah, Kurnah**, or **Qurna**: a name attached to a temple, and more or less loosely to a series of tombs on the western bank of the Nile at Thebes. The temple is the most northerly of the series erected by various kings, and its ruins lie at the edge of the cultivated land. It consisted of a colonnade of ten pillars facing the east, and three series of halls and chambers in the rear. Its construction was begun by Seti I. in memory of Ramses I., and it was decorated with figures and hieroglyphs in bas-relief. The structure was extended on a larger scale by Ramses II., who was compelled to adopt the less costly method of incised hieroglyphs. Unlike most temples, it was a cenotaph, on a plan totally at variance with the ordinary arrangement of the tomb. (See MASTABA.) Its inscriptions and paintings are noteworthy for their great beauty and delicacy of execution. The tombs in the northern portion of the area covered by the Theban necropolis are those of Drah Abul Neggah, Asasif, and Sheik Abd-el-Gurnah. Deir el-Bahri and Biban el-Moluk are farther to the west. Those situated nearest to the temple are known as Drah Abul Neggah, and belong to the eleventh, seventeenth, and eighteenth dynasties. They have practically disappeared. The Turin and other legal papyri have reference to thievish depredations committed here. (See EGYPTIAN LANGUAGE AND LITERATURE and EGYPTOLOGY.) The others belong to the eighteenth dynasty mainly, and contain the sepulchers of the nobility of that period. They are of great value for their portrayal of the manners as well as the history of the time. The other tombs were those of Deir el-Medineh and the tombs of the queens, situated at the extreme south, and belonging to the eighteenth dynasty, and Kurnet Murraï of the seventeenth and eighteenth dynasties. The inscriptions in the last show a thoroughly organized native rule at the time when the Hyksos were still powerful at SAN-TANIS (*q. v.*). CHARLES R. GILLETT.

**Gur'nard** [M. Eng. *gurnard*, from O. Fr. **gournard*, *grongnard* (> Fr. *grognard*), liter., grunter, deriv. of *grongner*, grunt > Fr. *grogner*]: any one of several marine fishes of the family *Triglidæ* and of the genera *Trigla*, DACTYLOPTERUS (*q. v.*), *Peristethus*, *Prionotus*, etc. The number of genera in the family is about thirty. Several species, called grunters, sea-robins, sea-swallows, cuckoos, etc., are found



The red gurnard.

in American waters. These fishes have the head, or in some genera the whole body, covered with hard plates. They often have numerous sharp spines and fantastic-looking appendages, which give them a singular appearance, but their flesh is generally very good. The red gurnard, found on both sides of the Atlantic (*Trigla enculus*), and the sapphirine gurnard of Europe (*T. hirundo*) are among the most important species.

**Gurney**, Sir GOLDSWORTHY: chemist; b. in England in 1793; was educated for the medical profession; became early absorbed in the study of practical chemistry; in 1822 delivered a course of lectures on chemical science at the Surrey Institution, which were published in 1823; was the inventor of the lime light, the magnesium light, the Bude and the oil-gas lights; also of the high-pressure steam-jet and the tubular boiler; and in 1829 drove a steam-carriage from London to Bath over the turnpike road at a speed of 14 miles per hour. By means of his high-pressure steam-jet, first applied to locomotives Oct., 1830, the rate of speed was increased from 12 to 30 miles an hour; subsequently it was used to ventilate coal mines and extinguish fires in them; it was further applied in 1849 to the exhaustion and consumption of the poisonous gases from the sewers of London. In 1852 he was appointed to assume charge of lighting and ventilating the new houses of Parliament, which he accomplished by a method of his own. In his early lectures he

claimed to have been the first to observe the deflection of the magnetic needle, the basis of the electric telegraph. He was knighted in 1863. D. Feb. 28, 1875.

**Gurney**, Joseph John: philanthropist; b. at Earlham, near Norwich, England, Aug. 2, 1788; was educated at Oxford without formally entering the university, and in 1818 became a preacher of the Society of Friends. He was distinguished for labors in behalf of prisoners, which he carried on in conjunction with his sister, Elizabeth Fry, and was also an active friend of the abolition of slavery. His ample wealth was freely used in benevolent causes. He traveled extensively in the U. S., the West Indies, continental Europe, etc., while prosecuting his charitable enterprises. D. at Earlham, Jan. 4, 1847. Among his quite numerous works are *Notes on Prison Discipline* (1819); *On the Religious Peculiarities of the Society of Friends* (1824); *Portable Evidences of Christianity* (1832); *Sabbatical Verses* (1837); *A Winter in the West Indies* (in letters to Henry Clay, 1840); and other books of much value. Mr. Gurney's doctrinal views called forth some opposition in the U. S., and the resulting controversy led to the separation of the party called Wilburites from the main body of Orthodox Friends in 1843. See his *Life* by J. P. Braithwaite (Norwich, 1884; 2 vols., 2d ed. 1854; rep. Philadelphia, 1854), and by John Alexander (1847).

**Gurow'ski**, Adam, de, Count: Polish revolutionist and author; b. at Kalisz, Sept. 10, 1805. In youth his sympathy with the Polish cause resulted in his expulsion from school, and in 1820 he went to Germany, where he pursued his studies until 1825, when he returned to Poland. He was on several occasions imprisoned for his active sympathy with the opponents of Russia. He was a prominent instigator of the revolution of 1830, and acted as agent of the republicans in France, where he remained in exile after the insurrection was suppressed. In 1835 he published a work (*La vérité sur la Russie*) advocating Panslavism, and was in consequence recalled to Russia and employed in the service of the emperor. Here he remained till 1841, when he secretly left Russia on account of troubles at court, and went to Berlin; there and at Heidelberg he pursued his studies, delivering lectures in the meantime at the University of Berne, Switzerland, on political economy. In 1849 he went to the U. S., and was for a time professor of languages; from 1861 to 1863 he was a translator in the Department of State at Washington. He was the author of numerous works in various languages. Among his published works are *Russia as it Is* (New York, 1854); *America and Europe* (1857); and *My Diary* (notes on the civil war, 2 vols., 1862–66). D. at Washington, D. C., May 4, 1866.

**Gurteen**, Stephen Humphreys Villiers, M. A., LL. B.: b. at Blean House, near Canterbury, Kent, England, June 9, 1840; educated at Jesus College, Cambridge (prizeman and scholar), and at Paris and Berlin; ordained deacon Feb. 21, 1875; priest the following year; acting Professor of Latin at Hobart College, and in charge of Trinity church; associate rector Trinity church, Buffalo; rector Trinity church, Toledo, O.; dean St. Paul's cathedral, Springfield, Ill. During his residence in Buffalo he introduced into the U. S. the English plan of charity organization. He published *Phases of Charity* (Buffalo, 1877); *Provident Schemes* (1879); *What is Charity Organization?* (Buffalo, 1879; reprinted 1880, 1881; rep. Chicago, 1882); *Hints and Suggestions to the Visitors of the Poor* (1879); *How Paupers are Made* (Chicago, 1883); *Handbook of Charity Organization* (1882); *Historical Sermon Fiftieth Anniversary St. Paul's Parish, Springfield, Ill.* (1886); and a work on *Casuistry*. D. in 1898. W. S. Perry.

**Guspini**, goos-pee'nĕe: town; in the province of Cagliari, Sardinia; 34 miles N. W. of Cagliari (see map of Italy, ref. 8–B). In its neighborhood are the ruins of Neapolis, an ancient and important town mentioned by Ptolemy, which was destroyed by the Saracens. Other antiquities exist in the vicinity, among them several *nuraghi*, or round towers of a peculiar construction, the origin and purpose of which are doubtful. With the exception of its archæological interest, the city is of small importance. Pop. about 6,000.

**Gusserow**, goo'se-rov, Adolf Ludwig Sigismund, M. D.: obstetrician; b. July 8, 1836, in Berlin; educated at Universities of Berlin, Würzburg, and Prague; professor at University of Utrecht 1866–67; at the University of Zurich 1867–72; at University of Strassburg 1872–78; Professor and Director of Gynæcological Clinic in University of Berlin since 1878. He is author of *Die Neubildung des Uterus* (2d ed. 1885) and of numerous professional papers. Since 1884 he has been editor of *Archiv für Gynäkologie*. C. H. Thurber.

**Gusta'vus I. Va'sa**: King of Sweden; the son of Eric, Duke of Gripsholm; b. at Lindholm, May 12, 1496; was descended lineally from the old Swedish kings; educated at Upsala, he entered the public service (1514) at a time of general discontent with the Danish domination, a large party having openly pronounced for independence. Vasa was one of the hostages sent in 1518 to warrant the safety of the Danish king, and was treacherously sent in irons to Denmark; escaped in 1519; listened to Luther's preaching, and became his correspondent; returned to Sweden, where his father was killed in 1520; headed an insurrection of Dalecarlians in 1521; gained the battle of Westeraas (1521); was made administrator of Sweden, of which he became king in 1523; openly professed Lutheranism in 1527; and in 1528 made it the state religion. His reign was disturbed by domestic wars with the peasants and with the reactionary party, and by contests with Russia. D. at Stockholm, Sept. 29, 1560.

**Gustavus II.** (Gustavus Adolphus): King of Sweden; grandson of Gustavus Vasa; b. at Stockholm, Dec. 9, 1594 (old style); succeeded Charles IX., his father, Nov. 8, 1611. Charles had been raised to the throne in 1604 by the Swedish estates, Sigismund of Poland, his nephew and the rightful heir, having been deposed because he was a Roman Catholic. In consequence, Sweden became involved in war with Poland, Denmark, and Russia. Gustavus detached Denmark from the alliance by a treaty in 1613; gained great advantages over Russia, and forced the czar to a disadvantageous peace in 1617; overran Polish Prussia, and was wounded at Dantzic; and though the Poles were sustained by the Emperor Ferdinand, who put Gustavus under the ban, he made an advantageous truce of six years, and landed again at Usedom in 1630. His greatest work was the leadership of the Protestant forces in the Thirty Years' War (*q. v.*); and the last two years of his life were the most glorious of all. The great battle of Leipzig, Sept. 7, 1631, Tilly's first defeat, established the fame of Gustavus; the victories of Würzburg and the Lech (Apr. 10, 1632), where Tilly received his death-wound, added to that fame. The generalship of Wallenstein drew him into Saxony, and the foes met at Lützen Nov. 6, 1632, where Wallenstein was defeated and Gustavus at the moment of victory fell covered with wounds. The first tactician and the first disciplinarian of his age, a man of large ambition for military glory, his most marked trait was nevertheless his profoundly religious spirit. As a ruler he showed what he might have been by the improvements introduced in the industrial, commercial, and mining interests of Sweden, and by the valuable changes he made in the internal economy of his Government. See his *Life and Times* (1884). Revised by C. K. Adams.

**Gustavus III.**: of Sweden; b. at Stockholm, Jan. 24, 1746; succeeded his father, Adolphus Frederick, in 1771. His reign was much disturbed by conspiracies, the machinations of the Hat and Cap factions, and wars with Denmark and Russia. Gustavus was a man of ability and ambition, but his vacillating and perhaps treacherous disposition, and his disregard of the constitutional limits of his power, bred much discontent, and he was shot by an emissary named Ankarstroem at a masked ball, and died of the wound Mar. 29, 1792.—His son, Gustavus IV., b. Nov. 1, 1778, succeeded to the crown in 1792; was robbed of Pomerania by Napoleon, and of Finland by the Czar Alexander; was forced to abdicate in 1809; was succeeded by Bernadotte (Charles XIV). D. at St. Gall, Feb. 7, 1837.

**Gustavus Adolphus Society**: a society of German Protestants, organized in 1832 in consequence of resolutions adopted on the two hundredth anniversary of the death of Gustavus Adolphus (which occurred Nov. 16, 1632, new style). This society is very popular in Germany, and also in the Netherlands and Sweden. Its object is the assistance of weak congregations of evangelical Protestants in all parts of the world.

**Güstrow**, güs'trov: town of Mecklenburg-Schwerin; on the left bank of the Nebel; 70 miles E. by S. of Lübeck by rail (see map of German Empire, ref. 2–F). It has a Gothic cathedral, a stately palace completed in 1565, formerly a ducal residence but now a workhouse, a gymnasium, a Real-gymnasium, a trade school, and an orphan asylum. It is an important wool-market, and has breweries, machine-works, foundries, and a large sugar-factory. Pop. (1890) 14,568.

**Gutenberg**, goo'ten-bẽrch, Henne, or Johann: printer; b. at Mainz, Germany, about 1400; was the son of Frielo zum Gänsfleisch, a patrician, but took the name of his mother's family; removed in 1420 to Strassburg, where in 1436 he took several partners for the practice of wonderful secret arts invented by him. Of these arts, that of printing with movable types was the most important. Books printed before this time are all of the class called block-books, printed from engraved plates of wood or metal. It is certain that Gutenberg and his associates had a printing-press, with other apparatus for practicing the new art, as early as 1438, but it is not known that any books were printed until after the formation of his partnership with Faust, or Fust, at Mainz in 1450. (See Faust.) In 1455 the partnership was dissolved, and Peter Schöffer became Gutenberg's partner. In 1465 Gutenberg, who had for some years been carrying on the business by himself, left and entered the court of the Elector of Nassau. D. at Mainz, Feb. 23, 1468.

**Guthrie**: city (founded Apr. 22, 1889); capital of Oklahoma Territory and of Logan County (for location of county, see map of Oklahoma, ref. 2–D); on the Cottonwood river and on the Atch., Topeka and S. Fé., Eastern Oklahoma, and Chicago, Rock Island and Pacific railroads. On Apr. 21, 1889, the day before the formal opening of the Oklahoma strip to settlement, the site of Guthrie was a bare prairie. On the 23d 8,000 people were encamped in tents within its limits. In 1890 Guthrie won an exciting struggle with Oklahoma city for the location of the territorial capital. It contains 8 churches, 5 large stone public-school buildings, water-works, electric-light plant, 3 banks, board of trade, 2 daily, 6 weekly, and 3 monthly periodicals, flour and planing mills, cotton-oil mills, ice-factory, cotton-gin, carriage and furniture factories, and other industries. Pop. (1890) 5,333; (1900) 10,006.

Editor of "State Capital."

**Guthrie**: Frederick: See the Appendix.

**Guthrie**, Thomas, D. D.: pulpit orator and philanthropist; son of a banker; b. at Brechin, Forfarshire, Scotland, July 12, 1803; graduated at the University of Edinburgh; studied medicine in Paris; was settled at Arbirlot, in his native county, in 1830; in 1837 removed to Old Grey Friars church in Edinburgh, and in 1840 to St. John's, a new church built for him in the same city; in 1843 took a prominent part in the establishment of the Free Church; encouraged the building of manses; became in 1847 the "Apostle" of the Ragged School system; was moderator of the General Assembly in 1862; was compelled to give up public speaking in 1864, when he began to edit *The Sunday Magazine* (Edinburgh and London). He was an earnest philanthropist and social reformer, and a very brilliant orator. Among his humanitarian publications may be named *A Plea for Ragged Schools* (Edinburgh, 1847); *A Plea on Behalf of Drunkards* (1850); *The City, its Sins and Sorrows* (1857). He published also *The Gospel in Ezekiel* (1855); *Christ and the Inheritance of the Saints* (1858); and *The Way to Life* (1862). D. at St. Leonard's, Fifeshire, Feb. 24, 1873. His sons issued his *Autobiography and Memoir* in 1874 and 1875 (2 vols., London).

Revised by S. M. Jackson.

**Guthrie**, Thomas Anthony: English author; publishes under name of *F. Anstey*; b. at Kensington in 1856; educated at Trinity Hall, Cambridge; called to the bar 1880, but never practiced; published short stories for various magazines 1878–81; author of *Vice Versa* (1882), which was very successful and was dramatized; *The Giant's Robe* (1883); *The Black Poodle* (1884); *The Tinted Venus* (1885); *The Fallen Idol* (1886); *The Pariah* (1889); *Vox Populi* (1892); *The Traveling Companions* (1892). C. H. T.

**Guthrie Centre**: town; capital of Guthrie co., Ia. (for location of county, see map of Iowa, ref. 5–F); on the Chi., R. I. and Pac. Railway; 50 miles W. of Des Moines. It is an agricultural and stock-raising region, with valuable tracts of coal and timber land; has 5 churches, 2 schools, and 2 weekly newspapers, and contains iron-bridge works, novelty-works, brick-works, and flour-mills. Pop. (1890) 1,037; (1900) 1,193.

**Guts Muths**, Johann C. F.: See the Appendix.

**Gutta-percha** [from Malay *gatah*, gum + *pertja*, the gutta-percha tree]: the hardened milky juice of the *Isonandra percha* or *I. gutta*, a large tree, which grows in Malacca, Borneo, and other islands of the Indian Archipelago, and also, according to Bleekrode, is procured from *Sapota mulleri*. The milky juice exudes from incisions in the bark made after the tree is cut down, and is inspissated by boiling. Crude gutta-percha is purified either by rasping in water to remove soluble impurities, and then heating to 230° F. to reduce to a compact mass, or by dissolving in bisulphide of carbon and evaporating the filtered solution. The purified gutta-percha has a brownish-red color, and a specific gravity of 0·979. It becomes electrical by friction, and is a very poor conductor of electricity; hence it is used for forming insulating supports for electrical apparatus and for covering telegraph wires which are to be immersed in water. At about 115° F. it softens and becomes pasty, without losing its tenacity. At 104° F. it may be easily spread out in sheets, drawn into tubes, applied to any surface, or worked into any desired form. It will take the finest impressions from a mold. It is used for water-pipes, moldings, and mixed with linseed oils for the molds employed in making electrotypes. It is insoluble in water, and but slightly soluble in alcohol and ether. Boiling olive oil dissolves a little of it, but deposits it again on cooling. It is readily soluble in bisulphide of carbon, benzol, chloroform, and oil of turpentine, especially when heat is applied. Alkalies and hydrofluoric acid have no action upon it. Bottles and other vessels for the latter acid are made from it. Oil of vitriol carbonizes it, and strong nitric acid converts it into a yellow resin. It yields volatile oils by dry distillation Gutta-percha consists of

| | | |
|---|---|---|
| 1. Pure gutta..... | $C_{10}H_{16}$ | 78 to 82 per cent. |
| 2. Fluavil... ..... | $C_{27}H_{32}O$ | 6 " 4 " |
| 3. Alban..... | $C_{20}H_{32}O_2$ | 16 " 14 " |

The fluavil and alban are products of the oxidation of the gutta. The fluavil is a yellow resinous body, soluble in cold alcohol; the alban, a crystalline substance, insoluble in cold but soluble in boiling alcohol. The gutta is insoluble even in boiling alcohol. Pure gutta is obtained by exhausting gutta-percha with water and hydrochloric acid, dissolving in boiling ether, pressing the substance which separates on cooling, repeating the operation as long as anything is taken up by the ether. The pure gutta is perfectly white, cakes together at 212° F., and begins to melt at 300° F. Gutta-percha is strongly attacked by ozonized oxygen and by strong hydrochloric acid. It rapidly deteriorates by oxidation when exposed to the air, especially in warm climates. It loses its flexibility, tenacity, and extensibility, and becomes very brittle and entirely useless for industrial purposes. Mixed with sulphur or certain sulphides, and heated to 260° or 300° F., the gutta-percha undergoes a change similar to that which occurs during the vulcanizing of caoutchouc. (See India-rubber.) Gutta-percha is chiefly employed for coating submarine telegraph-wires. For further details, see Ure's *Dictionary of Arts, Manufactures, and Mines*; Muspratt's *Chemistry*; *The American Chemist* (vol. ii., 1871, p. 81, *seq.*); and *Dictionary of Applied Chemistry*, I. E. Thorpe (1891). See Gutta-percha in the Appendix.

Revised by Ira Remsen.

**Gut'ta Ro'sea** [Lat., rosy drop]: a name somewhat vaguely applied to skin diseases in which some of the sebaceous glands of the nose and face become the seat of inflammatory action, often of a very obstinate kind. The name includes often those cases of acne so common among young persons of either sex just as they are coming to years of maturity. The whelks or tubercles which appear upon the faces of hard drinkers come under the same general name. Regulation of the habits in any case is the most essential condition of cure. Mild lead lotions, with iron, are useful.

**Gut'ta Sere'na** [Lat., clear drop, so called in distinction from *gutta opaca*, or cataract, it being the belief of the ancients that drops of some humor of untoward quality fell into the eye and quenched the sight]: an old synonym for amaurosis (see Blindness); the "drop serene" of Milton.

**Gutturals** [from Lat. *guttur*, throat]: sounds formed between the back of the tongue and the soft palate. To distinguish them more distinctly from the palatals formed between the body of the tongue and the hard palate they are often called *velars*. Guttural vowels are *a* (as in *father*), *o* (as in *rose*), *u* (as in *rule*). Guttural explosives are *k* (as in *cot*), *g* (as in *got*). Guttural spirants are *ch* in Germ. *ach*, its corresponding voiced consonant, as in Germ. *sagte*, and the uvular *r*, as in the "Northumbrian burr" and the Parisian *r*. Guttural nasal is the sound indicated by the two letters *ng* in *song*.

Benj. Ide Wheeler.

**Gutzkow**, Karl Ferdinand: novelist and writer; b. in Berlin, Germany, Mar. 17, 1811; studied philosophy and theology; became an acknowledged head of the Young Ger-

many party. His *Wally die Zweiflerin* (a novel, 1835) caused his imprisonment for three months, its tendency being considered atheistical and destructive to social order. He afterward attained very great popularity as a novelist, dramatist, and journalist, but he never achieved a really artistic effect by any of his numerous writings. He lived in various German cities, and from 1870 at Berlin. Noteworthy among his works are *Zur Philosophie der Geschichte* (1836, written against Hegel); *Blasedow*, a satirical tale (1838–39); *Zopf und Schwerdt* (1844) and *Urbild des Tartüffe* (1847), comedies; *Uriel Acosta* (a tragedy, 1847); *Die Ritter vom Geiste* (1850–52); *Der Zauberer von Rom* (1859–61); *Fritz Ellrodt* (1872), and many other novels. While the influence of Gutzkow's literary activity upon the political and mental development of Germany must not be underestimated, his writings are not of permanent value. His talent, like that of all the members of Young Germany, was chiefly critical and journalistic. His efforts in the fields of the drama and the novel lack artistic form, and frequently offend by the author's undisguised intention of winning one over to the cause he is representing. D. Dec. 16, 1878. See J. Prälss, *Das junge Deutschland* (1892).

Revised by JULIUS GOEBEL.

**Gützlaff**, güts'läf, KARL FRIEDRICH AUGUST: missionary; b. at Pyritz, 24 miles S. E. of Stettin, Prussia, July 8, 1803; went in 1823 as a missionary of the Dutch Church to Singapore, and showed wonderful proficiency in the acquisition of languages; went to Java in 1826, to Siam in 1828, and to China in 1831; became in 1834 interpreter and secretary of the British legation; sustained himself without connection with any missionary society, and was beloved by the Chinese, among whom he practiced medicine with great success. Among his works are *Journal of Three Voyages along the Coast of China* (London, 1834); *Chinese History* (in English, 1834; in German, 1847); *China Opened* (1838); *Life of Taou-Kwang, late Emperor of China* (1852); and numerous papers on the geography, social life, and religion of the Chinese, into whose language he translated the New Testament. D. at Hongkong, Aug. 9, 1851. See his *Life* in German (Berlin, 1851). Revised by S. M. JACKSON.

**Guy**, SEYMOUR JOSEPH: See the Appendix.

**Guy**, THOMAS: founder of Guy's Hospital, Southwark, London (1724); b. at Horselydown, Southwark, in 1644; carried on business first as a bookseller, importing English Bibles from Holland; then as a financier, buying prize-tickets of seamen at a large discount and investing the money thus obtained in stocks. By this means he amassed a fortune of nearly £500,000. He sat in Parliament for Tamworth 1695–1707. He built and furnished three wards in St. Thomas's Hospital, gave liberally to the Stationers' Company, and founded and endowed different charitable institutions at Tamworth, his mother's birthplace. Nearly half of his fortune was bequeathed to GUY'S HOSPITAL (*q. v.*). D. in London, Dec. 27, 1724.

**Guyon**, gē̆'ôn', Madame JEANNE MARIE BOUVIÈRES DE LA MOTHE: mystic; b. at Montargis, France, Apr. 13, 1648. In 1664 she married the wealthy Jacques de la Mothe-Guyon, a tyrannical and irreligious man, who late in life was converted to her religious views. He died in 1676, leaving his wife free to foster that state of spiritual exaltation to which from infancy she had been inclined. Severe penances, untiring labors for the spiritual good of others, the abandonment of her property for the use of her three children, the guardianship of whom she surrendered, led her to a state in which she believed herself to be the bride of Christ, united in soul with God, having daily and hourly communication with heaven. She was much with one Lacombe, a Barnabite of mystical views, a devout man who was long her confessor, and who died insane, and Mme. Guyon's enemies spread many scandalous rumors regarding this relationship, but no one who knew her ever believed any of these reports. She was (1688–89) confined as a Quietist in the Visitation Convent of Paris, was liberated through the agency of Madame de Maintenon, and for a time lived at the French court. She was (1695–1702) confined at Vincennes and in the Bastile. When released she retired to her daughter's house at Blois, where the rest of her life was spent in works of charity, and there she died June 9, 1717, in full fellowship with the Roman Catholic Church, which she had never forsaken. She left a considerable number of volumes containing hymns, letters upon spiritual questions, and devotional treatises, some of them of a highly mystical character. The best *Life* is that by T. C. Upham (2 vols., New York, 1848–50). Probably the so-called autobiography is not altogether her own. Revised by S. M. JACKSON.

**Guyon**, RICHARD DEBAUFRE: a general in the Hungarian army during the revolution of 1848–49; of English descent; b. at Wolcott, near Bath, in England, Mar., 1813. In 1832 he entered the Austrian service, but after marrying the Countess Splényi, in 1838, he lived as a private citizen on his estates near Comorn. As soon as the revolution broke out he offered his services to the national Government, and accompanied Görgei as a brigadier-general on his victorious march to Buda and on his unfortunate retreat to Temeswar. After the battle of Temeswar (Aug. 9, 1849) he escaped to Turkey and entered the service of the sultan. Under the name of Kourshid Pasha he was governor of Damascus, and during the Crimean war he organized the army of Anatolia. D. in Constantinople, Oct. 12, 1856.

**Guyot**, gē̆'ō', ARNOLD HENRY, Ph. D., LL. D., M. N. A. S.: geographer; b. near Neuchâtel, Switzerland, Sept. 28, 1807; was educated at Neuchâtel, Stuttgart, Carlsruhe, and at the University of Berlin, where he graduated Ph. D. in 1835; continued his studies in Paris 1835–39. Though at first a student of theology, he gave especial attention to the natural and physical sciences. With Agassiz, his early associate, he accepted in 1839 a professorship in the Academy of Neuchâtel, just founded, to carry on a post-graduate course of higher studies, and filled the chair of Universal History and Physical Geography from 1839 to 1848. During these years he studied the structure and physics of the modern and the extent of the ancient glaciers of the Alps. He discovered the laminated character of the ice glaciers and the fact that the movement of the glacier is due to molecular displacement, mainly under the action of gravity, explaining thereby the principal laws of glacier motion which he had found and pointed out. He then investigated the subject of the transportation of Alpine bowlders around the Central Alps, determined for the first time the real limits of each erratic region in Switzerland, Savoy, and Lombardy, as well as the vertical limits of the phenomenon, and demonstrated the identity of the laws of the distribution of erratic *débris* with those of moraines of glaciers. His observations were to have been published in full in the *Système Glaciaire* of Agassiz, Guyot, and Desor (Paris, 1848), of which, however, only the first volume was printed; but the most important results are found in the *Bulletin of the Society of Natural Sciences* of Neuchâtel, and in *Archive d'Histoire de la Géologie*, vol. ii. (Paris, 1848). He removed in 1848 to the U. S.; delivered (1849) the lectures in French, translated by President Felton of Harvard College, and published as the *Earth and Man* (1849). These lectures gave rise to the movement of reform in geographical teaching, and he was employed for six years by the Massachusetts board of education as a lecturer on physical geography. He organized for the Smithsonian Institution a system of meteorological observations, superintended the construction of improved instruments; became in 1855 Professor of Geology and Physical Geography in the College of New Jersey, Princeton; published *Directions for Meteorological Observations* (1850); a volume of *Meteorological and Physical Tables* (1851–59); a paper on the *Physical Structure of the Appalachian Mountains* in *Silliman's Journal of Science* (1861); the treatise on physical geography in *Johnson's Family Atlas of the World*; a series of school geographies (1866–75), and a series of wall-maps for schools; and a *Memoir* of Louis Agassiz (1883). In 1884 appeared his *Creation, or the Biblical Cosmogony in the Light of Modern Science.* In 1873 his geographical works received the medal of progress at the Vienna Exposition, and a gold medal at Paris 1878. He received the honorary degree of LL. D. from Union College; was one of the original members of the National Academy of Sciences created by Congress, and was member of many other scientific societies. D. at Princeton, N. J., Feb. 8, 1884.

**Guysborough**, gīz'bŭr-rŭ: port of entry and capital of Guysborough County, Nova Scotia; on the west side of Milford Haven and about 120 miles E. N. E. of Halifax (see map of Quebec, etc., ref. 2–C). It was settled in 1783. Its harbor is commodious. Fishing and gold-mining are among its most important industries. Guysborough is the seat of a large academy. Pop. 1,703.

**Guy's Hospital**: a great charitable institution of Southwark, London; named from its founder, Thomas Guy, a London bookseller, who began its erection in 1722, and at his death in 1724 most liberally endowed it. In 1829 it re-

ceived large benefactions from a Mr. Hunt. It was opened in 1725. New wards were built in 1852, and a chemical laboratory in 1872. Besides the hospital there are a dental school, and a residential college for the accommodation of fifty students and the junior medical staff. The hospital admits over 5,000 patients yearly; its annual income is about £40,000. New laboratories were opened in July, 1893.

**Guyton-Morveau**, gē̆'tōn'mōr'vō', Louis Bernard: chemist; b. at Dijon, France, Jan. 4, 1737. He had become an attorney, when he determined to devote himself exclusively to the study of natural science, especially chemistry. At his suggestion chairs of chemistry, mineralogy, and medicine were erected at the Academy of Dijon, and he filled the first-mentioned one till 1790. During the Revolution he was active as a politician, and voted for the immediate execution of Louis XVI. He contributed much to the erection of l'École Polytechnique in Paris, at which he became a professor. From 1800 to 1814 he was director of the mint. His chief merits as a chemist are his discovery of the disinfecting qualities of chlorine, made in 1773, and his establishment of a new and simpler chemical terminology, the idea of which he conceived in 1783, and in the execution of which he was aided by Lavoisier. But his experiments and researches also have been of great influence in the manufacture of saltpeter, gunpowder, Prussian blue, etc., in the employment of cement for building under water, and in many other instances of practical application of chemical science. His principal works are *Dictionnaire de Chimie* (1786); *Methode d'une Nomenclature chimique* (1787); *Traité des moyens de désinfecter l'air* (1801); *Rapport sur la restauration d'un tableau de Raphaël* (1802). D. in Paris, Jan. 2, 1816.

**Guzel-Hissar**: See Aidin.

**Gnzerat**, or **Gujarat**: the northern seaboard of the Bombay Presidency, British India. The name is geographical and not political, and is somewhat vaguely employed. It includes the British districts of Surat, Broach, Kaira, Panch Mahal, and Ahmedabad, and also the native states of Baroda and a dozen or more others. It sometimes also includes the peninsula of Kathiawar, with its 180 petty states. Defined thus it has an area of over 40,000 sq. miles. It has given its name to one of the great languages of Bombay, the Gujarathi. M. W. H.

**Guzman**, Nuño Beltran, de (Nuñez de Guzman according to some authors): lawyer and soldier; b. at Guadalajara, New Castile, Spain, about 1485. He was long a crown officer in Española, and in 1526 was appointed governor of Panuco in Mexico (a region about the present city of Tampico). Guzman was opposed to Cortés, and speedily quarreled with him on questions of boundary; he also encroached on the territory of Narvaez toward the N., and carried many Indians away into captivity. Notwithstanding these irregularities, the Council of the Indies made Guzman president of the first audience or high court of Mexico. He arrived at Vera Cruz with the other auditors in Dec., 1528, and by virtue of his office ruled, or rather misruled, New Spain until deposed by the arrival of a second audience in Jan., 1531. During this period the auditors made themselves wealthy by extortion and bribes; they were enemies rather than judges of Cortés in the proceedings against him, and the natives and Spaniards were oppressed in many ways. In 1530 Guzman led an expedition to the Pacific coast in Jalisco, opening up the region afterward known as Nueva Galacia. He was finally imprisoned, tried, and disgraced; in 1538 he was sent to Spain, and died in obscurity at Guadalajara (according to others at Torrejon de Velasco), 1544. Herbert H. Smith.

**Guzman**, Ruy Diaz, de: first historian of Paraguay; b. in that country in 1544. His father was one of the followers of Cabeza de Vaca in 1544, and the son early served in the numerous Indian wars; later he was military governor of Guayra. His *História Argentina del descubrimiento, población y conquista de las provincias del Río de la Plata* was finished in 1612, but remained in manuscript until 1836, when it was published in the Angelis collection. The date and place of Guzman's death are unknown. H. H. S.

**Guzman Blanco**: a state of Venezuela, now called Miranda (*q. v.*).

**Guzman Blanco**, Antonio: statesman and soldier; b. at Caracas, Venezuela, Feb. 29, 1829. He studied law at Caracas, and subsequently held consular and diplomatic positions in the U. S. In 1859 he joined Falcon in the revolt, which, after many vicissitudes, was successful in 1863. Falcon was then elected president and Guzman Blanco became first vice-president, holding later the portfolios of the treasury and of foreign affairs. During his absence in Europe (1868) Falcon was deposed by a revolution; Guzman Blanco at once returned and headed a counter-revolution, which was successful in 1870. Falcon having died, Guzman Blanco became president, and by successive re-elections he retained the office until Feb., 1882; during this period he maintained peace and the country was prosperous, but his dictatorial acts aroused strong opposition. After his retirement from the presidency his influence was paramount in Venezuelan affairs until the election of Rojas Paul in 1888. Afterward he generally resided in Trinidad. D. in Paris, July 29, 1899. Herbert H. Smith.

**Gwalior**, gwaa'lĕ̆-ōr: a feudatory state in several detached districts of Central India; belonging to the family of Sindhia. Its northern part is low, occupying the basin of the Jumna; the middle part is hilly, and the southern is covered with branches of the Vindhyan and Santpura Mountains. Area, 29,067 sq. miles. Pop. 3,200,000.

**Gwalior**: capital of the state of Gwalior, India; on the Subanrika, an affluent of the Jumna, but with very little water in the dry season (see map of North India, ref. 6–E). In the midst of the city rises a rock, perpendicular, 300 feet high, 1½ miles long, and 300 yards broad. This rock has been used as a fortress for more than 1,000 years. At the foot of the rock stretches the city, built in the ancient Hindu style, hot, squalid, uninviting, but containing some of the most stupendous specimens of Hindu palace architecture, dating back to the fifteenth and sixteenth centuries. It also contains some very interesting temples of Jain origin. The most remarkable Jain remains, however, are the caves and rock-cut sculptures in the rock on which the fortress is built. Pop. 30,000.

**Gwin**, William McKendry: U. S. Senator; b. in Sumner co., Tenn., Oct. 9, 1805; was educated at Transylvania University; studied medicine and removed to Vicksburg, Miss.; became U. S. marshal 1833; was in Congress 1841–43; as commissioner of public buildings supervised the construction of the New Orleans custom-house 1847; went in 1848 to California; was in the constitutional convention 1849; U. S. Senator 1850–61; was imprisoned for disloyalty 1861–63; took part in a scheme for colonizing Sonora with people of Southern birth 1864–65; and, according to a report (officially denied by the imperial representative), was appointed prefect of Northern Mexico under the short-lived empire of Maximilian. D. in New York city, Sept. 3, 1885.

**Gwin'iad** [from Welsh *gwyniad*, whiting (a kind of fish), deriv. of *gwyn*, white]: a lake fish of Northern Europe, the *Coregonus fera*, of the salmon family, closely resembling the whitefish of the lakes of North America, though greatly inferior to it as food. It is caught in England and Wales in large quantities, and salted, and sold to the poor at very cheap rates.

**Gwinnett**, Button: patriot; b. in England about 1732; emigrated to Charleston, S. C., in 1770, and became engaged in agriculture (1772). He took an active part in the political questions of the time during the Revolution, was elected by the general assembly of the province a representative to the general Congress, and was a signer of the Declaration of Independence. He was killed in a duel by Gen. McIntosh, May 27, 1777.

**Gwynn**, Nell: actress; b. in London, in the most abject poverty, about 1650. She sold oranges in the taverns, and sang and danced for money, and in her sixteenth year went upon the stage, where she made a great hit in humorous and wanton *rôles*. She became the mistress of Lord Buckhurst, and in 1669 of Charles II.; in 1671 she was appointed a lady of the privy chamber to Queen Catharine, and received the name of Madam Ellen. But once arrived at this station, her pretty face, wit, and generosity made her popular. She helped her old friends among the actors and poets, was the first to propose the erection of Chelsea Hospital for disabled soldiers, and was generally believed to have exerted herself in support of the Protestant cause at court. She bore two sons to the king, of whom the one died early, and the other was created Duke of St. Albans. After the death of Charles II. she lived in retirement, and when she died (about 1690) her funeral sermon was preached by Dr. Tenison, afterward Archbishop of Canterbury. Two memoirs have

been published of her—one by John Seymour in 1752, *Memoirs of the Life of Nell Gwynn, Mistress to King Charles II.* (a mere panegyric), and another by Peter Cunningham in 1850.

**Gya**: See GAYA.

**Gy'aros** (in Gr. ἡ Γύαρος, or τὰ Γύαρα): one of the Cyclades; now uninhabited and employed as a sheep-pasture. It lies S. W. of Andros; was anciently proverbial for the poverty of its people (Strabo, 4); and was a most dreaded place of banishment for the Romans (Juvenal, i., 73). It is very small and rocky. Its present name is Giura, or Giurna.

Revised by J. R. S. STERRETT.

**Gyges** (in Gr. Γύγης): a favorite officer of Candaules, King of Lydia. He expelled the Assyrian dynasty of the Sandonidæ (Heraclidæ) from Lydia, and founded the dynasty of the Mermnadæ, the last sovereign of which was the ever-famous Crœsus. At the suggestion of Candaules, who thought the queen's beauty was not fully appreciated by Gyges, the latter unwillingly concealed himself in her bedchamber in order to see her naked, but was discovered by the queen, who gave Gyges the choice of being put to death himself or of killing Candaules. He chose the latter, murdered Candaules, and became King of Lydia about 716 B. C. The Delphic oracle confirmed him in his new position, and in return he sent to Delphi an offering of immense value, including among other things six golden mixing-bowls (craters) that weighed thirty talents ($35,000). The story that Gyges came into possession of the throne by means of an enchanted ring is told by Plato (*de Rep.*, ii., 3), and the ring of Gyges was with the ancient Greeks a symbol of extraordinary good luck, like the lamp of Aladdin with the Arabs. D. 678 B. C. J. R. S. STERRETT.

**Gyldén**, HUGO: astronomer; b. at Helsingfors, Finland, May 29, 1841; was appointed astronomer at the Pulkowa Observatory, where he determined standard declinations with the vertical circle. In 1871 he removed to Sweden, as director of the observatory at Stockholm and professor in the university. Here he devoted himself principally to the mathematical theories of the planetary motions, having invented a new method of determining the perturbations of comets and planets, which is coming into wide use. D. in Stockholm, Sweden, Nov. 10, 1896. S. NEWCOMB.

**Gylip'pus** (in Gr. Γύλιππος): son of the exiled Spartan general Cleandridas by a Helot mother; he was therefore reckoned among the Mothaces (or Mothones), who, though they were not full citizens, were educated along with the Spartan youth, and might even attain the rank of full citizens in time. He was given the command of the allied forces sent in 414 B. C. to the relief of Syracuse, which was then being besieged by the Athenians. The force of Gylippus was so small that the Athenians did not take the trouble to annihilate it. He landed at Himera, marched across country to Syracuse, took command of the Sicilian land forces, captured the fortress Epipolæ, and conducted the campaign with such increasing success that the next year (413 B. C.) the Athenian army was utterly annihilated, when both Nicias and Demosthenes, the Athenian generals, were put to death by the Syracusans, against the wishes of Gylippus. The story of the siege of Syracuse, the retreat and capture of the Athenians, is told by Thucydides in the seventh book, which Lord Macaulay declared to be the finest piece of prose composition that ever issued from the pen of man. In 412 he returned to Sparta, though hard pressed by the Athenian fleet of observation. At the close of the Peloponnesian war Lysander sent him to Sparta in charge of great state treasure. Gylippus, following in the footsteps of his own father Cleandridas, stole a part of the treasure, was condemned to death for the crime, and escaped only by fleeing the country. Probably he died in exile.

J. R. S. STERRETT.

**Gyllembourg-Ehrensvärd**, gül'lem-boorch-ā'rens-vārd, THOMASINE CHRISTINE (*née* BUNTZEN), Baroness: novelist; b. at Copenhagen, Denmark, Nov. 9, 1773; was married in 1790 to the political writer Peter Andreas Heiberg, by whom she had one son, the poet Johann Ludwig Heiberg. Her husband was banished in 1799 for his political views, but she did not accompany him in his exile. Obtaining a divorce, she married Baron Gyllembourg-Ehrensvärd, a Swedish political refugee living at Copenhagen. After his death in 1815 she lived with her son, at whose house in Copenhagen she died, July 2, 1856. Her first work, *The Polonius Family*, was published anonymously in her son's paper, *The Flying Post*, and it was followed by *The Magic Ring* (1828) and by *An Everyday Story* in the same year. The last was especially popular, and roused the curiosity of the public as to the identity of the author, but she kept the secret till her death. Among her other works are *Old and New Novels* (1833–34); *New Stories* (1835–36); *Montanus and Ricida* (1839); *One in All* (1840); *Near and Far* (1841); *A Correspondence* (1844); and *Two Generations* (1845).

**Gymna'sium** (Gr. γυμνάσιον, athletic ground, deriv. of γυμνάζειν, exercise, practice, athletic exercises, deriv. of γυμνός, naked, lightly clad]: among the Greeks a place for athletic exercises. In its simplest form the gymnasium was a vast hypæthral building with a colonnade around the four interior sides. To make provision in this interior court for all the various kinds of athletic exercises was a problem of great interest to architects, one of whom, Vitruvius (5,11), has given a complete description of the ideal gymnasium of the Græco-Roman period. Appropriate places had to be provided for running, jumping, wrestling, boxing, spear and discus casting, for warm and cold baths, for undressing, for anointing the body with oil and besprinkling it with sand. In addition to this, space had to be provided for the accommodation of the people, who were fond of witnessing the athletic exercises of the young. By degrees the gymnasium became a place to which people went for amusement and mental refreshment, and so the grounds of the gymnasium were provided with promenades, both covered and uncovered, with gardens and resting-places of various kinds in which men might lounge, converse, study, or receive oral instruction. In classical times there were three gymnasia in Athens—the Academia, the Lycæum, and the Cynosarges—but in later times there were more. Ancient gymnasia have been discovered by excavations at Olympia, Pergamon, Hierapolis, Aphrodisias, Alexandria Troas, Assos, and Delos. The literature of the gymnasium is vast, and merely the chief works will be cited: L. Grasberger, *Erziehung und Unterricht im klassischen Alterthum* (Würzburg, 1881); Mahaffy, *Old Greek Education* (London, 1883), based on Grasberger; Wilkins, *National Education in Greece* (1873); Capes, *University Life in Ancient Athens* (London, 1877); Krause, *Gymnastik und Agonistik der Hellenen* (Leipzig, 1841); Jäger, *Gymnastik der Hellenen* (Stuttgart, 1881); Blümner, *Leben und Sitten der Griechen*, ii., 95 ff.; E. Paz, *Histoire de la gymnastique depuis les temps les plus reculés jusqu'à nos jours* (Paris, 1886); Wickenhagen, *Antike und moderne Gymnastik* (Rendsburg, 1891).

The gymnasium finally became merely a school. But except in Germany and some other European countries the name has reverted to its original sense. In Germany the gymnasia are the schools where young men are fitted for the universities. But those who intend to follow a technical profession, such as architecture, engineering, etc., study at the *Realschulen* and not at the *Gymnasia*, and after having passed through the Realschule they enter the Polytechnicum for their professional education. J. R. S. STERRETT.

**Gymnastics** [from Gr. γυμναστικός, gymnastic, from γυμνάζειν, exercise. See GYMNASIUM]: athletic or disciplinary exercises, designed to promote strength, including running, leaping, the use of parallel bars, and the lifting of weights. Among the ancient Greeks practice in the use of weapons was an essential part of gymnastic training. CALISTHENICS are light gymnasties designed to impart grace of movement as well as physical strength, and better adapted to women than ordinary gymnastics, as they do not subject the muscles to so violent a tension. The apparatus used chiefly consists of a light wooden staff, about 4 feet long, a pair of light dumb-bells, chest-weights, and parallel bars. Marching and other movements often are performed to the sound of music. See PHYSICAL EDUCATION.

**Gymne'trus** [Mod. Lat.; Gr. γυμνός, naked + ἦτρον, abdomen]: a genus of fishes of the family *Trachypteridæ*. They inhabit deep parts of the sea, and are seldom seen. *G.* or *Regalecus banksii* and *G. hawkenii* are found in the Atlantic waters. They are board-like in form, very much compressed, and from 6 to 20 feet in length. Their ventral fins are reduced to the form of oar-like filaments. These fishes are very delicate and fragile, and when found some of their parts are usually wanting.

**Gymnoc'ladus** [Mod. Lat.; Gr. γυμνός, naked + κλάδος, branch]: a genus of the order *Leguminosæ*, containing a single species, found in the U. S., the *G. canadensis*, called Kentucky coffee-tree, stump-tree, and chicot. Its range is from Western New York and Pennsylvania to Illinois and

southwestward. It is a handsome tree, with peculiar and very compound leaves, but in winter it appears as if dead, from the absence of small branches. Its wood is valuable to the joiner and furniture-maker, and the very hard seeds have been used for coffee.

**Gymnodon'tes** [Mod. Lat., plur. of *gym'nodon*, liter., naked-tooth; Gr. *γυμνός*, naked + *ὀδούς*, *ὀδόντος*, tooth]: a sub-order of plectognath fishes, distinguished by a complete union of the bones of the upper jaw and the consolidation of their dental armature, as well as that of the lower jaw, in exposed, beak-like masses, with or without median sutures; the scapular arch is also characterized by the atrophy of one of its bones (the hypercoracoid). The various species are distinguishable by a greater or less eccentricity of form and deviation from the fish-like type, some having sac-like bodies, with the belly more or less distensible, and others by a truncation of the body behind, and a consequent absence of the caudal peduncle and true fin. Three families belong to this group—viz., *Orthagoriscidæ*, *Tetrodontidæ*, and *Triodontidæ*, whose representatives are known popularly as salt-water sunfishes, swellfishes, porcupine-fishes, etc.

**Gym'nogens**: a synonym for Gymnosperms (*q. v.*).

**Gymnono'ti** [Mod. Lat., plur. of *gymnono'tus*; Gr. *γυμνός*, naked + *νῶτος*, back]: a sub-order of teleocephalous fishes, distinguished by the brain-case of the skull produced forward; symplectic bones present; pterotic normal; opercular all present; branchiæ normal; four anterior vertebræ, much modified and united in a single mass, with which are connected the ossicula auditus; air-bladder connected by a duct with the intestinal canal; and an anus far in front and in advance of the scapular arch, or even behind the symphysis of the lower jaw of a prolonged snout; the body is elongated and finless on the back, but with a long anal continued far forward. To this sub-order belong two families of South American fishes: (1) *Gymnonotidæ*, which includes a number of genera and species, and (2) *Electrophoridæ*, of which the only well-determined representative is the famous electrical eel, the *Electrophorus*, or *Gymnotus electricus*, which can give a shock sufficiently powerful to fell a man. The electric eel has a fin extending along the greater portion of the under side of the body, but none on the back; the vent is situated under the throat; the color is black. The animal attains a length of 6 feet, and inhabits the streams of Guiana and Brazil. The statement that the Indians drive horses into the waters inhabited by these eels, and capture them, after their electricity has been exhausted by repeated discharges directed against the horses, lacks confirmation. Revised by F. A. Lucas.

**Gymnophi'ona** [Mod. Lat., from Gr. *γυμνός*, naked + *ὀφιόνεος*, serpent-like]: a name frequently used for the Cæcilidæ (*q. v.*), on account of their resemblance to snakes without scales.

**Gymnosom'ata** [Mod. Lat., neut. plur. of *gymnosomatus*, naked bodied; Gr. *γυμνός*, naked + *σῶμα*, *σώματος*, body]: a subdivision of the group of pteropodous Mollusca (*q. v.*), in which the body is without a shell.

**Gymnos'ophists** [viâ Lat. from Gr. *γυμνοσοφισταί*, liter., naked philosophers; *γυμνός*, naked + *σοφισταί*, plur. of *σοφιστής*, sophist, professor, deriv. of *σοφός*, wise]: a name given by the Greeks of Alexander's time to the Fakirs of India. They were divided into two sects, the Brahmans and the Samanæans.

**Gym'nosperms** [*γυμνός*, naked + *σπέρμα*, seed]: a class (*Gymnospermæ*) of flowering plants characterized by having the seeds borne on the upper surface of an open leaf or scale, or on the margins of an open leaf, or even in open cup-shaped structures on modified branches. This fact, that the seeds are not inclosed in a folded leaf (pistil), but are naked, has given these plants their name. In fertilization the pollen falls directly upon the ovule, and, there germinating, sends its tube into its tissue and finally to its egg-cells. In all gymnosperms the prothallium is a well-developed cellular structure, and in it one or more archegones are developed. On this account they are regarded as the lowest of the flowering plants, and are unquestionably affiliated with the Fernworts (Pteridophytes). Three orders are usually recognized, viz., the Cycads (*Cycadeæ*), the Conifers (*Coniferæ*), and the Joint-firs (*Gnetaceæ*), to which the reader is referred for a fuller discussion. See also Plants, Fossil.

Charles E. Bessey.

**Gym'pie**: a town of Queensland, Australia; in about lat. 26° S., lon. 152° 25′ E.; on the upper Mary river, and on the railway; 90 miles N. of Brisbane (see map of Australia, ref. 5–J). There are important gold-fields in the neighborhood. Pop. (1891) 8,449. M. W. H.

**Gyöngyös**, dyön-dyösh′: a well-built and beautifully situated town of Central Hungary; 44 miles N. E. of Budapest (see map of Austria-Hungary, ref. 6–H). It has mineral baths and a considerable trade in corn, fruit, wine, cattle, and horses. Pop. 15,896.

**Gypsies** [earlier *Gypsen*, *Gypcyan*, viâ Fr. from Lat. *ægyptius*, Egyptian]: a widely distributed and peculiar race of vagabond people. It was long assumed that the gypsies first appeared in Europe at Lüneburg, Hamburg, etc., in 1417, and that this must have been shortly after their migration from their fatherland, India; but more recent research indicates that numbers of them had been living as serfs and nomads in the Greek-speaking countries of Southeast Europe in all probability as early as the eleventh century. In 1417, however, they suddenly appeared in Germany in hordes amounting to perhaps 1,400 persons, which, twenty-one years later, swelled to thousands. The contemporary chronicler Korner describes how the "strange multitude of Oriental vagabonds came into Germany. . . . They went afoot, camped by night afield, being thieves, and fearing arrest in cities. They were about 300 in number, ugly, black as Tartars, and called themselves *Secani*. They had leaders, a duke and count, whose judgments they obeyed. They were great thieves, especially the women; many of them were in many places arrested and slain. They bore letters of commendation from the Emperor Sigismund, through which they were admitted to cities, princes, castles, towns, bishops, and prelates, by whom they were kindly treated. Some of them rode." Another contemporary writer shrewdly observes that those who rode changed their horses very frequently. "They said that the cause of their wanderings and pilgrimage was a penance for having relapsed to paganism after being converted to Christianity, and this penance of wandering had been enjoined on them by their bishops for seven years." Another writer says they appeared as "baptized heathens" in Switzerland, at Basel, Zurich, and other places. They appear to have been the same party seen at Hamburg with the duke and count, "who wore silver girdles and rode," bearing the imperial letter. In 1422 they appeared in Bologna, headed by a "duke of Egypt," named Duke Andrew. Inspired by the success of the letter from the Emperor Sigismund in Germany, they added to the old story of their being renegades and penitents by declaring that Hungary was their original country, the king of which, having conquered them in battle, had sent them on a seven years' penitential pilgrimage, and had granted them a decree, which they showed, "authorizing them to rob and steal without being amenable to justice." They remained in Bologna fifteen days, stealing freely. It would appear that faith and respect attached to their "license," since the authorities did not arrest them, but decreed that any one whom they had robbed might steal to an equal amount from them; and the Bolognese availed themselves of this to such an extent that the gypsies were glad to pass on to Rome. They were *la più brutta genia*—"the most beastly people ever seen in those parts. Black and lean, they ate like pigs. The women went in chemises."

*Name and Origin.*—The gypsies in different lands have received a great variety of names. Several of these refer to their supposed Egyptian origin, as *gypsy* itself, the Spanish *gitano*, the Modern Greek *gyphtos*, etc. Then we have the French *bohémien*, the Scandinavian *tatar*, and, above all, a multitude of such forms as the Turkish *tchinghiané*, the Italian *zingaro*, the Magyar *cigány*, and the German *Zigeuner*. An immense amount of learning and research has been devoted to the origin of this last name. But as it is given among the gypsies of Persia to a large class among themselves, the saddle-makers, or Zingari, which has given its name in turn to the Zinganeh, a Kurd tribe, supposed to be of gypsy origin, this is possibly the true root. Among themselves they never say gypsy, but always *Rommany*. There exist in India several kinds of wandering pariahs or outcasts, which are identical in all respects with gypsies, the latter, however, uniting in one the peculiarities which in India attach to different bodies. Prominent among them are the Doms, whose name, it is probable, is identical with that of *Rom*, by which gypsies distinguish themselves all the world over. The Hindu *d* generally changes to *r* in the Rommany or gypsy language—e. g. *doi*, a spoon, into *roi*; and as the words Dom, Domni, and Domnipana mean in Hindu, a Dom, a female Dom, and "the being a Dom," so

Rom, Romni, and Romnipen have precisely the same signification, and in common use as applied to a gypsy, his wife, and gypsydom. The antiquity of the Doms is indisputable, as they are mentioned in the Shasters, where they are called Sopuckh or "dog-eaters." In India they roam about, living in tents, eat swine which have died a natural death, carry out corpses, etc., and flay animals; all of which are habits or pursuits peculiar to gypsies, or were so when they first appeared in Europe. The Doms of India, like gypsies, make baskets and mats, which they sell while roaming about. Their women sing, play on musical instruments, and frequent weddings, as did the gypsy women of Italy and Spain. Unlike all other Hindus, the Doms are madly addicted to intoxication, being "so fond of drinking that they spend nearly the whole of their earnings on spirits." Even in Germany the excessive fondness of gypsies for spirits was observed in early times. The name Dom probably was the first type of that of Rom, but other causes may have helped to form it. In Hindu, as well as English, a similar word signifies roaming. Many gypsies passed through Egypt on their way westward, and in Coptic—which was more generally spoken in the eleventh century than at present—*Romi* means, as in gypsy, a man; and it is also probable that from their long sojourn in Roumania and among Greeks, who are generally called Rūmi in the East, being confounded at an early period with *Romans*, they spoke of themselves as Romani when they first appeared in Hungary. There is, however, in India another body of outcasts which probably contributed largely to the gypsies, but at a *later* period, the first immigrants having been Doms. These are the Nāts, whom all European residents in India call simply gypsies, from their similarity. The Nāts "are noted thieves, wander about, are addicted to conjuring, legerdemain, and theatrical pursuits." Probably there is not one theater or circus in Great Britain or the U. S. in which there is not at least one performer of more or less mixed gypsy blood. The Nāts tell fortunes by chiromancy, and live, like English gypsies, in tents of dark blanket-stuff. Many of the men are skillful blacksmiths. Their women sell love-potions and charms against the evil eye, just as in Europe. The personal appearance of these tribes is peculiar, and so similar to that of gypsies that any one who is familiar with the one can not fail to recognize the other. This is especially seen in a very singular and characteristic glitter of the eye, and an expression not to be seen in any other kind of Easterns, excepting perhaps Persians, who often resemble gypsies. Like North American Indians, the gypsies all walk with the feet straight; so that, as a gypsy once informed the writer, he could tell the track of one of his own people among a hundred *gorgios* (or non-gypsies). There are in India two or three other roaming castes which have strongly marked gypsy traits. The use of a secret language among most of these wanderers, and especially by the Nāts, also identifies them with gypsies. Nothing is as yet known which explains the fact why at one period there was apparently a vast and sudden migration of them from India. The pariahs or outcasts of that country have in their ranks many men of genius, and it is to the writings of members of the Purraichchameiyan and Valluran sects of pariahs and similar heresies that India owes its best literature in a literal sense. It is probable that the first leaders of the gypsies into Europe, who are described as men of rank and knowledge, were of this class, and that owing to the free thought which sprang from Bûddhism the ranks of the intellectual pariahs were at one time largely augmented, the result being an effort to deliver themselves by emigration from the extreme tyranny to which they were subjected. The only history of their early migration is contained in their language.

*Language.*—This is called the Rommany or gypsy language. Though the first conjecture ever made by a scholar in Europe as to the origin of the gypsy tongue declared it to be Indian, and though specimens of it were printed by Andrew Boorde (1547) and Vulcanius (1589), the world at large, and even Ben Jonson, Sir Walter Scott, Lord Lytton, etc., believed that this language was only a jargon or cant, and under this impression more than one work has been published as a gypsy vocabulary which contained no gypsy words whatever. It is, however, a curious fact that in every country the gypsies have carefully excluded the current slang words from their own tongue, and when they find that a Rommany word has become known beyond themselves they discontinue its use. Thus the writer has heard gypsies say that a certain word has gone out of use or is going out, because the tramps have got hold of it or because it has become "canting." Yet, as their object is to have a secret language, they have not scrupled when migrating from one country to another to use many of the words which belonged to the language of their last home, since these answered every purpose and replaced those which had been eliminated because they were becoming known. These facts should be borne in mind as necessary to the understanding of the gradual formation of this curious tongue in its dialects, for it is by these additions to the original "new Indian" language, whatever it was, which the first gypsies spoke when they came to Europe, that their wanderings have been accurately traced by Miklosich. Great interest has been taken in the Rommany language, as gypsies themselves call their tongue, owing (1) to the extraordinary number of curious words, both ancient and modern, from different languages, which abound in it; (2) because it is possible that even if it be in the main a new Indian tongue formed with Urdu, its germ may still have existed originally as an obscure but very ancient Aryan language; (3) because, while the origin of every word in Rommany is known, and with it the grammar of the languages from which it comes, that of the Rommany grammar itself is as yet a mystery, nor is it ascertained whether it was formed in India previous to the great migration between the tenth and thirteenth centuries, or during the early travels of the race. And though there is one Indian element common to Rommany wherever spoken, and many words the same in all its dialects—e. g. *churi*, "a knife"—yet much may be found in one country that is not known to gypsies in others. The universal dissemination of Rommany, the great unwillingness of all who speak it to have it made known, and finally the number of words which it has contributed to English slang, are also causes which invest it with interest. Little was known regarding it until J. C. C. Rüdiger (*Neuester Zuwachs der Sprachkunde*, Halle, 1782) announced that the gypsy language, apart from its Slavonic and German additions, consisted of Hindu words. In 1783 H. M. G. Grellmann cleverly availed himself of his predecessor's labors, and published a work from which the public for many years inferred that he was the first to discover the Indian origin of Rommany. It has not yet, however, been pointed out by any writer through what media of more recent Indian tongues the Sanskrit words have passed, nor have any philologists shown to what degree the Slavonic and Greek words in Rommany are really Indian, but simply Slavonized or Græcized. This process is continually going on in Rommany.

There are fourteen principal dialects of the European tribes—Turkish, Roumanian, Hungarian, Moravo-Bohemian, German, Polo-Lithuanian, Russian, Finnish, Scandinavian, Anglo-Scottish, Welsh, Italian, Basque, and Spanish. But several of these are so corrupt that those speaking them would not comprehend the others, although a great number of isolated words are common to them. With little effort or practice Turkish, Hungarian, and Welsh gypsies could talk together, and the few Rommanies in England who have still preserved the grammar of their tongue could join them in mutual intelligence. But the majority of English gypsies, with all the Spanish and their Scandinavian and Egyptian brothers, would find themselves no nearer than a Spaniard and an Italian. It is impossible to assume with certainty any dialect as the type, but the Turkish, as set forth by Dr. Paspati, may be taken for a basis, since its grammar is the most perfect known. Its main features are as follows: The articles are *o* (masculine) and *i* (feminine), as *o rakló*, "the boy," *i rakli*, "the girl." *Nouns.*—These are masculine or feminine. Abstract nouns are formed in Hindu by the termination *pan*, like the English "-ship" or "-hood." In English Rommany this termination is still *pen* or *ben*; in Turkey it is *pé* or *be*. Thus *kushto*, "good," becomes *kushtopen* or *kushtopé*. In English Rommany, and to a certain extent in other dialects, an active agent or person doing anything is ingeniously expressed by the termination *engro*. Thus from *giv*, "wheat," we have *givengro*, "a farmer"; *saster*, "iron," *sastengro*, "a smith," corresponding to the generally applied *walla* of India. The origin of *engro* is to be found in the *koro*, genitive termination of all nouns, which is itself derived from the verb *ker-ava* (Sansk. *kâra*, m. rad. *kri*, *faciens*, factor). This is so general that it may be said that almost every adjective and active verb yields an agent. English gypsies make nouns by changing *engro* to *engrī* (a thing), thus *mui*, "a face," becomes *muiengrī*, "a pillow" (lit., a face-thing, also a portrait); *wast*, "a hand," *wast-engrī*, "a hand-cuff."

The regular declension is

*Raklό* = "a boy."

| | *Singular.* | | *Plural.* |
|---|---|---|---|
| Nom. | o *rakló*, | the boy, | o *raklé*. |
| Gen. | *e rakléskoro*, | of the boy, | *e rakléngoro*. |
| Acc. | *e raklés*, | the boy, | *e raklén*. |
| 1st Dative, | *e rakléste*, | to the boy, | *e raklénde*. |
| 2d Dative, | *e rakléske*, | in the boy, | *e raklénghe*. |
| Instr. | *e raklésa*, | with the boy, | *e rakléndja*. |
| Ablat. | *e raklestar*, | from a boy, | *e rakléndar*. |
| Voc. | *rakleya*, | O boy! | *raklale!* |

Nouns ending in *i* take *a* after it and before the inflection, as *raklí*, "a girl," *rakliákoro*, *raklia*, *rakliáte*, *rakliáke*, *rakliása*, *rakliatar*, and *raktie*. Feminine nouns ending in consonants are declined similarly: *len*, "a river," gen. *leniákoro*. *Eskoro* is commonly used to form adjectives; in England it is used like *engro*; e. g. *wardo*, "a wheel," *wardomescro*, a "wheelwright" or "cooper." These cases are not all *pure* inflections; several are formed with *postpositions* (as occurs in the Ural-Altaic groups and in Dakota). Thus the Rommany instrumental is formed by adding the Sanskrit *saha*, "with" or "together." The ablative sing. term. *ato* (*tar*) is the Sanskrit particle *tas*. "The gypsy noun has properly only four cases." (*Paspati.*) In English Rommany the plural and sing. *ia* has been corrupted into *yor*, sometimes into *yas*, as *lav*, a "word," which should be *lavya*, becomes *lavyor* or *lavyas*. Nouns ending in *o* are generally masculine—those in *i*, feminine. Adjectives are formed in *o* (masc.) or *i* (fem.). *O* is kept in the nom.; it becomes *e* in the other cases, as *kálo manush* (Eng. Rom. *kālo mūsh*) "a black man"; gen. *kalé manusheskoro*, "of a black man"; plural adj. termination for all cases, *e*. Many adjectives applicable to living beings end in *no* or *ni*, more in *lo*; e. g. *bākht*, "luck," *bakhtalo*, "lucky." From many verbal adjectives in Rommany lost verbs have been recovered. Whether these indicate an ancient Rommany language, or some early tongue merged in it, no one can say, but it is very certain that there is no language so very simple, and yet so rich—so capable of expressing thought, and yet so easy to learn. The comparative degree is formed in Turkey by adding *po* ("more"), as *lachó*, "good," *polachó*, "better." Also by *der*, as *baro*, "great," *baroder*, "greater." In England it is formed by *dir* or *diro*; e. g. *bāro*, "great," *bordir* or *borodiro*, "greater." No true superlative exists. Pronouns are formed in the singular like nouns plural; e. g. *me*, "I," *mangoro*, *man*, *mánde*, *mánghe*, *mándja*, *mandar*; plural, *amén*, ("we"), *améngoro*, *amén*, *aménde*, *aménghe*, *améndja*, *améndar*. *Tu* ("thou") is formed thus: *Tu* (gen. wanting), *tut*, *túte*, *túke*, *túsa*, *tutar*; plural, *tumen*, *tumengoro*, *tumen*, *tumende*, *tumenghe*, *tumendja*, *tumendar*. In England *tu* and *tute* are generally used for "you" in all cases, as "you" is used in English; *tukey*, "to you," rarely. *Ov* ("he," Eng., and Germ. *yov* or *yuv*) becomes *leskoro*, *les*, *leste*, *leske*, *tesa*, *testar*; fem. *oi*, *ai* (Eng. *yoi*), *lakoro*, *la*, *láte*, *láke*, *lása*, *latar*. *Ol* ("they," Eng. Rom. *yúl*), *tengoro*, *len*, *lende*, *lenghe*, *lendja*, *lendar*. All of these inflections are commonly known in England, but are greatly confused and corrupted. *Mo*, "my," simply becomes *me* in all other cases, and *me* in the plural; also *minro* ("mine"), *tinro* ("thine"). *Amaro*, "our," is in Eng. *moro*. *Tumaro*, "your," is unchanged. Hindu *pes* is the reflective pronoun "self," taking in Germany the form *peskro*, also very rarely in England, where the common form is *kokero* (i. e. "alone"). *Lester kokero*, "his self." In Turkey, *po* and *pi*, plural *po*, are the common possessive pronouns; e. g. *po drom*, "his road," evidently from the Hindu. *Aka* and *avaka* ("this" and "that") exist in English Rommany as *akovo*, *'covo*, and *kavakoi*; e. g. *'covo*, "that man," (slang, *cove*, *covey*). The Turkish *odova*, "this" or "that," is in English *odova* or *dovo*, "that." *Verbs.*—All simple verbs are of Indian origin; their conjugation is as follows:

| *Indicative.* | | *Imperfect.* | *1st Aorist.* |
|---|---|---|---|
| *Me avava*, | I come. | *Me avávas*, | *Avilom*. |
| *Tu avesa*, | Thou comest, | *Tu avésas*, | *Avilan*. |
| *Ov avella*, | He comes, | *Ov avélas*, | *Avilas*. |
| *Amen avása*, | We come, | *Amen avasas*, | *Avilomas*. |
| *Tumen avéna*, | Ye come, | *Tumen avenas*, | *Avilonas*. |
| *Ol avena*, | They come, | *Ol avenas*, | *Avilas*. |

All participles in Turkish Rommany end in *to* or *do*, *lo*, *no*. We can trace in Rommany verbs a class formed with an Indian root and the auxiliaries *isam*, "to be," or *uvava*, "to become," the former of which is conjugated:

| | | | |
|---|---|---|---|
| *Me isam*, | I am. | *Me isamas*, | I was. |
| *Tu isan*, | thou art. | *Tu isanas*, | thou wert. |
| *Ov isi*, | he is. | *Ov isas*, | he was. |
| *Amen isám*, | we are. | *Amén isámas*, | we were. |
| *Tumen isan*, | ye are. | *Tumén isánas*, | ye were. |
| *Ol isi*, | they are. | *Ol isas*, | they were. |

In Sanskrit *asmi*, *asi*, *asti*, plural *sma*, *stka*, *santi*. It is remarkable that in England gypsies use commonly several Oriental forms of the verb not known in Germany. Thus the English Rommany verb runs *me shom*, "I am," *tu shan*, "thou art," *yuv se*, "he is," *men shom*, *tute shan*, *yul see*. In fact, the verb is nearly the same with the Turkish, while in Germany it is *hom*, *hal*, *hi*, *ham*, *ham*, *shi*.

There is as yet wanting a grammar which shall reduce Rommany to its original simple elements. Pott, Ascoli, and Miklósich have collected the material and cleared it, but no one has distinctly set forth in paradigms this curious tongue, which with the simplest elements is capable of as much expression as English. Even in its present popular and corrupt form, English Rommany is only unmusical where the English grammar intrudes, as may be seen in the following verses by Miss Janet Tuckey, who was the first to write *poetry* in this dialect:

I tāni mūllos 'pré ó dóeyav
Shān sār i sāni chūmor fon o báv;
O lūllopen apré i pābor chám
Li se i tátti chūmor ó the kám;
Te dóvo rinkeni hév pré tíri mūi,
Sbán mīri chūmor, o mi kāmeli.

The little bubbles floating on the wave
Are all soft kisses which the west wind gave;
The luscious glow upon the peach's face
Bears blushing witness to the sun's embrace;
And those two dimples, sweet, that come and go,
Tell tales of true-love kisses: is it so?

No writers have as yet sufficiently indicated the influence of Persian dialects on the Rommany. A few words, with their origin, drawn from English gypsy and taken down by the writer in gypsy tents, are as follows: *Sakkū*, "a swan," Persian and Arabic, *sakka*; *purser*, "to ask," P. *pursidan*; *pusht*, "the back" (also *dūmo*), P. *pusht*; *pish*, "before," P. *pish*; *shock*, "a bough," P. *shakht*; *rushni*, "bright," P. *rūshán*; *bunner*, "to build," "shape," etc., the foundation of a house, P. *bunyad*; *sikar*, "a clothes-line," Hind. *sikhar*; *sig-tud*, "milk-weed," H. *sij*; *sim*, also *rupp*, "silver," both the same in Hindu; "*Yeck simmery covva se yeck ruppeny covva*," i. e. "a silver thing *is* a silver thing"; *bero*, "a ship," H. *buhr*; *sīrni*, "sacred," "magical," H. *sīhr*. The transposition of Oriental words through a Slavonic medium may be seen in *sivety*, "people" (as in French *te monde*), which the gypsies are supposed to have picked up in Slavonic, as *sweti*, "the world," but which they probably had originally as *saraswati* in Hindu. All Rommany dialects are extremely corrupt, and even in Turkey it has been almost impossible to determine their grammar, simple as it is. The English gypsy generally uses *tute* for *you* in all cases, and will say *mandy avella* for *me avava* ("I come"), and *yoi weltas* for *yoi avilas*. In Germany the language is spoken with very little admixture of non-Rommany words, and with a great exercise of ingenuity English gypsies often achieve the same feat. To do this one word must do duty for many. Thus *chiv* means to "put," "place," "throw," "lay," and in fact almost any positive *action*; while *hatch* expresses "stand," "rest," "encamp," and *kér* "make," "do," "cook," "cause." Most words for the different kinds of trees, animals, minerals, fish, and insects are wanting in Rommany, showing that they have recently come from a land where nature is different; and in many cases they have applied the name of a similar animal, etc.; e. g. *sakku*, "a swan" (E. R.), is the P. Arabic *sakká*, "a pelican." No language in the world is so easy to acquire as Rommany; most persons can learn it in three months, and when learned it is of incredible assistance in acquiring Hindustani and Persian. In fact, a proficient in Rommany can within a month make himself readily intelligible in Hindustani. In pronunciation Rommany resembles the soft Latin tongues; e. g. *kūshto* or *cōōshto*, "good"; *mās* or *mawhs*, "meat"; *tūte* or *tooty*, "thy"; *me kamāva*, "I love." The English Rommany pronounce *sīg*, with *i* as *ee*, and the *g* very soft (between the German *ch* and *g*, inclining to the latter strongly accented). It is not impossible that the thousands of Rommanies of every kind reuniting in the U. S. may in time originate an American Rommany dialect, which, of course, would be very much like the English Rommany, though with local shades.

*English and Scottish Gypsies.*—Their dialect contains Greek, Slavonian, Magyar, and German words. To these Miklosich adds French, but the ten "French" words given by five different writers are not all French, and the rest are either not gypsy or are doubtful. The fact that an immense number of Indian and Persian words not as yet found on the Continent are used by English gypsies goes far

to prove that the English branch are of a separate migration; which seems the more likely from the fact that many of these so-called Greek, etc., words are also of Indian origin. The first gypsies slipped over into Britain very quietly, reaching England by 1514 and Scotland by 1505 (or possibly fifty-six years earlier). In 1522 they were described as an outlandish people calling themselves Egyptians, exercising no craft but palmistry and robbery, etc. In 1549 they were included in a search made through Sussex for all "vagabonds, gypsies, conspirators, prophesiers, players, and such like." From some cause it would appear that gypsies during the reign of Henry VIII. were imported into England. A fine of £40—a large sum for those days—was imposed in consequence on every gypsy entering England; and at one time a great number were reshipped to the Continent. Yet in 1562 there were fully 10,000 of them in England. At this time they taught their language freely to recruits. Acts for their suppression being useless, it was made felony without benefit of clergy for any person above fourteen years of age to keep company with them; and Judge Hale remarks that at one assize a few years before the Restoration thirteen gypsies were executed—i. e. simply for being gypsies. It should be remembered that the outrages and evils committed by them were incredible. The *Rommany* is still the life of the entire vagabond population of the roads in England, it being almost impossible to find a tinker or petty hawker who is not part gypsy. There are but a few hundred full-blooded *tent*-gypsy persons in England, but of *kairengroes*, or house-dwellers, who keep their gypsy blood a secret, and of half-breeds (*churedi* or *posh an posh*), or of those affiliated by blood—all of whom possess the great secret of the Rommany language to a greater or less degree—there are perhaps 20,000. As the tinkers in England are all gypsies, and as they were probably the same in the time of Shakspeare, since he speaks of "their own language," it is thought by some that John Bunyan was of gypsy origin, for his father was a tinker, he himself speaks of being of the most despised *race* in the land, and James Bownian was in 1586 the name borne by "an Egiptian rogue" in Cornwall. The old class of gypsies in England occasionally speak Rommany very purely, and mourn for the dead, as in Germany, by abstaining from some peculiar food for years, or from some pursuit or pleasure. They also refrain from mentioning the name of the dead, and otherwise manifest great respect for them. Gypsydom in England received its first blow at the period of the American Revolution, when great numbers were forced into the fleets and armies serving in North America. Most of these deserted, finding America a congenial home. Another great blow to English gypsyism was the railways, and later the Inclosure Act, which by inclosing all commons and wastelands deprived them of places to camp. In an outskirt of London called the Potteries about 1,000 live in small houses, especially during the winter. The gypsies are by no means so dishonest as is generally supposed, though, like all childish, ignorant, and very poor people, they yield to temptation. When implicitly trusted they are very honorable, and are grateful for kindness. They are all strong of body, are good rough riders, and box well. They are very quarrelsome, continually fighting, and even murdering, among themselves, but very seldom trouble *gorgios*. When one is arrested for crime, his friends make incredible efforts to obtain his release. They burn the clothes of their dead, and sometimes other valuables. Their favorite food is the hedgehog, stewed or roasted. It should be known that gypsies among themselves ridicule fortune-telling as being mere *hockerben* or lying, as the writer has learned from frequent conversations with them on the subject.

In Scotland the gypsies multiplied prodigiously, and married well among the natives, their thieving habits, as Simson (himself a Scotchman) asserts, proving no bar to such connections, "as the Scottish people were accustomed to thieving of all kinds." Severe laws were, however, passed against them in 1541 and subsequent years; and nearly a hundred gypsies, men and women, were hanged or drowned in Scotland between 1577 and 1701 "for being Egyptians." They remained, however, in great numbers; and it was only after the persecution ceased that they rapidly diminished. Until a very recent period the Scottish gypsies were generally robbers and villains of the worst kind, availing themselves of the popular weakness for romance and boldness to outrage law, as they appear, according to Simson, to have always been popular. The border village of Kirk-Yetholm, near Kelso, was once peopled by them, in consequence of a gypsy, by his bravery at the siege of Namur, having obtained a grant authorizing his descendants to dwell there. Very few remain in it, great numbers of the Scotch gypsies having gone to the U. S., where they generally became at once house-dwellers, and are lost to view. At one time English gypsies buried their dead in remote places, but at present they are careful to secure Christian burial. Their ordinary weddings generally consist of nothing but an announcement and a feast, but the better class obtain the aid of a clergyman. They have several Hindu superstitions not known to the English, such as the evil eye and a belief that the blind worm sees for half the year out of his right eye, and half with his left. Like the Hindus, they send cooked food for three days to the family of a deceased person, and call it by nearly the same words (*kair hābben*; Hindu, *karwá khana*). Their children are very beautiful, and the old people are distinguished by a peculiarity which is also observed among their ancestors, the Doms of India. Their hair seldom turns gray, even in advanced age, unless there be "white" blood in their veins. During the summer the gypsies frequent races, where they set up cocoanuts or toys to be thrown at at a halfpenny a throw, while their women beg and tell fortunes. They also frequent fairs, where they sell horses and haunt picnics with their games or music. In the autumn, during a period of three days, hundreds of them may be seen in London crowding one or two favorite shops, and buying baskets, brooms, clothes-lines, etc.; after which they wander all over England selling them. As winter advances the men begin to manufacture clothes-pins and butchers' skewers, by which they earn two shillings a day. Chair-mending with split rattan is in England exclusively followed by quarter-blood gypsies or those more remotely allied to them. This class speak very little Rommany. In England gypsies are industrious; the women, however, earn more than the men. On the whole, they earn twice as much as farm-laborers, and lead much happier lives. They are very fond of tea and beer, and always live well. The men greatly prize a coat or other garment from a gentlemen, particularly from a patron, far above its value. There are nearly 100 English gypsy family-names, most of which are represented in the U. S.

It has been asserted that there are no gypsies in the U. S., but in fact they are found in great numbers. Simson met with French, Hungarian, German, and English gypsies in the U. S., and speaks of a village in Pennsylvania and of one in New England originally established by gypsies, in which Rommany is still secretly spoken. Many peddlers in the U. S. are gypsies, and many of the smaller tin, crockery, and basket stores in New York are kept by half or quarter blood gypsies. The tinware they sell is of a plain, coarse kind, so that a gypsy tin-store is easily known. A very large proportion of the itinerant cutlers and tinkers in cities of the U. S. are German, Hungarian, or French gypsies. Hungarian gypsies are sometimes to be found in negro-minstrel and other bands. There are a number of gypsy musicians in Baltimore. Many of the fortune-telling women in cities are half-blood gypsies. Many tent-gypsies roam from Canada to Texas. They are, like all gypsies, very reticent as to their language. Yet very few among the wanderers possess a large vocabulary or speak Rommany well.

Bibliography.—Of more than 300 works upon the gypsies may be mentioned those in German by Grellmann (1783; Eng. trans. 1787); Pott (2 vols., 1844–45); Liebich (1863); Ascoli (1865); and Miklosich (12 parts, 1872–80); in French by Paspati (on the Turkish gypsies, 1870); and Bataillard, whose numerous writings, published between 1844 and 1890, are mainly historical, and ascribe to the gypsies a prehistoric origin; and in Italian by Colocci (1889)—this last with a full bibliography. In English, besides five well-known works by George Borrow (1840–74), and four by the present writer (1873–91), there are works by Richard Bright (1818); Simson (1865); Smart and Crofton (1875); Groome (1880); and MacRitchie (1886); to which should be added the invaluable *Journal of the Gypsy Lore Society* (3 vols., Edinburgh, 1888–92), whose work was taken up in 1893 by Prof. Hermann's *Ethnologische Mittheilungen* (Budapest).

Revised by F. H. Groome.

**Gyp'sum** [= Lat. *gyp'sum*, from Gr. *γύψος*, chalk, gypsum]: a mineral, the natural bihydrated calcium sulphate, $CaSO_4 + 2H_2O$, crystallizing in the monoclinic system. The translucent crystalline varieties are known as selenite (from selene, the "moon," in allusion to the characteristic soft luster); the ordinary massive forms and opaque crystals as

gypsum; the finer granular sub-translucent massive kinds, as alabaster, and fibrous varieties, as satin-spar. In hardness gypsum varies from 1·5 to 2·0, and the specific gravity of pure crystals is from 2·314 to 2·328. Heated, this mineral gives off its contained water, and becoming opaque falls to a powder, which has the power, if moistened, of rapidly "setting" or assuming again the solid form. Upon this property depends the most extensive application of this mineral in the arts, as plaster-of-Paris is made from it by heating and subsequently grinding it to a fine powder. It is also used as a fertilizer and in the manufacture of glass and porcelain. Alabaster, being of great beauty and easily carved on account of its softness, is extensively used for ornamental purposes. Extensive deposits of gypsum are worked in England, France, and other countries of Europe, and also in the U. S. and Nova Scotia. The latter occur in the Palæozoic series of rocks, but this mineral occurs most abundantly in the Mesozoic or Secondary formations, especially in association with deposits of rock-salt. Gypsum is also found generally in volcanic regions. In the U. S. gypsum is obtained from a great number of localities, more or less extensive beds having been met with in Virginia, Tennessee, Michigan, etc., and in imitative forms of scrolls, vines, flowers, shrubbery, etc., it constitutes one of the wonders of the Mammoth Cave, Kentucky. Perhaps the most celebrated gypsum-beds are those of Montmartre, near Paris, which have given rise to the name "plaster-of-Paris," and which are rich in the remains of Tertiary mammals.

**Gypsy Moth**: See the Appendix.

**Gyrenceph'ala** [Mod. Lat. *gy'rus*, gyre, convolution (from Gr. γῦρος, ring, circle) + Gr. ἐγκέφαλος, brain]: those mammals in which the superficies of the cerebrum is folded into gyri or convolutions (as implied by the name), and the cerebrum itself extends over more or less of the cerebellum, and generally over the olfactory lobes; they were considered by Owen as a "sub-class," and in the group were included the quadrumanous Primates, Carnivores, Ungulates, Proboscidians, Toxodonts, Sirenians, and Cetaceans. Man was excluded, through a peculiar interpretation of certain characters, as the sole representative of a corresponding group called *Archencephala*. This sub-class has not received the approbation of original investigators, although it has found considerable currency in popular and semi-popular works. The *Gyrencephala* and *Archencephala* had been combined long previously in a group named (by Bonaparte) Educabilia, for more valid reasons.

**Gyrfalcon**: See Gerfalcon.

**Gyro-pigeon**: See Pigeon, Gyro.

**Gy'roscope** [= Fr.; Gr. γῦρος, circle + σκοπεῖν, to view]: an instrument designed by Bohnenberger, and made famous by Foucault's use of it to show oeularly the rotation of the earth. The Bohnenberger machine (Fig. 1) was first described in the *Tübingen Blätter für Naturwissenschaft*, etc., 1817, and also in Gilbert's *Annalen*, vol. lx., p. 60, and is the prototype of gyroscopic instruments. Designed, probably, to illustrate the precession of the equinoxes, and consisting merely of a spherical or spheroidal body so balanced in gimbals that its axis is free to take any direction, it is well fitted to illustrate —first, the *stability of direction* of the axis of rotation of a solid of revolution possessing high rotary velocity, which may be done by placing the instrument on the revolving disk of a centrifugal machine, when the axis of the rotating sphere will continue nearly invariable in direction; second, *precessional motion*. This is accomplished by attaching the small weight G to the inner ring J near one of the extremities of the axis of the rotating spheroid, which causes a slow horizontal gyration.

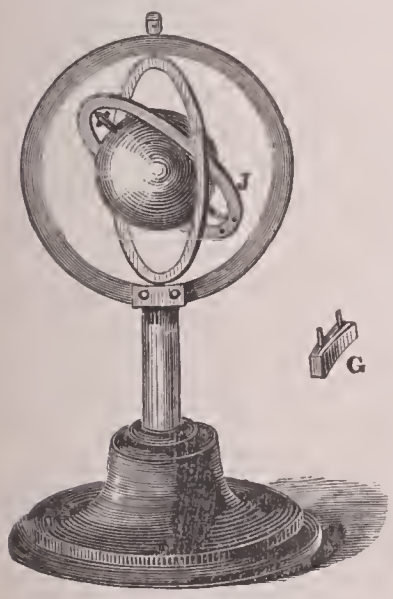


Fig. 1.—Bohnenberger machine.

The gyroscope in its common form is shown in Fig. 2. The circular disk A of the instrument having been put in motion with very great velocity, the bearing-point C of the ring in which the disk and axis are mounted is placed on the point of an upright support, B. Not only does the rotating disk (with its ring) *not* fall, as would happen were there no rotation, but, preserving the angular elevation of

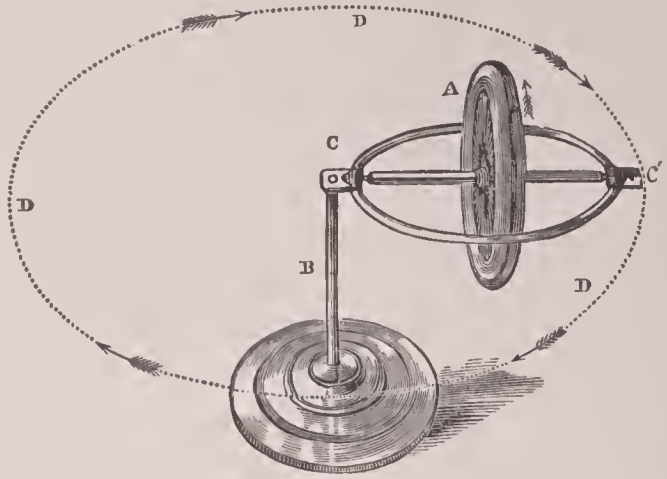


Fig. 2.—Gyroscope.

its axis, it takes up a slow horizontal motion (gyration) in the reverse direction to that in which, by rotating, the upper periphery of the disk is moving—e. g. the disk in the figure revolves as marked by the arrow near its top; its *gyration* is as the arrows along the indicated horizontal circle D. If the direction of disk-rotation be reversed, so will be that of the gyration. It will be found also that the *rate of gyration* is the same for all elevations of the axle, and that the greater the rotating velocity of A the *slower* will be the gyration—that as rotatory velocity is lost, the *gyratory* velocity increases simultaneously, with a gradual drooping of the outer extremity of the axis, which, with continually accelerated gyratory velocity, falls in a descending spiral (or helix). When the wheel, rotating with great velocity, is placed on the point of support with axis considerably elevated, the axis, instead of falling (as it gyrates), will *rise*.

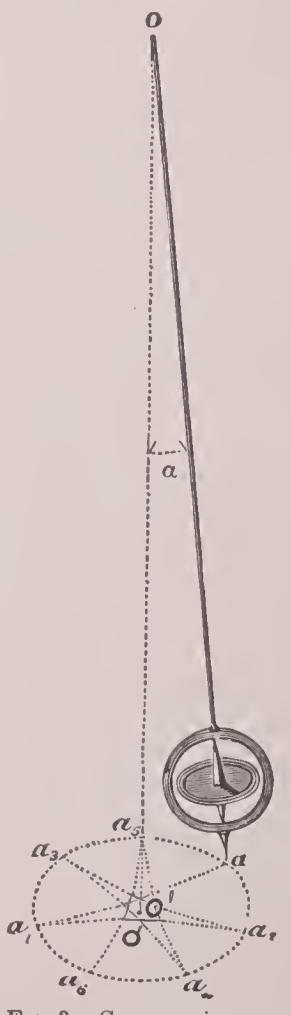


Fig. 3.—Gyroscopic pendulum.

The Gyroscopic Pendulum (Fig. 3) consists of a freely suspended rotating gyroscope. If the pendulum starts from a position of rest at *a*, and O O′ is a vertical dropped from the point of suspension, the foot of the pendulum will not swing through O′, but, passing near it, be deviated in a curve, *a* $a_1$, convex toward O′, till it attains a departure at *a* equal to the initial angle α, where, coming to rest, it begins (making a *cusp* at $a_1$) another swing at $a_2$; and so on. If propelled from a state of rest *in* O′, the curves of vibration will all pass *through* the center O′, and the extremities $a_1$, $a_2$, $a_3$, etc., will be loops instead of cusps. The special analysis of the motion is identically the same as that of the "freely suspended pendulum," which reveals by the progressive azimuthal displacement of its plane of vibration the rotation of the earth, though in the case in hand this azimuthal motion is far more rapid. See *Smithsonian Contributions*, vol. xix., *Problems of Rotary Motion*.

The Top (which is called by Sir John Herschel in his *Treatise on Astronomy* a "philosophical instrument") is but a gyroscope of which a point of its rotary axis rests not on a fixed point, but on a horizontal plane. The theory is analogous. As in the gyroscope, a *deflecting force* is generated by any angular motion of the axis of the rotating top; and it is this force which supports it. Did the axles of the top terminate in a mathematical point, and were the horizontal surface on which it spins a true plane, and *perfectly* hard and smooth, the center of gravity of the top would be ever in the same vertical line, and its point would *gyrate*, describ-

ing on the surface an epicycloid. It will be found that the more perfectly pointed the top is, and the harder and smoother the surface, the less will be the tendency to *rise*. This rising is due to the (more or less) *rounded* point rolling on the surface, and thus increasing the angular motion of the axle, by which the upward *deflecting force* is made greater than the downward force of gravity, and the top gradually rises to a motionless spinning in a vertical position.

Another form of the gyroscope (Fig. 4) is the apparatus introduced by Fessel (*Pogg. Ann.*, vol. xc., pp. 175 and 351).

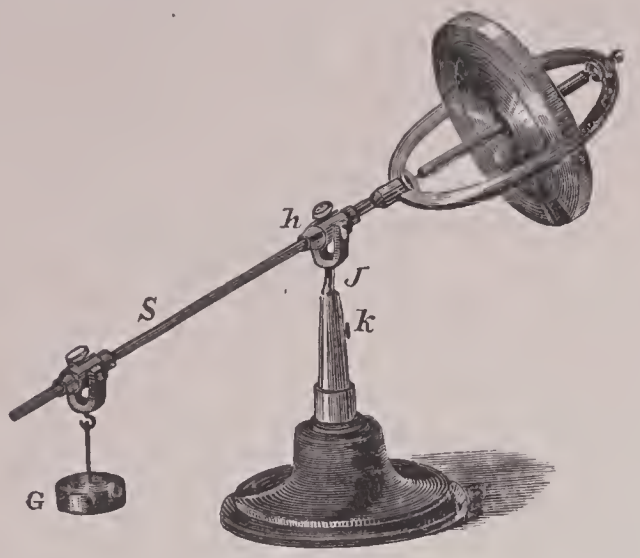



FIG. 4.

The prolonged stem S and the movable counterweight G serve only to vary the experiments. If the counterweight is placed so near the fulcrum that the weight of the disk and ring preponderates, gyration will ensue, as in the case of Fig. 2, but slower, since the weight of the latter is partly counterbalanced. If the weight is so far removed as to preponderate, gyration in the reverse direction will ensue, since, through the preponderating counterweight, gravity tends to *lift* (instead of to pull down) the rotating disk. If the weight be placed so as exactly to balance the disk and ring, no gyration will be observed. The weight and a portion of the prolonged stem S can be removed, and then we have *essentially* the gyroscope of Fig. 2; with this difference, however, that instead of a mere pointed end to the standard B, there is introduced the fork J (Fig. 4), the vertical stem of which turns freely in the standard, while the prongs hold the trunnions of the band or socket *h* through which the stem S is introduced and clamped. By this arrangement free angular motion is permitted, while at the same time the disk and ring are always firmly connected with the standard, and can not fly off, as they often do from the common gyroscope. The machine illustrates another property, which has been announced as a discovery of experiment, but which theoretical investigation without experiment affirmed—viz., that by simply *preventing gyration* (by means of the clamp-screw *k* which fixes the axle J) the disk and ring *fall* "as if no rotary motion existed."

Foucault's modification of the gyroscope is shown in Fig. 5.

"The tall figure shows the gyroscope in supposed action, the frame *e e* being suspended at the top by a simple thread passing through the upright cylinder, and resting at its bottom on a very fine point placed in an agate cup. Within the frame *e* the detached frame *c c* may be laid at any time so that the knife-edges *d d* rest on hard plates; the rotation-disk *a a* may be put into rapid rotation by a separate machine, and placed in that state of rapid motion within *e e*, where, by the suspension, and by the knife-edge bearings, it will have perfect freedom of motion.

"Suppose, now, that a graduated slip on the edge of the apparatus is examined through the telescope *m*; it is clear that if the earth be at rest, the same graduated line will continue under the spectator's eye at the telescope. But if the earth is rotating, and carrying the gyroscope along with it, the revolving ring can not remain in its original relation

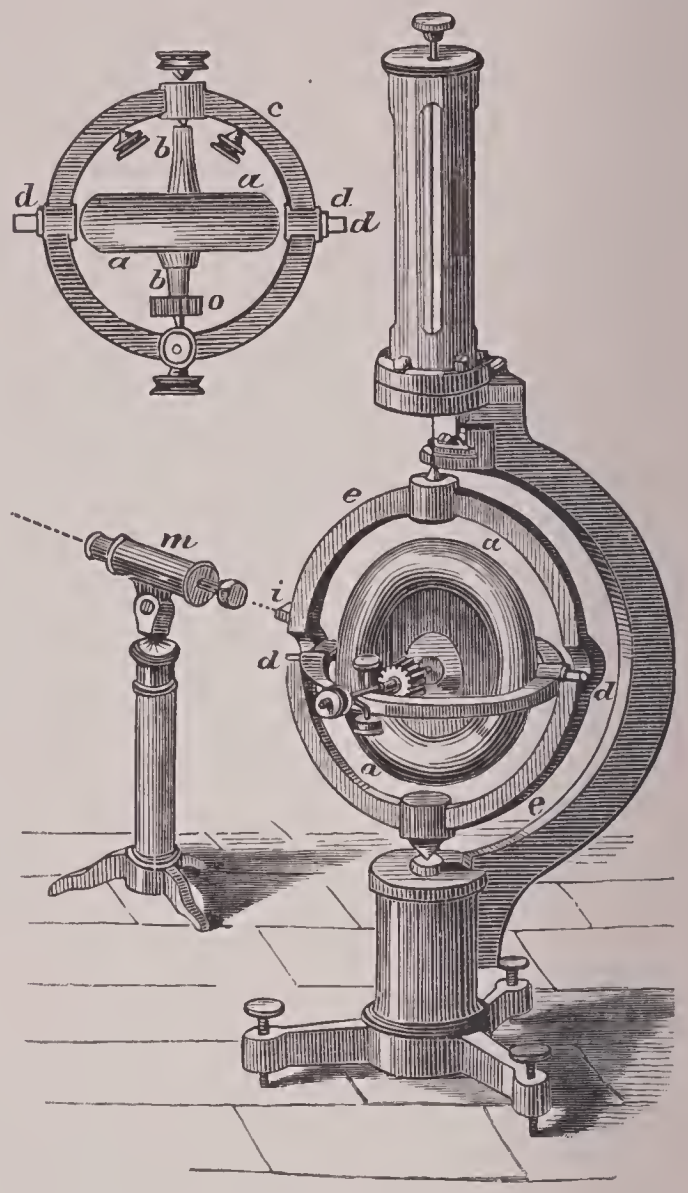



FIG. 5.

to the telescope, just because its displacement by the earth would, if it did so, *change the direction of the plane in space in which the ring revolves.* The graduated slip will therefore move in the telescope, and the observer will discern the different lines of graduation passing regularly under his eye, exactly as a star moves across the field of view of a transit instrument."

The same inventor had previously applied the pendulum to the same effect—ocular exhibition of the earth's rotation.

**Gzowski**, Sir CASIMIR STANISLAUS: See the Appendix.

# H

: the eighth letter of the English alphabet.

*Form.*—Its form is derived through the Latin H from the Chalcidian Greek H or B, the latter being the primitive Phœnician form.

*Name.*—The Phœnician name *Cheth* (fence) was adopted as *hēta* (ἧτα) by the Greeks, and the letter used to denote *h*, but among the Asiatic Ionians the name was *ēta* (ἦτα), and the letter denoted the initial sound of its name, viz., *ē*. With the predominance of the Ionic alphabet in Greece this name and value became standard. The English name "aitch" (pron. *ētš*) strangely enough does not contain the sound denoted by the letter. It comes through the old French *ache*, cognate with Italian *acca*. These coupled with Portug. *agá* point to a Vulgar Latin *ac'ca* or *aca'*, which probably combines the old Lat. name of *h* (*ha*) with that of the rare letter *k* (*ka*), which followed it in the list of the mutes as recited in the schools (i. e. *b*, *c*, *d*, *g*, *h*, *k*, *p*, *q*, *t*), hence (*h*)*aka*. Cf. E. S. Sheldon, *Studies and Notes in Philol. and Liter.* (i., 83 ff.).

*Sound.*—When standing alone in English it indicates the whispered beginning or close of a voiced sound. Thus *ha* differs from *a* in that the vowel opens as an impulsive whispered form of *a*, the organs of the mouth being somewhat slacker than in the position for the voiced vowel, while in *a* the vowel opens as voiced. Comparison of the *h* in *ha* with that, e. g., in *hoo* (*hu*) will show that the position of the organs is determined by the following vowels, or, strictly speaking, by the voiced portion of the vowel. When accompanying *w* in *wh* it is a sign for a whispered beginning of *w*, or in some pronunciations of an entirely whispered (often called voiceless) *w*; similarly in Greek ῥ and in the *hy* of Eng. *hue*, etc.

*Sources.*—The commonest sources of English *h* are: (1) Teutonic *h* < Indo-Eur. *k*, as in *horn* : Lat. *cornu*; *heart* : καρδία : Lat. *cor*; *hundred* : Lat. *centum*; *h* < Indo-Eur. *kh*, as in *have* : Lat. *habe're* (*khabh-*). (2) Teutonic *hw* (ƕ) < Indo-Eur. *q*, as in *what* : Lat. *quod*. (3) The digraph *gh* represents generally a spirant which was preserved in English down to the beginning of the seventeenth century; *ght* < Indo-Eur. *kt*, e. g. *eight* : Lat. *octo*; *night* : Lat. *noct-em*; *light* : Germ. *licht*; *brought* : Germ. *brachte*; *might* : Germ. *macht*, etc.; *-gh* < O. E., *-h* < Teuton. *k*, ɣ < Indo-Eur. *k*, *gh*, e. g. *bough* < O. E. *bōh* < Indo-Eur. *bhāghu'-*, cf. Gr. πῆχυς; *dough* < O. E. *dāh* : Gr. τοῖχος; *high* < O. E. *hēah* : Germ. *hoch*; *nigh* < O. E. *nēah* : Germ. *nach*. Under the influence of a preceding guttural vowel the *gh* has been labialized and preserved as *f*; as in *rough*, *tough*, *trough*, *enough*, *slough*. (4) French *h* representing Latin *h* is often silent, as in *heir* (Lat. *heres*), *honest* (*honestus*), *honor*, *humble*, but cf. *habit* (M. Eng. *abit*), *humor* and (*h*)*umor*, *hotel* and *ostler*, etc. In *ch*, *sh*, *th*, *ph*, the letter does not stand for an independent sound, but serves merely to indicate a spirant pronunciation, while in initial *gh* it indicates that *g* is an explosive; e. g. *gherkin*, *ghost*, *ghastly*.

*Symbolism.*—H stands in chemistry for hydrogen. In Latin H = hic, H. S. = *hic situs est*, H. H. = *heredes*, H. E. T. = *heres ex testamento*. In Gr. η′ = 8, η = 8,000.

Benj. Ide Wheeler.

**H** (pronounced haa): the German name for B natural, B flat being called B.

**Haar**, Bernard, ter: poet; b. in Amsterdam, Holland, June 13, 1806; d. at Velp, near Utrecht, Nov. 19, 1880. Through a long life he maintained side by side the interests of a poet and of a preacher and scholar. He obtained his doctor's degree in theology in Leyden in 1829, and the next year became pastor at Eemnes-Binnen, passing thence to Vlaardingen (1833), to Arnhem (1835), to Leyden (1839), to Amsterdam (1843). In 1854 he was appointed Professor of Ecclesiastical History in Utrecht, and fulfilled the duties of his office until 1874, when he retired. The remainder of his life was spent quietly in his villa at Velp. The strongest poetical influence upon ter Haar in his youth seems to have been that of Lamartine, and he became himself perhaps the best representative of romantic sentimentalism in Holland. The same feeling pervaded his religious studies, as is shown by his strong aversion from Strauss, Renan, and the whole body of their followers. His poetical work is accordingly vivid, highly colored, and noble in manner, but seriously defective in inwardness and imaginative comprehension of life. The dates of his most notable poems are: *Johannes en Theagenes* (1838); *Huibert en Klaartje* (1844); *De Sint-Paulus-Rots* (1846); *Gedichten* (ed. in fol., Arnhem, 1871); *Gedichten* (3 vols., The Hague, 1878); *Laatste Gedichten* (The Hague, 1879). Of works in prose, the following may be mentioned: *Welken invloed heeft het Christendom gehad op de Poëzy?* (2 vols., 1843); *De Kerkhervorming in tafereelen geschetst* (5th ed., The Hague, 1854); *Hollands bloei in Schoone Kunsten en Wetenschappen, enz.* (Leyden, 1848); *De historiographie der kerkgeschiedenis geschetst* (2 vols., Utrecht, 1870–73).

A. R. Marsh.

**Haar'lem**: city of the Netherlands; in the province of North Holland, on the Spaarne; 10 miles W. of Amsterdam (see map of Holland and Belgium, ref. 5–E). It is a well-built and extremely neat city, with several interesting buildings, as, for instance, St. Bavon's Kerk, with its world-famous organ. It has many collections of consequence to science and art, good educational institutions, and considerable manufactures of velvet, silk, linen, carpets, and lace. It is the center of the trade in flowers, especially hyacinths, bulbs, and flower-seeds, which is a specialty of Dutch enterprise, and which here has assumed astonishing dimensions. Close by is the beautiful Haarlem Forest, with the royal palace, Welgeleque, which is a much frequented summer resort for people from Haarlem and Amsterdam. It has a Roman Catholic church and a Jansenist bishop. The city has played an important part in the history of the Netherlands, and particularly during the revolt against Spain, when its inhabitants sustained a seven months' siege (1572–73) against the Spanish commanded by Don Frederick, Alva's son. After a heroic defense it was forced to capitulate, and the conquerors, despite their promise of mercy, took a barbarous vengeance upon the inhabitants. It was not till 1577 that it was regained by the Dutch under the Prince of Orange. Pop. (1896) 60,788.

**Haarlem Lake**: a body of water which was contiguous to the city of Haarlem in Holland. A map of the date of 1531 shows within the area afterward covered by it, which was traversed by two highways, four small lakes and three flourishing villages; the combined area of the lakes was about 15,000 acres. In 1591 one of these villages had disappeared, and so in 1647 had the other two, and the four lakes had united into one. In the early part of the nineteenth century it had acquired an area of 45,000 acres. With such an area, and a perimeter of more than 30 miles, every tempest caused new encroachments, and the danger to some of the adjacent regions became very great. Long before, projects of drainage had been proposed and discussed. The need grew more and more urgent, and in 1839 the Dutch Government inaugurated the great work. The entire lake was surrounded by a dike and an encircling canal, 37 miles in length, whose construction occupied nine years. Pumping began in May, 1848, three enormous engines having been especially built for the work, and in July, 1852, the lake was dry. The total cost of the drainage was $3,940,000, and $3,500,000 was received from the sale of land, so that the net cost of the work was less than $10 per acre for the land reclaimed.

Revised by Mansfield Merriman.

**Haase**, haa'ze, Heinrich Gottlob Friedrich: classical scholar; b. in Magdeburg, Germany, Jan. 4, 1808; studied in Halle, Greifswald, and Berlin. After extensive researches in the libraries of Paris, Heidelberg, Strassburg, Bern, and Vienna, made with a view to an elaborate edition of the Greek and Roman military writers, he was appointed professor at Breslau in 1840, where he remained till his death, Aug. 16, 1867. The most important of his numerous works are editions of Xenophon, *de republ. Lacedæm.* (1833); *Thucydides* (1840); Vell. Patereulus, *Seneca* (3 vols., 1852), still

the best edition; *Tacitus*, with excellent prolegomena (2 vols., 1855). The most valuable of many contributions to *Ersch und Grubers Encyclopädie* is his article on philology (sec. iii., vol. xxiii., pp. 374–422). He is also the author of the *Vorlesungen über latein. Sprachwisseuschaft*, edited after his death by F. A. Eckstein and H. Peter, a work which gave a decided impetus to research in this field of study. See Bursian, *Geschichte der classischen Philologie in Deutschland* (p. 805–812). ALFRED GUDEMAN.

**Habak'kuk** [Heb., loving embraee or embracer]: the eighth of the twelve minor prophets of the Old Testament. Apparently (iii. 19) he was a Levite, and he is thought to have prophesied during the reign of Josiah (638–608 B. C.), Delitzsch supposes about the year 630 or 629 B. C. As Nahum denounces the Assyrians, who had already crushed the kingdom of Israel, so Habakkuk denounces the Chaldeans, who are about to crush the kingdom of Judah. The third chapter, which has been called a Pindaric ode, is one of the sublimest compositions ever penned. *The History of Bel and the Dragon*, an apocryphal addition to the book of Daniel, is, in the Septuagint, ascribed to "Habakkuk, the son of Joshua, of the tribe of Levi," thought by some to be identical with the prophet.

Revised by WILLIS J. BEECHER.

**Habana** (in Cuba): See HAVANA.

**Habberton**, JOHN: author; b. in Brooklyn, N. Y., Feb. 24, 1842; learned type-setting in the establishment of Harper & Brothers, New York; enlisted as a private in the Union army 1862; returned to the Harper establishment in 1865; began business on his own account in 1872, but failed; became literary editor of *The Christian Union* in 1874 and editorial writer on *The New York Herald* in 1877, and published many novels, of which *Helen's Babies* is the best known.

**Ha'beas Cor'pus** [Lat., you may have the body]: in law, a writ issuing out of a court of justice, or awarded by a judge in vacation, with the view of bringing a person before the court or judge to be dealt with according to law. There are several writs passing by this name with words added, more specifically to denote their application, such as: (1) *Habeas corpus ad faciendum et recipiendum*; (2) *ad prosequendum*; (3) *ad respondendum*; (4) *ad satisfaciendum*; (5) *ad subjiciendum*; (6) *ad testificandum*. The office of the first of these is to remove, on the application of a defendant, a cause from an inferior to a superior court; of the second, to remove a prisoner to be tried within the jurisdiction where an alleged act was committed; of the third, on the part of a suitor, to remove a cause of action to a higher court; of the fourth, after judgment, to charge a person in a superior court, with process of execution; of the fifth, to bring up a person detained by another, with a view of inquiring into the cause of detention; and of the sixth, to bring a witness who is in custody at the time of a trial into court. Of these the last two are much the most important. The fifth, as above enumerated, is the great writ of *habeas corpus*, of so much importance to the liberty of the individual both in Great Britain and in the U. S.

The writ of *habeas corpus* is called in the English law a "writ of right." By this is meant that the party in confinement, on making a proper case, is entitled to it. It is, accordingly, only issued on a proper foundation of proof. It is necessary that there should be an affidavit and motion for an allowance of the writ. When these steps are taken, the right of the prisoner is fixed. The writ is said by some jurists to be based on the well-known clause in Magna Charta that "no freeman is to be deprived of his life, liberty, and property except by the judgment of his peers and the law of the land." The subject will be treated under the following principal divisions: I. History of the writ and of the statutes affecting it; II. Its general effect; III. Procedure; IV. Relation of the States to the U. S. courts; V. Power of U. S. courts to issue the writ.

I. At the common law the writ issued from the court of king's (or queen's) bench, not only while the court was in session (or in "term-time"), but also in the vacation, by an order from one of the justices. In the latter case it was made returnable either before the judge who issued it or before the full court. The other great common-law courts (viz., the common pleas and exchequer) did not originally have general power to issue the writ, but only in special cases. It was supposed at one time that the lord chancellor had no power to grant the writ in vacation, though the law is now settled to the contrary. A serious controversy arose in England in the reign of Charles I. upon the point whether a return to a writ of *habeas corpus* by the warden of the Fleet Prison was legally sufficient, which set forth that the prisoners were detained by a warrant from the privy council, setting forth no particular cause of imprisonment, but that they were committed by the special command of the king. The counsel for the prisoners insisted that the council was bound as much as any petty magistrate to assign a sufficient cause for commitment. The decision of the judges was in favor of the legality of the warrant. The effect of this decision was that every statute from the time of Magna Charta designed to protect personal liberty was practically nullified, since it was only necessary, in order to avoid their effect, to insert in the warrant the words "by the special mandate of the king." This servile action of the bench so aroused the nation that an act affecting the subject was passed in the same reign, the famous petition of right, 16 Charles I., ch. 10, sec. 8. This statute, among other things, provided that where a person was committed by the king or his privy council, he should have a writ of *habeas corpus* upon demand or motion made to the *court* of king's bench or common pleas. A close construction was put upon this statute by the judges, who declined to award the writ (*ad subjiciendum*) in vacation. At a later day, for the purpose of furnishing a more complete remedy, the famous *habeas corpus* act was passed (31 Charles II., c. 2). This act is frequently termed "Lord Shaftesbury's act," its enactment having been due largely to the exertions of that distinguished statesman. It is said to have been carried through the House of Lords by a mere artifice. Bishop Burnet gives the following account of it in his *History of his Own Time*: "Lords Gray and Norreys were named to be the tellers. Lord Norreys, being a man subject to vapors, was not at all times attentive to what he was doing, so, a very fat lord coming in, Lord Gray counted him for ten, as a jest at first; but seeing Lord Norreys had not observed it, he went on with this misreckoning of ten, so it was reported to the house, and declared that they who were for the bill were the majority, though it indeed went on the other side." (Vol. ii., p. 256, Oxford ed., 1833.) This story is corroborated by a note by Speaker Onslow and adopted by Lord Mahon in his *History of England* (ed. 1858; Murray, London, vol. iv., p. 125. See also Cooke's *Life of Shaftesbury*, 220, ed. 1836). The last-named work adds that when the numbers were reported from the wool-sack, the ministry, who knew their strength, were surprised; and while they were whispering to one another, Lord Shaftesbury, who found there was a mistake and guessed their intentions, immediately started up and spoke upon the first thing that occurred to him almost an hour. While he was speaking several lords went out and others came in, so that it was impracticable to retell the house, and by this means the bill was carried. This great act was an important contribution to English constitutional law, as it tended to render more effectual rights whose existence had long been recognized, but which had hitherto been imperfectly vindicated. This statute has had much influence upon legislation in the U. S. It is applicable to persons committed and charged with *crime*, and therefore does not embrace all the cases in which there may be an unlawful detention. The act provides that, with certain exceptions, when any person is charged with crime, a judge, in vacation, on viewing a copy of the warrant, shall award the writ, returnable either before himself or any other of the judges, and if the case is bailable shall discharge the prisoner on proper security being given. The prisoner is required to be brought up within a limited time, not exceeding twenty days. Heavy fines are imposed upon the judge for refusing to award the writ upon a proper case being made, as well as upon the officer or keeper of the prisoner neglecting to make return or evading the mandate of the judge; similar provisions are made for punishment of one causing, after discharge, a recommitment of the prisoner for the same offense. The writ was made to run into all counties palatine and privileged places. There are also clauses providing for the prisoner's discharge unless he is speedily indicted and tried after indictment. There is also a heavy penalty imposed upon any one sending a person as a prisoner out of England, unless in cases of transportation for crime, etc. The *habeas corpus* act of Charles II. was seriously defective in one respect: it only applied to persons arrested on *criminal* charge. In the year 1757 an instance occurred of a gentleman being by some mistake pressed as a foot-soldier, whereupon his friends, on applying for the writ, found that the case did not come within the

act. This led to the introduction of a bill into Parliament extending the act to other cases of confinement besides those resulting from a charge of crime. Though the bill passed the House of Commons, it was defeated in the House of Lords under the lead of the great Lord Hardwicke, and it was not until the year 1816 (56 Geo. III., c. 108) that this obvious defect in the law was supplied and the writ in other respects made more effective.

Legislation in general in the U. S., while following the spirit of the British act, is not confined to commitments on criminal charges, but is more comprehensive in its character, and extends beneficial provisions to all arrests and detentions on any grounds or pretexts whatsoever. There is a clause in the U. S. Constitution and in State constitutions to the effect that "the privilege of the writ of *habeas corpus* shall not be suspended unless when, in cases of rebellion or invasion, the public safety may require it." The effect of this clause was much discussed in the civil war, the President of the U. S. having on Apr. 27, 1861, addressed to Lieut.-Gen. Scott an order authorizing him, under certain contingencies, to suspend the writ. Other orders of a similar nature were issued. One Merryman having been arrested on May 25, 1867, charged with various acts of treason, the general having him in charge refused to comply with the writ, as well as to yield to an attachment issued for its enforcement, on the ground of its suspension by the President. Chief Justice Taney, who had issued the writ, filed an opinion denying the President's authority, and insisting that the power of suspension was vested solely in Congress. (9 Am. Law Register, N. S., 527.) This view is supported by the opinion of Deady in the case of *McCall* v. *McDowell*, 1 Abb. U. S. 112, and of Smalley in *Ex parte Field*, 5 Blatchford 63. These views of the judges referred to have been distinctly controverted by able jurists in pamphlets and professional opinions. Congress passed an act upon this subject, Mar. 3, 1863, authorizing the President to suspend the writ. (12 U. S. Statutes at Large, 282. See also ch. 22, Laws of 1871, sec. 4; 17 U. S. Stat. 15.) A proclamation by the President, issued Oct. 17, 1871, under the last-named act, will be found in 17 U. S. Stat. Appendix No. 4, and another in Appendix No. 7, issued Nov. 10, 1871. The current of judicial and professional opinion appears to be in favor of the view that the power of suspension under this constitutional provision is vested in Congress rather than in the President.

II. The general scope and office of the writ is to bring before a court or judge the question whether the person in whose behalf it is issued is lawfully detained. The cases coming before the court, etc., will be divisible into two principal classes, one where the person is simply detained without any legal process, and the other where he is in custody under such process. The first class of cases is illustrated by that of a contest between a father and a mother as to the custody of a child. There being no legal process in such a case, there must be an inquiry embracing the merits of the whole controversy for the sake of determining to whom the custody of the child shall be awarded. Wholly different considerations occur when the detention is upon legal process. The point then may be whether the legal proceedings were not wholly void because the court instituting them had no jurisdiction, or whether, assuming that the tribunal had jurisdiction, it was proceeding irregularly, or if all the proceedings were regular whether the merits of the controversy can be considered. There will thus be three principal points to be examined: (1) The right upon a writ of *habeas corpus* to relieve from detention where the process is issued by a court or magistrate having no jurisdiction; (2) where jurisdiction exists, but the proceedings are irregular; and (3) cases where there is an entire regularity of proceeding and the claim is made that the merits of the case shall be considered.

(1) Where the court or magistrate has no jurisdiction over the subject-matter or the person, the prisoner may be relieved by this writ even though there may have been a final judgment, and though the court may have been one of high jurisdiction. So if it had no power to dispose of the particular question in the mode that it pursued, its judgment is a mere nullity. In the eye of reason there has been no decision and no judgment, no matter though legal forms may have been pursued. Thus if a court had only power to sentence to imprisonment, and it rendered judgment of death, a writ of *habeas corpus* might be resorted to. It may be said that this is a dangerous document. While this is readily conceded, its soundness can not be denied. Judicial as well as administrative power has its limits. If these are exceeded by a court, its pretended decision is no judgment; it is but waste paper, and may be disregarded. Great caution should be observed in reaching a conclusion that the judgment is a nullity. If, however, it be clear that jurisdiction is exceeded, there is no more reason why a prisoner held under such a void judgment should be detained than that property seized under a similar void proceeding should be sacrificed. The writ of *habeas corpus* is a legitimate mode of showing the nullity of the judgment and of relieving from the false imprisonment.

(2) In the second class of cases (where the court has jurisdiction over the subject in the way that it is presented for its action, but it is proceeding in an irregular manner), it will not necessarily follow that a prisoner will be discharged by the writ. If the proceedings be of a summary nature, and it appears upon the face of them that some essential step or form has been omitted, they will be void and the prisoner will be discharged. Thus if a fugitive from justice were demanded by way of extradition, the regularity of the proceedings might be tested by means of a writ of *habeas corpus*. It has, however, been maintained by some jurists that if the warrant or other process is sufficient to protect the officer who executes it from an action of false imprisonment a discharge will not be made. In many cases where a court has jurisdiction over the subject-matter and of the person, the only mode of taking advantage of an irregularity in the proceedings is by a motion addressed to the court itself in the very proceeding complained of. In other words, the writ of *habeas corpus*, an independent method of review, is not to be resorted to, but the mode of correcting the irregularity is to be found in addressing the very tribunal before which it takes place, and asking it so to mold and correct its own procedure as to make it conform to the rules of law; and if such correction is refused, resort may perhaps be had to an appellate court.

(3) Where the case is regularly before a court, the writ under consideration can not be used to determine the merits of the controversy. This point will only be considered in detail in connection with the administration of criminal law. When a prisoner is charged with crime the common practice is to bring him before a magistrate, e. g. a justice of the peace, and to make an inquiry into the circumstances which are supposed to establish his guilt. This is not a trial, but a preliminary proceeding devised for the purpose of securing his attendance at the trial. The testimony of witnesses is taken down in writing by the magistrate; on this he proceeds in making his commitment. The writ of *habeas corpus* may be resorted to with the view of testing its validity, and the court may, in connection with a *certiorari*, consider whether the testimony, as shown in the depositions, supplied a sufficient basis for the action of the magistrate, as well as whether the commitment itself is sufficient in point of legal form. No inquiry can be had even at this stage as to the guilt or innocence of the prisoner. To do that would be to examine the case on its merits. Let it now be assumed that an indictment has been found. The writ of *habeas corpus* can not be used to inquire into the depositions before the committing magistrate. These are shut out of view by the indictment; the prisoner is now held upon that. The only question that can be examined is whether the indictment itself is sufficient in point of form. If that be regular, the court or judge will not go beyond the indictment to inquire into the merits; if it would, trial by jury might be practically abolished. The writ of *habeas corpus* accomplishes its beneficent purposes by securing the prisoner so far that he is not to be held without *apparent* cause. Whether he is in fact guilty or innocent can only be determined by a regular course of trial. The prisoner may be allowed, in certain cases, to go at large on bail, notwithstanding that the proceedings are valid. The statute of the respective States must be consulted upon this point.

III. *Procedure.*—Application for the writ must be made by petition signed by the party or some one in his behalf. In the well-known case of *Ashby* v. *White*, in Parliament, it was resolved "that every Englishman who is imprisoned by any authority whatsoever has an undoubted right, by his agents or *friends*, to apply for and obtain a writ of *habeas corpus* in order to procure his liberty by due course of law." A father claiming the custody of an infant child may himself apply for the writ. Statutory provisions in some of the U. S. lead to the view that if the petition is properly drawn the writ must be granted, even though there is good reason to believe that it would be without practical effect; in other

words, it must be granted where there is but slight apparent ground for asking for it. The form of petition is also in some States prescribed by statute. It may be directed to any one who has the prisoner in custody or who has participated in the illegal detention. The writ is made returnable at a specified time and place, either before the officer who issues it, at chambers (see CHAMBERS), or to the court as such. The person to whom the writ is directed is expected at the appointed time to make a "return," or a statement of the grounds on which the detention is made. This must be distinct and unequivocal. It would not be enough, for example, to state that the prisoner is not in the defendant's *custody*, but it must be made to appear that he is not under his control, so that he could respond to the requirements of the writ. If the return be evasive or otherwise imperfect, an amendment of it may be allowed. Formerly, the prisoner could make no denial of the truth of the matters alleged in the return. If that furnished a sufficient excuse for the imprisonment, though it were wholly unfounded in point of fact, the prisoner must be remanded. The only remedy of the prisoner was to bring an action for damages for any injury sustained by him for the false return. In some cases criminal proceedings might be instituted. This serious defect in the administration of justice has been remedied by modern statutes, and the prisoner has been allowed to deny the statements of his custodian, or, in legal phrase, to "traverse the return," and also to set up any facts arising subsequently which may make in his favor. The judge or court disposing of the writ may thus have to consider both questions of fact and of law, the matters of fact being presented by way of affidavit or affirmation. If the return is not made or is evasive, the party to whom it is addressed may be regarded as having committed a contempt of court, and will be liable to be placed in close custody until he obeys the writ. On the hearing of the case the prisoner, if the circumstances require it, may be discharged, or may be remanded to the original custody. The decision does not, as it would seem, necessarily prevent the hearing of the matter again upon a new writ, particularly where the circumstances of the case have changed. Thus if the custody of a child were awarded to one of its parents at a given time, the facts might be so changed as to make it proper that, on a new application, it should be awarded to the other. Severe penalties are imposed by law upon a ministerial officer who knowingly recommits a prisoner for the same cause as that on account of which he was discharged. There is another writ existing at common law in favor of personal liberty, *de homine replegiando* (replevying a man). This raises a question to be tried by a jury; while the proceedings in a *habeas corpus* take place before a judge or court. The former writ has become practically obsolete.

IV. Conflicts of jurisdiction have arisen frequently in executing writs of *habeas corpus* between the State and the Federal courts. The principles that should apply to the subject as expounded by the final interpreter of the U. S. Constitution, the Supreme Court, may be found in *Tarble's Case*, 13 Wallace Reports, 397. It is there said that no State judge has a right to issue a writ of *habeas corpus* for the discharge of a person held under the authority of the Federal Government. If it do not appear, upon application for such a writ, that the person is so held, the State judge may inquire into the circumstances of the case as to how the prisoner is held, and the marshal in whose custody the party is should give the requisite information. These principles were applied to a case in which the commissioner of a State court issued a warrant to a recruiting officer of the U. S. to discharge a minor who had enlisted in the service of the U. S. It was decided that the commissioner had no jurisdiction, the prisoner being detained under the authority of the Federal Government. The proper course in such a case is that the U. S. officer upon whom the writ is served shall produce the body of the prisoner before the State court, and set forth in what manner he holds him under the authority of the U. S. The State court or judge should go no further. By this decision the relations of the two governments as to this writ must be regarded as authoritatively settled.

V. The power of the U. S. courts to issue the writ is more limited than that of the State courts, being confined to the exercise of such authority as is either expressly or by implication conferred by the U. S. Constitution and the laws made under its provisions. The courts and judges of the U. S. are authorized to issue the writ in cases coming within Federal jurisdiction. The *circuit* court may inquire into the cause of a commitment, and except when the privilege of the writ is suspended may determine the question whether the prisoner is entitled to be discharged. Thus this court may by this means, where the circumstances of the case require it, discharge a prisoner held under a warrant of extradition issued by the Governor of a State. The writ, however, can not be issued to bring up any person *confined in jail* unless held under or by color of the authority of the U. S., or unless such person is required to testify in a cause depending in a court of the U. S. Neither a court of the U. S., nor any judge thereof, under these rules can issue the writ to bring up a prisoner in custody under a sentence or execution of a State court for any other purpose than to be used as a witness. When a prisoner is taken by an order of a U. S. court from a State court to be used as a witness, its authority continues so as to send him back, after his testimony is taken, to the place from which he was brought. In cases coming within the purview of the U. S. Constitution and the laws of Congress, it has been said that relief may be granted not only to those held under legal process, but also to such as are confined without any formal appearance of authority; as, for example, where the prisoner and the defendant are citizens of different States, or where a master, before the abolition of slavery, demanded the return of slaves taken from him by force. The *Supreme* Court of the U. S. has not the same power to issue the writ in question as the circuit court. It can only exercise the power in an appellate form, as its original jurisdiction is limited to specific cases. It may accordingly issue the writ, where the circumstances of the case require it, when a person is imprisoned under the order or warrant of a court of the U. S. It does not by this means review decisions made at chambers (see CHAMBERS) by a justice of the court.

Further information upon the general subject of the writ will be found in Hurd's treatise on *Habeas Corpus*, and in an elaborate note written by the late Nicholas Hill, of Albany, and published in vol. iii. of his *Reports*, pp. 647–676; also in Blackstone's Kent's *Commentaries*, Story, Rawle, Paschal, and Pomeroy on the *United States Constitution*, and in the digests and decisions of the Federal and State courts. See also Hallam's *Constitutional History* for historical information.

The writ *ad testificandum* is resorted to for the purpose of bringing up a person who is in custody to testify in some cause or other matter pending judicially. When his testimony is given in he is returned to the custody from which he is taken. The writ is obtained upon motion based upon an affidavit setting forth the facts upon which the application is founded. A legislative body, e. g. the House of Representatives, desiring the attendance of a witness at the time in custody, simply executes its will by the warrant of its Speaker, giving authority to its sergeant-at-arms to produce the prisoner. The writ of *habeas corpus ad testificandum* can not in such a case be resorted to.

Revised by HENRY WADE ROGERS.

**Haber'geon** [M. Eng. *haubergeoun*, from O. Fr. *haubergeon*, dimin. of *hauberc*, from O. H. Germ. *halsberg*; *hals*, neck + *bergan*, protect]: in the Middle Ages, a coat of chain-mail, a HAUBERK (*q. v.*); in later times, a piece of plate armor, the exact nature of which is uncertain.

**Habington**, WILLIAM: author; b. at Hindlip, Worcestershire, England, Nov. 5, 1605, of an old Roman Catholic family; educated at St. Omer, in France; married Lucy Herbert (Castara), the daughter of Lord Powis, and lived chiefly on his ancestral estate at Hindlip, where he died Nov. 30, 1645. He is chiefly remembered for his *Castara* (1634), a collection of poems addressed mostly to his wife, and remarkable for their pure and elevated sentiment and for their occasional quaint and farfetched conceits. The *History of Edward IV.* (1640) is believed to have been his father's work. He also wrote the *Queene of Aragon, a Tragi-comedie* (1640).

**Habit** [M. Eng. *habit*, from O. Fr. *habit*: Ital. *abito* < Lat. *habitus*, condition, attire, nature, disposition, habit, deriv. of *habe're*, have]: a constitution or state of mind or body which disposes one to certain acts or conditions, mental or physical. A habit is of more fixed character than a *disposition*, but is generically the same. There are habits intellectual and moral, acquired and inherited, active and passive. Habits are originally the results of voluntary acts, but the control of them may become impossible to the will. A wise and skillful formation of habits may be of the greatest moral and intellectual advantage, while habits injudiciously formed may be destructive of mind, character, body, and

estate. The question of habit is intimately connected with that of the Association of Ideas (*q. v.*).

The *law of habit* in psychology and physiology is the principle by which habits are expressed in terms of functions. A habit represents, according to the degree of fixity which it has attained, the amount of readiness of an organism or an organ for the performance of its peculiar function, this readiness being due to the previous exercise of this same function. Further, on the physiological side, habit always represents modification of structure to an extent which gives the organism a bent or tendency toward a repetition of the function again. Each performance of the function also further strengthens the habit by deepening the organic tendencies which lie at the basis of the habit. The acquisition of complex movements of skill illustrates the manner in which simple organic habit may bring the influence of the organism to the support of the efforts of the mind.

On the mental side, the law is capable of a corresponding statement. A mental function grows easy and then habitual in proportion to the frequency of its performance. Probably the *locus* of the mental disposition involved is the attention, and the strength of mental habit depends upon the relative ease or freedom in the concentration of the attention. No adequate statement of mental habit, however, is possible which does not recognize the alliance spoken of between organic and mental dispositions, as is done in what is called the psycho-physical theory of mental functions in Physiological Psychology (*q. v.*). The principle which takes account of the breaking up or modification of habit by new adjustments of an organism or new efforts of the mind is the law of *accommodation*. "Psychologically, habit involves loss of mental oversight, diffusion of attention, subsiding consciousness" (Baldwin's *Handbook of Psychology*, ii., p. 49); and accommodation means the opposite, i. e. "reviving consciousness, concentration of attention, voluntary control—the mental state which has its most general expression in what we call Interest" (*q. v.*). See Imitation and James's *Principles of Psychology*, vol. ii., chap. iv.

J. Mark Baldwin.

**Habsburg, House of:** See Hapsburg, House of.

**Hack'berry, Sugarberry,** or **Nettle-tree** [hackberry is from an earlier *hagberry*, from Dan. *haeggebaer*, liter., hedgeberry]: the *Celtis occidentalis*, a North American tree of considerable height and much beauty, but singularly variable in its mode of growth and botanical characters. Its wood is quite tongh, but is not much used in the arts. It makes good charcoal, and when young is used for barrel hoops, and sometimes called hoop-ash. The genus (*Celtis*, family *Urticaceæ*) contains several foreign trees of considerable importance. Revised by L. H. Bailey.

**Hackel,** Eduard: German botanist; Professor of Botany in the Gymnasium of St. Poelten, Austria, and the foremost living student of the grasses. Among his published works are *Monographia Festucarum Europæarum* (1882); *Gramineæ* (in Engler and Prantl's *Pflanzenfamilien*, 1887), of which an English translation appeared in 1890 under the name of *The True Grasses*; *Andropogoneæ* (in de Candolle's *Monographiæ Phanerogamarum*, 1889).

Charles E. Bessey.

**Häckel,** Ernst H.: See Haeckel, Ernst H.

**Hackensack**: town; capital of Bergen co., N. J. (for location of county, see map of New Jersey, ref. 2–E); on the Hackensack river, and the N. J. and N. Y., the N. Y., Susq. and W., and the W. Shore Railways; 8 miles S. E. of Paterson, 13 miles N. of New York. It has gas, water, and electric-light plants, several brick-yards, wall-paper factory, silk-mill, jewelry-factory; 16 churches; 5 public, 1 parochial, and 2 private schools; a public library; a hospital; and 1 daily and 4 weekly newspapers. There is considerable trade by railway and river. Pop. (1880) 4,248; (1890) 6,004; (1900) 9,443. Editor of "Index."

**Hack'ett,** Horatio Balch, D. D., LL. D.: educator; b. at Salisbury, Mass., Dec. 27, 1808; graduated at Amherst College in 1830; was tutor there 1831–32; studied theology at the Andover Seminary until 1834; was Adjunct Professor of Latin and Greek in Brown University three years, and Professor of Hebrew one year; was elected to the chair of Biblical Literature in the Newton Theological Institution (Baptist) in 1839; studied at Halle and Berlin from Sept., 1841–42; Professor of New Testament Greek in Rochester Theological Seminary 1870. He published Plutarch's *De Sera Numinis Vindicta*, with notes (1844); translated and enlarged Winer's Chaldee grammar (1845); published a Hebrew grammar and reader (1847); *Commentary on Acts* (1851); *Illustrations of Scripture*, suggested by a tour through the Holy Land (1855; new edition 1882); *Philemon*, newly translated, with notes (1860); *Christian Memorials of the War* (1864); translated (for Lange's *Commentary*) Von Oosterzee on Philemon (1868), and Braune on Philippians (1870); was one of the editors of the enlarged American edition of Smith's *Dictionary of the Bible*; edited also Rawlinson's *Historical Illustrations of the Old Testament* (American reprint, 1873); and was a member of the New Testament company of the American Bible Revision Committee. D. at Rochester, N. Y., Nov. 2, 1875. See *Memorials of Horatio Balch Hackett*, edited by G. H. Whittemore (1876).

**Hackettstown**: town; Warren co., N. J. (for location of county, see map of New Jersey, ref. 2–C); on the Musconetcong river, the Morris Canal, and the D., L. and W. Railroad; 52 miles W. of Newark. It is at the head of the beautiful Musconetcong valley, with mountains surrounding it on three sides, and within half a mile of the highest point in the State. The public water-supply is from mineral springs on Schooley's Mountain, 2½ miles distant. The town is the seat of the seminary of the Methodist Episcopal Conference of Newark, and has manufactures of agricultural implements, silk goods, and carriages, and two weekly newspapers. Pop. (1880) 2,502; (1890) 2,417; (1900) 2,474.

Editor of "Gazette."

**Hackländer,** haăk'len-der, Friedrich Wilhelm, von: novelist and comedy-writer; b. at Bertscheid, near Aix-la-Chapelle, Nov. 1, 1816. He learned the dry-goods business in Elberfeld; entered the Prussian artillery; returned again to his commercial occupations, and succeeded at last in 1841 in making for himself a literary name by the publication of his *Bilder aus dem Soldatenleben* in a Stuttgart paper, and shortly after of his *Wachtstubenabenteuer*. He published in 1842 *Daguerreotypen aufgenommen auf einer Reise in den Orient*, which recommended him to the Crown Prince of Würtemberg, whom he accompanied on a journey through Italy, France, and Russia. New sketches and humorous tales followed, and the King of Würtemberg gave the author an office and a pension. In 1850 he published a large novel or romance, *Handel und Wandel* (2 vols., Berlin), and in 1854 another, *Europäisches Sklavenleben* (4 vols., Stuttgart). Of his dramas, *Der geheime Agent*, a comedy in five acts (1850), and two or three one-act pieces, *Schuldig*, *Unten im Hause*, etc., have been played with success in all the German theaters. In 1857 he founded, in connection with Zoller, *Ueber Land und Meer*, an illustrated paper. D. at Leoni, near Munich, July 6, 1877. Revised by Julius Goebel.

**Hackle, Hatchel,** or **Hetchel** [dialectal forms of *heckle* < M. Eng. *hekele*; cf. Dutch *hekel* (: Germ. *hechel*), deriv. of Dutch *haak*, hook : Germ. *hake* : Eng. *hook*]: a comb with long steel teeth by means of which the tow is removed from flax, hemp, or jute, and the fibers fitted for spinning or other uses by straightening and laying them parallel to each other. The long, tapering, polished teeth are affixed to a wooden or metallic block, and are arranged in two, or more frequently in many, rows. Their adjustment for effective use requires considerable skill. See Flax.

**Hack'matack** [Amer. Ind.], **Tam'arack** [Amer. Ind.], or **American Larch** (*Larix americana*): a forest-tree of the U. S., growing frequently in wet places, and attaining a large size, except in the far north. It is one of the few native coniferous trees whose leaves fall off in winter. Its wood is of excellent quality. It is used for poles and rafters; in ship-building it is used for ship's knees, top-timbers, and spars; and if fastened with square iron is far better than oak for such uses. It is very durable in contact with the soil, and is prized for posts, pump-logs, etc. It is also a good ornamental tree, especially when young. The European species (*L. europæa*) is planted in the U. S. for ornamental and forestry purposes. Revised by L. H. Bailey.

**Ha-Dani**: See Eldad Ben Malchi.

**Hadassah**: See Esther.

**Haddam**: town; one of the capitals of Middlesex co., Conn. (for location of county, see map of Connecticut, ref. 10–I); on the Connecticut river, 20 miles from its mouth, and the N. Y., N. H. and Hart. Railroad; 26 miles S. S. E. of Hartford. Haddam township contains the villages of Ponsett, Walkley Hill, Arnolds, Higganum, Little City, and

Tylerville. The principal industry of the town is granite-quarrying. Pop. (1880) 2,419; (1890) 2,095; (1900) 2,015.

**Had'dingtonshire**, or **East Lo'thian**: county of Scotland; bounded N. by the Firth of Forth, E. by the North Sea, S. by Berwickshire, and W. by Midlothian. Area, 271 sq. miles. In the southern part rise the Lammermoor Hills; the northern and eastern part is a plain sloping gently toward the Firth of Forth, and mostly consisting of clayey loam. Haddingtonshire is famous for its agriculture, in which respect it is said to occupy the foremost rank in Scotland. Coal and lime-stone abound. Pop. (1901) 38,653. The capital is Haddington, a small town on the Tyne.

**Haddock** [M. Eng. *hadok*; cf. Irish *codog*: Gael. *adag*]: *Melanogrammus æglefinus*, a fish of the cod family, captured in large quantities on both sides of the Atlantic for food. It

The haddock.

is generally eaten fresh, but is sometimes smoked or salted and dried. It resembles the cod, but is easily distinguished by the black line along its side, that of the cod being white. It sometimes weighs 15 lb., and is often caught in great quantities. It is, however, somewhat fickle in its habits, often leaving the places where it once congregated, and not returning for a long time. See FISHERIES.

**Haddonfield**: borough; Camden co., N. J. (for location of county, see map of New Jersey, ref. 6–C); on the Camden and Atlantic Railroad; 6 miles S. E. of Philadelphia. It is in the township of Haddon, which includes the boroughs of Collingswood and Haddonfield, and is the center of a fertile agricultural region. Pop. (1880) 1,480; (1890) 2,502; (1900) 2,776.

**Hade**: See FAULTS and GEOLOGY.

**Haden**, FRANCIS SEYMOUR: etcher; b. in London, Sept. 16, 1818; a physician of repute and a member of the Royal College of Surgeons. He had been a collector and a passionate lover of landscape art and of fine prints, and began to make etchings as a rest from professional practice; so that he is one of the very few amateurs whose artistic work is of value. His *Études à l'Eau-forte*, with text by Ph. Burty, were published in Paris and London simultaneously in 1865. Since that time his prints have been continually in demand at high prices. The largest of them is a study after J. M. W. Turner's picture, *Calais Pier*. R. S.

**Hadersleben**, haa'ders-lā-ben [Germ., from Dan. name *Haderslev*]: town; in the duchy of Schleswig, Prussia, with a harbor for small vessels on the Haderslev Fjord, an inlet of the Little Belt (see map of German Empire, ref. 1–E). The town has some tanneries, iron-foundries, etc., and a beautiful church built in the thirteenth century. It suffered considerably in the wars between Schleswig and Holstein in the fifteenth century, and in 1864 was ceded, with Schleswig, to Prussia. Pop. (1890) 8,399.

**Ha'des** [from Gr. Ἅιδης, Hades or Pluto, god of the lower world, the lower world itself. Derived from ἀ-, un- + ἰδεῖν, to see: the invisible one, or he who makes invisible]: in Greek mythology, a son of Cronus and Rhea. Uranus, who had been mutilated by Cronus, prophesied that the latter would be dethroned eventually by one of his own sons, wherefore Cronus swallowed his children as soon as they were born. Along with the rest Hades shared this fate, and was freed by the machinations of Zeus and Gæa. In the war waged by Zeus against the Titans, Hades fought by the side of Zeus, wearing a cap that made him invisible. After the conquest of the Titans, Zeus shared the empire of the universe with his two brothers, Poseidon and Hades. Poseidon received the empire of the sea and Hades that of the lower world, along with the sovereignty of the dead. Hades figures but rarely in myths, and he left the lower world only on two occasions—once when he ascended to earth to carry off Persephone (Proserpina) to be his wife, and again when, wounded by Hercules, he went to Olympus to be healed by Pæon. His epithets usually have reference to what is powerful, dark, and terrible in his nature, though euphemistic epithets also were applied to him. In Eleusis he was worshiped along with Demeter and Persephone under the title of the Well-wisher (Eubouleus). The name Pluto (in Gr. Πλούτων) was given to Hades by the poets as early as the fifth century B. C.; it applies to him as the giver of wealth, whether in the shape of grain or of precious metals, both of which come out of the bowels of the earth, his realm. So far as is known Hades had but one single temple in his own name (i. e. in Elis), though he was worshiped in many places along with Demeter and Cora, and then in a modified character; men were not fond of worshiping a god whose very name they dreaded to pronounce. Only black animals were offered in sacrifice to him; the dog, the wolf, the snake, the cypress-tree, and the narcissus flower were sacred to him. The Greeks were not fond of representing Hades in art, and no statues of the best period of art have come down to us, though in his modified character of Eubouleus he is often figured on vase-paintings, where he carries a cornucopia in addition to his scepter. In 1885 a bust of Eubouleus, thought to be a work of Praxiteles, was discovered at Eleusis. The sitting statue of Hades in the Villa Borghese belongs to the fourth century B. C.

The lower world was spoken of from the earliest times as "the house of Hades," and a dead man was said to have gone "to the house of Hades," our phrase "he has gone to *Jones's*" being precisely analogous. The house of Hades was vast, and had wide gates that stood open day and night, for Hades was hospitable, in so far as that all might enter freely, but none depart. The door of the house of Hades was watched by Cerberus, a many-headed dog, who caressed and fawned upon all who wished to enter, but allowed none to go out. The house of Hades was dark and gloomy and full of ghost-like horrors; its very vastness was terrible. Quite in keeping with the house were its gloomy surroundings—the Grove of Persephone, with its weeping-willows and barren aspen-trees, and the Asphodel Meadow, upon which the shades of the dead disported themselves, with its rocky or sandy ground that was covered with hateful trees and prickly shrubs. See Preller, *Griechische Mythologie* (Berlin, 1872; i., 655 ff; new ed. by Robert, Berlin, 1888); H. D. Müller, *Mythologie der griechischen Stämme* (p. 151 ff); the articles *Hades* in Roscher's *Lexicon* and Baumeister's *Denkmäler*.

The word in Hebrew corresponding to Hades is *Sheol*, which in the English version of the Bible is sometimes rendered "grave," sometimes "pit," and sometimes "hell." *Hades* is almost always employed by LXX. in translating *Sheol*. In the text used by King James's translators it occurs eleven times, and was rendered "hell" in every place except 1 Cor. xv. 55. In the text adopted by the revisers (1881) it occurs ten times (1 Cor. xv. 55 dropping out), and is uniformly rendered simply "Hades." See HELL.

J. R. S. STERRETT.

**Hading**, JANE: actress; b. at Marseilles, France, Nov. 25, 1859; appeared on the stage when a child; studied at the Marseilles Conservatory, and while still very young played at Algiers and Cairo, usually in comic opera. Returning to Marseilles in 1876, she played in a variety of *rôles*, and in 1879 appeared in *La Chaste Suzanna* at the Palais Royal in Paris. Her Parisian success was assured in 1883 when she appeared at the Gymnase in *Autour du mariage* and *Le Maître de Forges*. Since 1885 she has played with success in Great Britain and the U. S.

**Hadj** [Arab., setting out, pilgrimage]: the pilgrimage to Mecca—one of the five ritual observances incumbent on Mussulmans, ablution, almsgiving, fast, and prayer being the other four. The Hadj may, however, be performed by deputy, or be dispensed with altogether in case of disease, poverty, or any sufficient cause. The strictest discipline is maintained among the Hadjis (pilgrims) who visit the various objects of sacred interest in prescribed order, according to a scrupulous ceremonial. Formerly, if possible, all pilgrimages were made by land, generally in caravans, along one of the four main routes from Cairo, Damascus, Babylon, and Zibith. Steam-navigation has greatly modified this system. The annual departure of the pilgrims of the sacred caravan from Constantinople, with the sacred camel bearing the presents of the sultan, is an occasion of great solemnity and magnificence. EDWIN A. GROSVENOR.

**Hadji Khalifah**: See HAJJI KHALIFAH.

**Hadley**, Arthur Twining: politieal economist; b. at New Haven, Conn., Apr. 23, 1856; son of Prof. James Hadley; graduated at Yale 1876; pursued graduate studies in political science at Yale University and Berlin for three years; tutor in Yale College 1879–83; engaged in journalistic work on railways mainly; commissioner of labor statistics for Connecticut 1885–87; appointed Professor of Political Science at Yale 1886; President since May, 1899; continued his journalistic work, chiefly for *The Railroad Gazette* and *The Financial Chronicle*. Author of *Railroad Transportation, its History and its Laws* (1885; translated into Russian 1886, and into French 1887); *Report on the Labor Question* (1885); *Economics* (1896); associate editor *Johnson's Universal Cyclopædia*, in charge of political economy, finance, and transportation.

**Hadley**, Henry K.: See the Appendix.

**Hadley**, James: linguist and professor in Greek: b. at Fairfield, Herkimer co., N. Y., Mar. 30, 1821, where his father was Professor of Chemistry in a medical institution. Entering the junior class in Yale College, James Hadley graduated in 1842. From 1843 to 1845 he was a theological student in New Haven, serving as tutor in Middlebury College meanwhile (from Sept., 1844, to Apr., 1845); was tutor at Yale from 1845 to 1848, when he was appointed Associate Professor of Greek; succeeded Dr. Woolsey as full professor in 1851. As a student he gave great promise of distinction in mathematics, but circumstances turned his genius and industry in a different direction. In addition to his mastery of the Greek language, he was well versed in Hebrew, Arabic, Armenian, Sanskrit, Welsh, Gaelic, Irish, and the principal modern languages. His *Greek Grammar*, based on that of Curtius, was published in 1860. In 1873 a posthumous volume of twelve lectures on *Roman Law* was edited by ex-President Woolsey, and in the same year another volume of twenty *Philological and Critical Essays* was edited by Prof. Whitney. D. in New Haven, Nov. 14, 1872. See President Porter's article in *The New Englander* (Jan., 1873). Revised by A. T. Hadley.

**Hadley**, John: an English astronomer, the date and place of whose birth are unknown; became a fellow of the Royal Society in London in 1717, and published in the *Transactions* of the society for 1731 an account of an invention he had made with respect to the quadrant. (See Sextant.) Soon afterward, however, Thomas Godfrey, of Philadelphia, laid before the society a similar invention. The case was investigated, both parties were declared entitled to the honor of invention, and each of them received a prize of £200. Hadley died Feb. 15, 1744.

**Hadramant'** (the *Adramitæ* of Strabo): the southwestern portion of Arabia Felix, but in a larger sense it includes nearly all that part of Arabia S. and S. E. of the central desert of the peninsula. The coast land is low, the interior dry, and broken with ranges of mountains and hills. In the valleys there are some torrents, which are often dry. Its people are of many tribes, subject to various local sultans. As a rule, they are not nomadic. The country affords fine horses, camels, wool, dates, gums, and grain. Copper, coal, and bitumen exist. Chief seaport, Makallah.

**Ha'drian**, or **Hadrianus**, Publius Ælius: the fourteenth Roman emperor; b. at Rome in 76 A. D.; the son of a senator, a kinsman of Trajan, who became his guardian in youth. Young Hadrian was a zealous student of Greek letters; entered the army in Spain when fifteen years old, and passed rapidly from the rank of a military tribune (95 A. D.) through the successive steps of military and civil life to the consulship, an office which he held in 109. His promotion was facilitated by the influence of the wife of Trajan, who also brought about his marriage to Julia Sabina, a granddaughter of the emperor's sister. On the death of Trajan he was proclaimed emperor, 117 A. D. His policy with regard to foreign conquest differed radically from that of his predecessor, and, realizing that the time for an extension of territory was past, he gave up the country east of the Euphrates to the Parthians, and made Armenia independent. He appeased the discontent of the people consequent upon the bloody suppression of a formidable conspiracy by the remission of all arrears in taxes and debts due the state, and by large gifts of money to the people. A large part of his reign was spent in travels throughout the empire, redressing wrongs, confirming disputed privileges, inspecting the troops and the fortifications. During one of these trips the wall of Hadrian from the Tyne to the Solway was constructed (119 A. D.). In 132 the bloody revolt of the Jews broke out, which lasted for several years, and was not ended till Palestine was almost depopulated. Athens was a favorite residence of the emperor. He rebuilt Jerusalem (134); returned finally to Rome in 135, spending a great part of his declining years in his splendid villa near Tibur. He died at Baiæ, July 10, 138 A. D. Hadrian's name is one of the most illustrious in the imperial annals. He was the first emperor, almost the first Roman, who cared for any part of the empire except Italy. He fostered peace and promoted the welfare of his people. But his private character was not free from stains, and late in his reign he was guilty of many acts of tyranny. He affected to be a poet, architect, painter, philosopher, orator, and musician. Six Greek epigrams and some quotations from a history of his own life are all that remain to us of his written works. The poems of the Latin anthology attributed to him are of doubtful authenticity. Revised by G. L. Hendrickson.

**Hadrian's Wall**: an ancient line of defenses extending from the Solway to the Tyne in the north of England. It consisted originally of a stone wall, three parallel earthen walls, two ditches or fossæ, and numerous castles and turrets connected by a military road. It bears evident marks of Roman workmanship and is commonly assigned to the time of the Emperor Hadrian.

**Hadrosau'rus** [Mod. Lat.; Gr. ἀδρός, thick, stout + σαῦρος, lizard]: a genus of fossil reptiles from the North American Cretaceous, belonging to the order *Dinosauria*, which included animals now extinct. These animals were mostly of large size, some of them being the largest of land animals, and, although true reptiles, they possessed also some characters of birds and mammals. Their affinities with the birds, as Huxley has shown, are especially seen in the large medullary cavities of the long bones, and in the structure of the pelvic arch and hind limbs. Thus the sacrum consists of several vertebræ; the ilium extends far in advance of the acetabulum, the ischium is greatly elongated, and often presents the obturator process characteristic of birds; and the *os pubis*, in some genera at least, is elongated, and its posterior branch directed downward and backward. The femur has, usually, a strong inner trochanter, and its distal end is particularly bird-like in the presence of a strong ridge between the tibia and fibula. The tibia closely resembles that of a bird, and in some genera the astragalus is ankylosed with its distal end. The latter bone is very similar to that of a bird. The metatarsals are as a rule elongate and closely fitted together; the inner and outer digits are short or even wanting; and the third digit is the longest, as in the birds. The hind legs were usually much larger than the fore legs, and ordinarily supported the body in walking. Probably the so-called bird-tracks in the Connecticut river sandstone were all made by Dinosaurs. The cervical vertebræ, in some genera, were convex in front and concave behind—a character possessed also by the dorsals, but in a less degree posteriorly. The teeth in some herbivorous forms present broad grinding surfaces, and the articulation of the jaw admitted of lateral motion, as in herbivorous mammals. Other genera were, however, carnivorous, and furnished with sharp, recurved, serrated teeth. The latter are implanted in various ways, but never ankylosed with the jaws. In their manner of life Dinosaurs seem to have resembled ordinary terrestrial mammals. Their remains are found throughout the Mesozoic or Reptilian age, at the close of which they appear to have become entirely extinct. The genus *Hadrosaurus* is one of the principal American representatives of the herbivorous group of this order. Its existence was first made known in 1858 by Dr. Leidy, who described portions of a skeleton found at Haddonfield, N. J., under the name of *Hadrosaurus foulkii*. It is related to the *Iguanodon* from the Wealden and Cretaceous of Europe. The teeth of *Hadrosaurus* are small, set in alveolar grooves separated by narrow intervening ridges. They were crowded together, both those in actual use and the successional teeth, in a quincuncial arrangement. In the upper teeth the layer of enamel was on the outer side, so that the series of teeth at the border of the jaw, as worn down by use, formed a continuous pavement sloping outward and downward, and presenting triturating points and facets of various sizes and patterns, according to the portion of the tooth that had reached the grinding surface. In the lower teeth the inner side of the crown only is covered with enamel, and forms a lozenge-shaped surface, divided by a prominent median keel. This structure and disposition of teeth indicate a vegetable feeder that masticated its food like the herbivorous mammals.

The humerus resembles that of *Iguanodon*. The bones of the forearm are similar to those of the living iguana. The bones of the hind limbs are very large in comparison with those of the fore limbs—larger than in *Iguanodon*. The entire length of this animal is estimated at over 25 feet. It moved usually upon its hind legs, and used its large tail as an additional support while it browsed upon the vegetation growing near the water where it lived. Several smaller species of *Hadrosaurus* have been found, also in the Cretaceous. O. C. MARSH.

**Haeckel**, or **Häckel**, hek'el, ERNST, Ph. D., M. D., LL. D.: naturalist and writer; b. at Potsdam, Germany, Feb. 16, 1834; educated at several German universities, and at Naples and Messina in Italy; Professor of Zoölogy in Jena 1862; chief representative of radical naturalistic evolution in Germany; a bold theorist. Author of *Natural History of Creation*, translated into twelve languages (8th ed. 1889); *The Origin of the Human Race*; *Life in the Deep Seas*; *The History of Man's Development* (1874); *Popular Lectures on Evolution* (1878); *Letters of Travel through India* (2d ed. 1884); and numerous important scientific monographs. C. H. T.

**Hæmatem'esis** [liter., vomiting of blood; Gr. αἷμα, αἵματος, blood + ἔμεσις, a vomiting, deriv. of ἐμεῖν, vomit]: vomiting of blood or hæmorrhage from the stomach; the result chiefly of ulcer of the stomach, cancer of the stomach, or extreme inflammation or congestion of the stomach, as when caused by corrosive irritants, excess of alcoholic drinks, or serious diseases of the liver. Hæmatemesis is treated by perfect rest on the back, cold packs over the stomach, and bits of ice swallowed. It must be carefully distinguished from HÆMOPTYSIS (*q. v.*).

**Hæm'atite**, or **Specular Iron Ore** [*hæmatite* is from Lat. *hemati'tes* = Gr. αἱματίτης (sc. λίθος, stone), hæmatite, liter., blood-like, deriv. of αἷμα, αἵματος, blood]: one of the most common ores of iron, distinguished by its color into red and brown hæmatite. It does not attract the magnet. These ores are composed chiefly of peroxide of iron, and are very important sources of metallic iron. They occur largely in metamorphic strata, and are found sometimes crystallized in various forms. See IRON, ORES OF.

**Hæmatocrystallin**: See HÆMOGLOBIN.

**Hæmatoglobin**: See HÆMOGLOBIN.

**Hæmatop'tysis**: same as HÆMOPTYSIS (*q. v.*).

**Hæmatox'ylin** [deriv. of *hæmatoxylon*, liter., blood-wood; Gr. αἷμα, αἵματος, blood + ξύλον, wood]: a crystalline yellow principle obtained by digesting the aqueous extract of logwood (*Hæmatoxylon campeachianum*) in ether or alcohol, and carefully evaporating it; then adding a little water and allowing the hæmatoxylin to form crystals. When pure, it is sweet to the taste. Its formula is $C_{16}H_{14}O_6 + 3Aq$. It does not have the power of dyeing cloths, but with alkaline bases fine reds, blues, and purples are produced. It exists already formed in the logwood.

**Hæmatozo'a** [Mod. Lat., liter., blood animals; Gr. αἷμα αἵματος, blood + ζῷα, plur. of ζῷον, animal]: parasitic animals which live in blood. This habit is not confined to one natural group, but is manifested by representatives of widely different types, some belonging to the nematode and trematode families of the Vermes, others to the *Gregarinidæ* and *Protozoa*. They have been found in the blood of the lower animals, such as turtles, frogs, fishes, and birds, as well as in that of the higher mammals and man. Their size is necessarily small, and often microscopic. Much remains to be learned of the whole cycle of life of all of them. In man Hæmatozoa bear close relations to several diseases. Of the lower forms, the organism now commonly recognized as the cause of malarial fever may be cited. This small animal organism, generally smaller than the red blood-corpuscles, and often inclosed within them, bears some resemblance to monads, but some also to the *Sporozoa*, so that its exact position can not as yet be determined. Species very similar to the malarial "plasmodium," as it has been termed, occur in certain birds, frogs, and other animals. An interesting form is the nematode, *Filaria sanguinis hominis*, or *Filaria bancroftii*. It is found in the circulating blood in certain diseases as a slender, thread-like body, about a ninetieth of an inch in length, and the diameter of a red blood-corpuscle in thickness. This is the embryo form, and each is incased in a shell which is hardly visible and does not impede the motions, which are very active. The adult male and female are found together somewhere in the lymphatic system. The latter is much larger than the former, and gives birth to living young or embryos, that is, is viviparous. Curiously the embryos are found in the blood only during the night, but if the patient sleep during the day and wake at night a reversal of this fact is observed. This organism causes chyluria, a condition in which the urine is milky or chylous, and elephantiasis. Another hæmatozoön, the trematode, *Distoma hæmatobium*, *Bilharzia hæmatobia*, or blood-fluke, is of importance. It occurs especially in Egypt and other parts of Africa. The embryo probably enters through impure drinking-water, and the adult is found in various parts of the venous system, especially the portal, splenic, venal, and mesenteric veins, and those of the bladder. It causes continuous hæmaturia—that is, bloody urine. Bilharz affirms that fully 50 per cent. of the lower classes in Egypt are infected with this worm. In the lower animals there are numerous Hæmatozoa, many of which do not produce recognizable diseases. See FLUKEWORMS, MIASMA, and INTERMITTENT FEVER. WILLIAM PEPPER.

**Hæmoglo'bin, Hæm'atoglob'ulin**, or **Hæm'atocrys'tallin** [liter., the substance of blood-globules; deriv. of Gr. αἷμα, blood + Lat. *glo'bus*, ball, globe, or + Gr. κρύσταλλος, ice, crystal]: a substance found in venous blood, probably in combination. It is formed by abstracting oxygen from OXYHÆMOGLOBIN (*q. v.*), either by pumping or by treating with reducing agents. By decomposition in sealed tubes oxyhæmoglobin is converted into hæmoglobin, and in this way the latter substance has been obtained in crystallized form. The water solution of hæmoglobin absorbs oxygen and oxyhæmoglobin is thus formed. In the arterial blood which has been aërated in the lungs, the hæmoglobin is in combination with oxygen, as oxyhæmoglobin, which gives the crimson color. In venous blood the "reduced hæmoglobin" causes the dark color.

**Hæmophilia**, or **Hæmatophilia** [Mod. Lat., from Gr. αἷμα, αἵματος, blood + φιλεῖν, love]: a tendency manifested in certain persons to bleed excessively after slight injury. The common name applied to such persons is *bleeders*. Hæmophilia is to a certain extent inherited, passing through the females of affected families to their male offspring, the females being rarely affected, though they transmit the disease. It manifests itself as a rule soon after birth and many children die early in life, though sometimes the tendency seems to be outgrown. The fundamental cause is unknown, but among the theories which have been offered two probably contain some part of the truth. First it is held that certain chemical defects are present in the blood, which render it less coagulable and more watery. The second theory is that there is present some disease of the blood-vessel walls, rendering them more pervious. WILLIAM PEPPER.

**Hæmop'tysis** [Gr. αἷμα, αἵματος, blood + πτύσις, spitting; deriv. of πτύειν, to spit]: the expectoration of blood from the vessels of the lungs, or from the mucous membrane of the thoracic air-passages. Hæmoptysis occurs in pulmonary consumption, in heart disease, etc. It is sometimes vicarious in cases of suppressed menses. The significance of hæmoptysis in any case can only be estimated by the trained diagnostician. A distinction is to be observed between hæmoptysis from the congested mucous membrane of the air-passages (the blood issuing from many points in the congested surface, which is not lacerated), and the far more formidable *pneumorrhagia*, when the flow is from the vessel opened in the course of pulmonary disease. It is believed by some good observers that cases of consumption which are characterized by a decided tendency to hæmoptysis are as a rule slower in progress and less rapidly fatal than other cases are. Patients rarely die from the hæmorrhage, though sudden death may occur in this way. Hæmorrhages are popularly thought to bring on consumption, but this is not the case. The hæmorrhage in these cases results from slight changes which are easily overlooked. Perfect rest, secured if necessary by morphia, such hæmostatics as ergot, gallic acid, and turpentine, with ice-bags to the chest and swallowing of lumps of ice, are recommended for the relief of hæmoptysis. Revised by WILLIAM PEPPER.

**Hæmorrhage** [Gr. αἱμορραγία, violent bleeding; αἷμα, blood + ῥαγῆναι (ῥηγνῦναι), burst]: See BLEEDING, HÆMOPTYSIS, and HÆMATEMESIS.

**Hæmorrhoids** [Gr. αἱμορροΐδες (sc. φλέβες), veins liable to discharge blood, piles; αἷμα, blood + -ροος, flowing; deriv. of ῥεῖν, flow]: See PILES.

**Hæ'res**, or **Heir** [= Lat. *he'res*, *here'dis*, heir, whence viâ Fr. Eng. *heir*]: in the Roman and the civil law, one who is the universal successor to all the property and all the rights and liabilities of a person deceased, except such as are so purely personal as to be untransferable. The *hæres* succeeded immediately to all the property of the deceased, and not merely to some specific portion, as the real estate, there being a complete fusion between the estates of the deceased and the hæres, who had to discharge all the inherited obligation or incur the infamy of bankruptcy. When legacies or devises were made to a third person he was charged with their payment out of the funds inherited. The hæres might be such either by virtue of an appointment by a testament or by operation of law on account of his connection by blood with the deceased; but the hæres could not be partly testamentary and partly intestate. The *hæres* therefore corresponded partly with the heir or devisee, and partly with the executor or trustee under the common-law system. All persons might act in this capacity except persons not Roman citizens, slaves of such persons, persons not in being at the death of the testator, corporations unless specially privileged, and a few less important classes. If a person appointed *hæres* was a slave of the testator, or was under the testator's authority (*patria potestas*) at his death, he was obliged to accept the position, but in other cases acceptance was discretionary. The severity of this necessary inheritance, however, was mitigated in the case of all but the slave by the interference of the prætor, who under certain conditions would not allow the hæres to be sued for claims against the inheritance. Revised by F. Sturges Allen.

**Hāfiz**, haa'fiz [Pers., one who knows the Kor'ān by heart]: *takhallus* or *nom de plume* of Shams ud-dīn Mohammad; Persian lyrical poet; b. at Shīrāz in the beginning of the fourteenth century.

The historical notices of his life are scanty, and the known facts of his biography are confined chiefly to a few unimportant incidents. One of the best authenticated of these is that Mahmūd Shāh Bahmani, one of the kings of the Deccan, admiring the genius of Hāfiz, endeavored by splendid presents to attract the poet to his court. Hāfiz set out from Shīrāz and reached Ormuzd in safety, but no sooner had he embarked on shipboard than a storm arose which forced the ship to put back to port. The poet proved so bad a sailor that he refused to trust himself again on the ocean, sent an ode to his royal friend as an apology for not coming in person, and returned to his home in Shīrāz. Another incident related by the Persian historians is the following: When Timur-lang (Tamerlane) had subjugated the province of Fars, in which Hāfiz's home was, he sent for the poet and took him to task for having so freely given away the conqueror's dominions in one of his well-known verses, "For the black mole on thy check I would give Samarcand and Bokhara." Hāfiz promptly replied, "Yes, sire, and it is such reckless extravagance that has made me poor as I am." Tamerlane was so pleased with the ready wit of the answer that he bestowed on the offending author some magnificent gift of royal favor. Unfortunately for the truth of the story, Tamerlane did not capture Shīrāz till at least four years after the poet's death.

From an allusion in Hāfiz's writings it is inferred that he was happily married, as one of his odes contains a lament for the death of a beloved wife. He died in the year A. D. 1388 (A. H. 791), and was buried in a garden near Shīrāz; a white marble monument was erected over the tomb, which is still an object of veneration to numerous pilgrims who visit the spot. Owing to the anacreontic and freethinking expressions which abound in his writings, Hāfiz seems to have come into disfavor with the clerical party, and they hesitated to accord him Moslem burial. A *fāl*, or omen, was taken from his own poems after the fashion of the *Sortes Virgilianæ*; the verse in the poet's works opened at random chanced to be the following:

> Shun not Hāfiz's bier, for though sunk in sin, he will yet go straight to heaven.

The coincidence was considered sufficiently remarkable to overcome the scruples of the Mollahs, and Hāfiz was honorably interred. The works of Hāfiz are still used in similar superstitious practices.

The poems of Hāfiz consist for the most part of *ghazals*—that is to say, of short odes or sonnets, consisting of from five to fifteen verses each, with the same rhyme throughout, and having the poet's *nom de plume* woven into the last couplet as a signature. A collection of such short poems, arranged in alphabetical order of the rhymes, is called in Persian literature a *dīvān*, and the *Dīvān i Hafiz* is perhaps the most famous and is the name under which the writings of Hāfiz are generally known.

Hāfiz is justly esteemed to be the greatest lyrical poet Persia has produced. His language is singularly idiomatic and beautiful; his verse is exquisitely smooth and flowing, and his thoughts and allusions are eminently national. European writers for the most part disputed whether the odes of Hāfiz are to be considered anacreontic and erotic, as they at first sight appear, or whether they are mystical and religious, as native readers and critics deem them. The fact is that both views are correct. Hāfiz, in common with nearly all his compatriot poets, belonged to the religious order of dervishes called Sūfis. This sect professes doctrines which may be fairly called the esoteric creed of Islam; steering a middle course between the pantheism of India on the one hand, and the monotheism of the Koran on the other, the Sūfis's cult is a religion of beauty, where heavenly perfection is considered under the imperfect type of earthly loveliness. He aims at elevating mankind by the contemplation of spiritual things through the medium of the most impressionable feelings. The charms of visible objects are enthusiastically described by him, but as he refers all love and beauty to the Deity, it is easy to extract an allegorical meaning from the most passionate of his utterances. This is the real secret of understanding Hāfiz's poetry; his utterances are fresh and natural, and, as he was no ascetic, it is probable that many of the passages in which he describes the pleasures of love and wine are actual records of his own experience. But the sorrows and yearnings to which he gives expression may also have been real; but, for all that, they may be read—nay more, may have been written—in an allegorical sense. As a true poet Hāfiz poured his soul into his verse; as a true mystic, he saw God reflected in the human soul.

To a person who desires to study the thoughts, manners, or language of Persia, Hāfiz is the best guide. The native editions of his *Dīvān* are so numerous that it would be difficult to make a selection, but for general use an edition lithographed at Lucknow by Munshī Nowel Kishore, proprietor of the *Audh Akhbār* newspaper, may be recommended. It is furnished with a concise and useful commentary in Persian. Of European editions, etc., there are H. Brockhaus, *Die Lieder des Hafiz, Persisch mit dem Commentar des Sudi* (Leipzig, 1855–60); Vincenz Ritter von Rosenszweig-Schwanau, *Der Diwan des grossen Lyrischen Dichters Hafiz, in Persischen Original herausgegeben ins Deutsch metrisch übersetzt, und mit Anmerkungen versehen* (Vienna, 1858); J. v. Hammer, *Der Diwan v. Mohammed Schems eddin Hafis aus dem Persischen zum erstenmal ganz übersetzt* (Stuttgart and Tübingen, 1813); J. Richardson, *A Specimen of Persian Poetry*, or *Odes of Hafiz*, with an English translation and notes (London, 1774; also a second ed., by Rousseau, London, 1802); J. Haddon Hindley, *Persian Lyrics, or Scattered Poems from the Diwan Hafiz*, with paraphrases in verse and prose (London, 1800); J. Nott, *Select Odes from the Persian Poet Hafiz*, translated into English verse, with notes critical and explanatory (London, 1787); Prof. Cowell, *The Persian Poet Hafiz*, in *Macmillan's Magazine* for Aug., 1874, No. 177, p. 251; *Selections from the Poems of Hafiz*, translated by A. H. Bicknell (London, 1875); also H. W. Clarke, *Divan of Hafiz, translated, with Comments and with Notes on the Author's Life* (London, 1891). The works of Hāfiz have never been completely translated into English. Revised by A. V. Williams Jackson.

**Hag** [presumably the same word as *hag*, witch: Germ. *hexe*]: popular name of a very low form of cyclostome fishes, including the *Myxine glutinosa* of Atlantic waters, found on

Hag.

both coasts of the U. S. northward. They live largely in the bodies of other fishes. They have a remarkable power of se-

creting slime. There are no eyes, and the ears are but little superior to the molluscan type. The six pairs of gill-sacs receive water from the gullet, and discharge it from an opening upon the ventral aspect of the fish. There are no bones, and the dorsal chord is of embryonic type. There is a portal heart. The mouth is a sucking organ, and is surrounded with barbules. A species (*Polistotrema dombey*) is common on the coast of California, and is very destructive to other fishes, boring into their bodies, devouring the muscle, leaving only the skin, skeleton, and viscera untouched.

**Hagarty**, Sir John Hawkins: See the Appendix.

**Hagberg**, Jakob Teodor, Ph. D.: poet and lingnist; b. in Stockholm, Sweden, 1825; studied at the University of Upsala; graduated 1848; in 1851 he was made a lecturer in French Literature, 1860 Associate Professor of Italian and French, and 1868 Professor of Modern European Languages and Modern Literature at the same university. He has been active as a linguistic author, translator, and poet; published an Italian grammar (*Italiensk språklära*, 1863; 2d edition 1882); translated *Trende dramer af Don Pedro Calderon de la Barca* (Three Dramas by Don Pedro Calderon de la Barca, 1870) and *Petrarcas sonetter till Laura* (Petrarch's Sonnets to Laura, 1874). Hagberg is the author of the historical dramas *Karl den tolfte* (Charles the Twelfth, 1864) and *Karl den elfte* (Charles the Eleventh, 1866). Besides, he has published *Om arten af Molières Lustspel* (The Manner of Molière's Comedies, 1851); *Hvarför es vår tid icke poetisk?* (Why is not our Time Poetical? 1852); *Om Rabelais* (1862); *Det historiska skådespelet* (The Historical Drama, 1866); *Den provençalska vitterhetens återuppståndelse, i. 19 : de århundradet* (The Resurrection of Provençal Literature in the Nineteenth Century, 1873); and other literary essays.

P. Groth.

**Hagdon**, or **Hagden**: the common name among the New England fishermen for the greater shearwater (*Puffinus major*), a bird abundant in the North Atlantic off the shores of Europe and America. F. A. L.

**Hagedorn**, Friedrich, von: poet; b. in Hamburg, Apr. 23, 1708; studied jurisprudence at Jena; was secretary to the Danish minister in London 1729–31, afterward to the "English Court," a trade association in Hamburg. He wrote poems of various descriptions. He is called the father of the German *Lieder*, and his songs, which distinguished themselves by great elegance and easiness of language and rhythm, were set to music by the leading composers of his time. He represents a French and especially an English (Prior) influence in German literature, and exercised a great and beneficial influence upon the development of lyrical art in Germany. D. in Hamburg, Oct. 28, 1755. A collected edition of his works appeared at Hamburg (1800, 5 vols.). See also H. Schuster, *Friedrich von Hagedorn und seine Bedeutung für die d. Lit.* (1882); Witkowski, *Die Vorläufer der anakreontischen Dichtung und Friedrich von Hagedorn* (1889). Revised by Julius Goebel.

**Ha'gen**: town and railway junction of Westphalia, Prussia; on the river Volme; 12 miles N. E. of Elberfeld (see map of German Empire, ref. 4–C); it has extensive manufactures of metallic wares, steel, cloth, paper, leather, and tobacco. Pop. (1890) 35,428.

**Ha'genau** [Germ., hedge-meadow]: town of Germany; in the province of Lower Alsace; on the Moder (see map of German Empire, ref. 7–C). It was founded by Frederick Barbarossa in 1164, and was formerly a fortress which played a conspicuous part in the wars between France and Austria. It has manufactures of porcelain, stoves, and cotton and woolen fabrics. Pop. (1890) 14,752.

**Hagenbach**, haa'gen-bäăkh', Karl Rudolph, D. D.: theologian and author; b. at Basel, Mar. 4, 1801; studied at Basel, Bonn, and Berlin; in 1823 became privat docent in Theology at Basel 1823, professor extraordinary 1824, full Professor of Theology 1829. He was a firm Protestant, but a man of catholic temper. Of the long list of his publications, the most important are *Encyklopädie und Methodologie der theologischen Wissenschaften* (Leipzig, 1833; 12th ed., by Reischle, 1889; Eng. trans. by Crooks and Hurst, New York, 1884; 2d ed. 1894); *Lehrbuch der Dogmengeschichte* (1840; 6th ed., by Benrath, 1888; Eng. trans. from 5th ed., Edinburgh, 1880, 3 vols.); and *Vorlesungen über die Kirchengeschichte von der ältesten Zeit bis zum 19. Jahrhundert* (1868–72, 7 vols.; n. e. by F. Nippold, 1885–87; partially trans.; *History of the Reformation* [2 vols., Edinburgh, 1878]; *History of the Church in the Eighteenth and Nineteenth Centuries* [New York, 1869, 2 vols.]). His sermons were published in Basel, 1858–75; his poems 1846 (2 vols., 2d ed. 1863). D. in Basel, June 7, 1874. See his *Life* by C. F. Eppler (Güterslop, 1875).—His father and his two brothers, Johann Jakob and Eduard, were distinguished naturalists.

Samuel Macauley Jackson.

**Hagerstown**: city; capital of Washington co., Md. (for location of county, see map of Maryland, ref. 1–C); on Antietam creek and the B. and O., the Cumberland Val., the Norfolk and W., and the W. Md. Railways; 20 miles N. W. of Harper's Ferry, 85 miles W. N. W. of Baltimore. It has manufactures of flour, machinery, agricultural implements, furniture, cigars, and fertilizers. Its railway connections make it the distributing point for a large section of country. Pop. (1880) 6,627; (1890) 10,118; (1900) 13 591.

Editor of "News."

**Hagersville**: a town of Haldimand County, Ontario, Canada; on the Michigan Central and the Port Dover Branch of the Grand Trunk Railways; 15 miles N. E. of Port Dover (see map of Ontario, Canada, ref. 5–D). Pop. 1,500. M. W. H.

**Hagga'da** [Heb., narration, plur. *haggadoth*; from *higgīdh*, relate]: the part of Jewish tradition consisting of stories, legends, etc., giving a homiletical exposition of the entire Bible, as complementary to the Halacha, which gives the legal exposition and is limited chiefly to the Pentateuch. The two make up the Midrash. See the German translation of the Midrashim by A. Wünsche (n. e. Leipzig, 1890, *sqq.*). The Haggadoth are not regarded as authoritative in their teachings. S. M. J.

**Haggai**, hag'ā-ī [Heb. *Chaggāi*, festal; derivative of *ḥāg*, festival, feast], in the Apocrypha and Vulgate Aggeus: the tenth of the twelve minor prophets of the Old Testament, and the first after the Babylonian captivity. Chronologically, he follows Jeremiah, Ezekiel, and Daniel. The rebuilding of the temple, which began under Zerubbabel in 535 B. C., had been arrested by the hostility of the Samaritans. In 520 B. C., the second year of Darius Hystaspis (521–486 B. C.), Haggai roused his disheartened and sluggish countrymen to a resumption of the work. His three messages were delivered in the sixth, seventh, and ninth months (September, October, and December) of that year. His third message contains a striking Messianic prediction, which is referred to in Heb. xii. 26. Haggai is supposed by some critics to have written also a part of the book of Ezra. In the Roman martyrology Hosea and Haggai are reckoned among the saints, and commemorated on July 4. See *Acta Sanctorum*.

**Haggard**, Henry Rider: novelist; b. in England, June 22, 1856; entered the colonial service in 1875, serving in Natal and the Transvaal till 1879, when he retired and returned to England; published (1882) *Cetewayo and his White Neighbors*, a work of a political character that made no great impression. This was followed by two novels, *Dawn* (1884) and *The Witch's Head* (1885), which, though favorably received, were not especially popular, but in 1886 *King Solomon's Mines* took the popular fancy, and gave its author a prominent place among the narrators of the marvelous. His subsequent works have had a ready and extensive sale. Among them are *She*; *Jess*; *Allan Quatermain*; *Colonel Quaritch, V. C.*; *Maiwa's Revenge*; *Mr. Meeson's Will*; *Cleopatra*; *Allan's Wife*; *Beatrice*; and *Nada the Lily*.

**Haggart**, John Graham: Canadian politician; b. at Perth, Ontario, Nov. 14, 1836. He became engaged in business as a mill-owner, and was for several years mayor of Perth; entered the Dominion Parliament in 1872; re-elected in 1874, 1878, 1882, 1887, 1891, and 1896. He was appointed Postmaster-General by Sir John Macdonald, Aug. 6, 1888, and was Minister of Railways and Canals from Jan., 1892, to July, 1896.

**Hagiog'rapha**: See Bible.

**Hagood**, Johnson: See the Appendix.

**Hague**, hāg, or **The Hague** (Dutch, *s' Gravenshaag*, or the count's meadow, or hedge): city of the Netherlands; the capital of the province of South Holland, and the residence of the king and seat of the States-General; in lat. 52° 4′ N. and lon. 4° 81′ E. (see map of Holland and Belgium, ref. 6–D). It is a very handsome city, with beautiful parks and broad streets, many of which are intersected by canals, with rows of linden-trees planted on both sides, and spanned by fine bridges. Among its most notable buildings are the Church of St. James, built in 1308, and famous for its hexagonal tower, with a chime of thirty-eight bells; the picture gallery,

containing large collections of the most excellent works of the Dutch school of painting; the Gevangenpoort, the Binnenhof, and the Buitenhof, old places of striking architecture, and interesting on account of their connection with the history of the country. In 1668 the triple alliance between England, Sweden, and the Netherlands was concluded here, and in 1717 the peace between Austria, Spain, and Savoy. A mile and a half N. from the city lies the Huis in 't Bosch, a royal summer palace, containing some of the finest frescoes and paintings by Rubens, and to the S. is the Castle of Ryswick, where the treaty was signed in 1697. The Hague, although chiefly important as the capital of the country, is also known for its metal-working, printing, and manufactures of furniture, carriages, and lace. Scheveningen, a favorite resort on the North Sea, is 2½ miles from the city. Pop. (1896) 191,530.

**Hague**, ARNOLD: geologist; b. in Boston, Mass., Dec. 3, 1840; educated at Sheffield Scientific School (Yale University), Heidelberg University, and Freiberg Mining Academy; assistant geologist on the Fortieth Parallel Survey (1867–77); Government geologist to Guatemala (1877); Government geologist to China (1878); geologist on U. S. Geological Survey from 1879; member of the National Academy of Sciences from 1885. His official works and writings have a wide range, but the volcanic rocks are his favorite theme. His principal writings are contained in *Descriptive Geology*, vol. ii., *Geological Exploration of the Fortieth Parallel* (1878), and in *Geology of the Eureka District, Nevada*, Monograph XX., *U. S. Geological Survey* (1892). Among his minor papers are *Volcanoes of Northern California, Oregon, and Washington Territory* (1883); *Volcanic Rocks of the Great Basin* (1884); *Development of Crystallization in the Igneous Rocks of Washoe, Nevada* (1886); and *Geological History of the Yellowstone National Park* (*Proc.* Amer. Inst. Mining Engineers, 1888). GROVE K. GILBERT.

**Ha-Ha Bay**: See GRAND BAY.

**Hahnemann**, haa'ne-maän, SAMUEL: founder of the system of homœopathy; b. at Meissen, Saxony, Apr. 11, 1755. When twenty years of age he entered the University of Leipzig with only twenty ducats in his possession, and took the course in medicine. He managed to eke out his scanty resources by translating medical works from foreign languages, chiefly from the English. After spending two years at Leipzig he went to Vienna, but was obliged to leave from lack of means and spent two years at Hermanstadt, where he was employed as physician and librarian to the governor of Transylvania. After this he entered the University of Erlangen, where he graduated in 1779. Subsequently he settled in Hettstadt, then in Dessau, where he pursued the studies of chemistry and mineralogy. His special work was in the toxicology of arsenic and the various chemical preparations of mercury. In 1790 he translated from the English Cullen's *Materia Medica*, and while at work upon this, it is said, he became impressed with the similarity of the effects of various substances, especially of quinine, to the diseases which it was known they would produce in healthy people. Certainly at this time he became intensely interested in the investigation of the law of "similars" in therapeutics, and made extensive researches in medical literature for corroborations of the truth which had dawned upon him. His first great paper upon this subject was published in Hufeland's journal in 1796, and was entitled *An Attempt to find a New Principle for the Discovery of the Healing Power of Medicines, with Observations on Existing Methods.* In it he propounds the "law of similars," and gives a list of drugs known to produce effects similar to the diseases they seem to cure. At this time he began to make experiments upon himself and his friends in order to obtain further knowledge of the pathogenetic power of drugs. He was then practicing medicine as district physician at Gommern, near Magdeburg, where he became utterly discouraged and disgusted with the prevailing methods of therapeutics. Although extremely poor, with scarcely means enough to support his family in the most frugal manner, he pursued his investigations with the greatest eagerness.

In 1805 he published in Leipzig, in Latin, a collection of all that was then known concerning the positive action of drugs, entitled *Fragmenta de viribus medicamentorum*, the first part of which (269 pages) consisted of the arrangement of the effects of drugs under each drug; the second part (470 pages) was an index to the first part. In 1810 he published, in Dresden, the first edition of his celebrated *Organon of Rational Healing*, a moderate work of 222 pages (the fifth edition of which was published in 1833). In 1811 he published in Dresden the first volume of the *Reine Arzneimittellehre.* This was followed in quick succession by five other volumes, the sixth being published in 1821. This was immediately followed by a second edition, the first volume of which was published in 1822 and the sixth in 1827. A third edition was subsequently published. These volumes comprise his collected observations of the effects of drugs upon healthy human beings.

In 1820 Hahnemann's revolutionary methods had aroused such an interest, the results of their application had proved to be so remarkable, and his success so great that an obsolete law was revived and he was forbidden to dispense his own remedies. He was thus driven from his home, but found an asylum with Ferdinand, the reigning Duke of Anhalt-Coethen, where he resided fifteen years. In 1828 he published a work of five volumes, known as *Chronic Diseases.* The first part is occupied with observations concerning the character and symptomatology of chronic diseases, and the subsequent volumes give the properties of various medicines which seemed to Hahnemann to be particularly adapted for their cure. In this work he discusses the famous and much-abused psoric theory. In 1835 a second edition of the same work was issued. During these years Hahnemann had been publishing various articles in Hufeland's journal. Homœopathy had been very much favored by the fact that about the year 1800 a violent epidemic of scarlatina ravaged Germany, during the progress of which Hahnemann discovered and announced the prophylactic virtues of belladonna.

When eighty years of age he remarried, this time a French lady, and moved to Paris, where he acquired an enormous reputation and practice, and on the occasion of the sixtieth jubilee of his doctorate received deputations from all parts of Europe, from hospitals, and from princely houses, congratulating him on the unprecedented and rapid spread of his methods. He died in Paris, July 2, 1843, leaving a large fortune and a mass of unpublished manuscript.

Samuel Hahnemann was essentially a reformer in medicine. It is difficult to realize the condition of therapeutics in his day and the enormous departure from old medicine, both in methods and results of the homœopathic system. It was a revolution in medicine such as the world had never seen. It spread with the greatest rapidity, and was adopted with avidity by many of the most cultivated physicians of Europe. While it is not true that Hahnemann was the first to announce the homœopathic method, since Hippocrates, long before the Christian era, distinctly stated that some diseases may be cured by the "law of similars," while others were cured by the "law of contraries," yet Hahnemann is as much entitled to be termed the discoverer of homœopathy as though Hippocrates never had promulgated this law. Hahnemann evidently apprehended the truth of the "law of similars" independently of Hippocrates, and, what is of vastly more importance, he immediately proceeded to fortify himself by investigation into the records of the past, and, when thoroughly convinced, at once began to investigate the properties of drugs in order to make the application of the law possible and universal. Baron von Stoerck, in Austria, before Hahnemann's time had made experiments with aconite and other drugs upon healthy people, but had done this without any conception of a law in therapeutics, and no practical results followed. Hahnemann, moreover, promulgated an entirely new theory concerning the preparation of drugs as affecting their action, namely, that of dynamization. Finding it necessary, in order to avoid intensely aggravating the sufferings of his patients by the application of large doses of a similar drug, Hahnemann, instead of mixing the curative drug with other drugs to counteract injurious effects, simply reduced the doses of drugs homœopathically applied, and finding the amount of the homœopathic remedy sufficient to remove morbid symptoms from his patients minute beyond all previous conceptions of the nature of drug action, adopted the working hypothesis of potentization or dynamization. By this he accounted for the wonderful action of such minute and apparently infinitesimal quantities of the homœopathic remedy, and also explained the development of drug power in substances apparently inert in their crude condition by means of subdivision and trituration of dry substances and of dilution and succussion of liquid substances. Hahnemann conceived the idea that each substance, particularly each drug, possesses a "spirit-like force," which could be developed by dynamization. This theory of Hahnemann's does not sound

so strange to those who know that substances owe their material form, physical and probably medicinal properties, to the peculiar groupings of their molecules and atoms; that substances absolutely identical as to atomic constitution possess quite different physical as well as medicinal properties when the molecules or atoms are differently grouped. This molecular force, determining the properties of substances, may reasonably be supposed to constitute the "spirit-like force" of a substance, as conceived by Hahnemann a century before the era of molecular physics and atomic chemistry. There is nothing in Hahnemann's theory of dynamization which conflicts with our present knowledge of chemistry or physics, and it may yet be proved to be true, experimentally, in the laboratory, as it seems to many of Hahnemann's followers to have been proved clinically.

TIMOTHY F. ALLEN.

**Haidarabad'**, or **Hyderabad**: a native state in the Deccan, Southern India, otherwise called the Nizam's Dominions. With the Haidarabad assigned districts, known as Berar and lying to the N., the state lies between lats. 15° 10′ and 21° 41′ N. and lons. 74° 40′ and 81° 31′ E. The area of Haidarabad is 82,697 sq. miles, and that of Berar 17,714 sq. miles, making a total of 100,411 sq. miles. The state is bounded on the N. E. by the Central Provinces, on the S. E. by the Madras Presidency, and on the W. by the Bombay Presidency. It presents great variety in surface and features. It is in general well watered, though irrigation is necessary in some places. The principal rivers are the Godavari, which with its tributaries forms the northeast boundary, and the Krishna, which in the same way forms the southeast boundary. The climate is healthful, the mean temperature about 81°, and the rainfall about 30 inches. Rice, wheat, maize, several native cereals, cotton, sugar-cane, and tobacco are grown. The silk of a wild species of worm is largely utilized. Lac, suitable for use as a resin or dye, is found in great quantities. The Deccan-bred horses are well adapted to military and general uses. Among the manufactures are ornamental wares, gold-embroidered cloths, and excellent paper. The railway line from Bombay to Madras runs through the southwestern part of the state, and a branch from this runs eastward nearly across the state to Warangal. The latter is the Nizam's State Railway, and from it a short spur extends to the capital.

Nizam is a title derived from the founder, Asaf Jah, a distinguished soldier of Aurangzeb, who in 1713 was appointed Nizam-ul-Mulk, regulator of the state. Since 1765 the British Government has cultivated friendly relations with the Nizam. He has repaid them abundantly by remaining faithful in critical times. He is the principal Mohammedan ruler in India. The population in 1901 was 2,752,418 for Berar and 11,174,897 for the Nizam's Dominions proper, making in all 13,927,215. The Mahrattas are most numerous in the west. They are usually in the employ of the Government. There are also many Sikhs, Parsees, and Arabs. The chief languages are Marathi, Kanarese, and Telugu.

The capital is Haidarabad, near the center of the state; lat. 17° 22′ N., lon. 78° 30′ E.; at an elevation of 1,827 feet above sea-level, and in the midst of an immense plain; the terminus of a branch of the Nizam's State Railway (see map of South India, ref. 4–E). It was founded in 1589, is surrounded by a wall, and is celebrated for its mosques and for the fanaticism of its Mohammedan inhabitants. The palace of the Nizam is here; it is a vast waste of edifices without character. Outside the city is the residence of the British political agency; it is one of the finest European constructions in India. Five miles N. are the British cantonments of Sekanderabad and 7 miles W. is the celebrated fortress of Golconda. Pop. of the city of Haidarabad with suburbs (1881) 231,287; (1891) 312,390.

MARK W. HARRINGTON.

**Haidarabad**: a district and city of Sindh, Bombay Presidency, British India. The district lies on the left bank of the Indus from lat. 23° 13′ to lat. 27° 15′ N.; 216 miles long by 48 broad; area, 9,053 sq. miles. It is a vast, monotonous alluvial plain, fertile near the Indus but gradually passing eastward into the desert. The district is healthful, but the climate is severe, growing worse toward the north. Agriculture is entirely dependent on inundations and irrigation. Pop. about 750,000, more than two-thirds of whom are Mohammedans. The chief town is Haidarabad, 3 miles from the left bank of the Indus, near the apex of the delta, lat. 25° 23′ N. (see map of North India, ref. 6–A). It is on the opposite side of the river from the railway, the station being Kotri. It is believed to occupy the site of the ancient Patala, founded by Alexander the Great 325 B. C. It is the commercial center of the district, and is celebrated for its manufactures of ornamental silks, silver and gold work, and lacquered ware. Pop. (1891) 57,790.

**Haidinger**, WILHELM, von: See the Appendix.

**Hai'duk, Hajduk**, or **Hayduk**: the Magyar inhabitants of the district of Hajdu Kerület in Eastern Hungary. They are Calvinists, and descendants of Bockskay's soldiers. From 1605 to about 1700 they were free from taxation and had the privileges of nobles. They are chiefly agriculturists, and are estimated to number 70,000. The name signifies "shepherds"; sometimes designates the militia of the country; and frequently is incorrectly applied to menial attendants at German courts.

**Haight**, BENJAMIN I., S. T. D., LL. D.: b. in the city of New York, Oct. 16, 1809; graduated at Columbia College 1828, and at the General Theological Seminary 1831; ordained same year, and became first rector of St. Peter's church in New York; from 1834 to 1837 was rector of St. Paul's church, Cincinnati; from 1837–46 was rector of All Saints' church, New York; from 1837 to 1855 acted as Professor of Pastoral Theology and Pulpit Eloquence in the General Theological Seminary. His connection with Trinity parish began in 1855, and in 1874 he was elected assistant rector. He received the honorary degree of LL. D. from Hobart College in 1870, and was appointed a delegate from the diocese of New York to the General Conventions of 1868, 1871, and 1874. In 1873 he was elected Bishop of Massachusetts, but was obliged, from failing health, to decline. He was secretary of the diocese of New York for twenty years, and for more than ten years a member of the standing committee of that diocese. He held the office of trustee of Columbia College from 1843. D. in New York city, Feb. 21, 1879.

Revised by W. S. PERRY.

**Hail** [M. Eng., *hayle* < O. Eng. *hægel*: O. H. Germ. *hagal* > Mod. Germ. *hagel* < Teuton. *hagl-* < Indo-Eur. *kaghlo-*; cf. Gr. κάχληξ, pebble]: small masses of ice which fall from the clouds. Frozen precipitation from the air may be snow, which is in crystals; sleet, in part liquid and and in part frozen; ball-snow, small opaque balls, like small shot; and hail. Snow belongs to the winter season, ball-snow to the spring and autumn, and hail to the summer, while the occurrence of sleet is more a question of climate than season. Hailstones vary much in size, form, and constitution. In size they are generally from that of peas to hazelnuts, but they sometimes reach the size of walnuts or even of hen's eggs, and there are a few fairly authentic records of storms in which hailstones of much greater size have fallen. The forms are extremely varied. The commonest is that of a lens or flattened sphere, but they are often angular, or knobby, or irregular, and are sometimes massed together like a bunch of grapes. They are generally symmetrical about one axis, which is probably the vertical one during the fall, and the upper surface is often different from the other, being rougher, more irregular, streaked, sometimes spirally. Perfect spheres are rare in hail. The surface is usually opaque, and sometimes has a rough, floury look. The nucleus is sometimes an opaque ball; the rest of the stone is usually transparent ice, and may be in layers like an onion, or with an obscure radiating crystalline structure, or without apparent structure, or with these arrangements in separate layers. Microscopic analysis shows the existence in the stones of numerous minute air-bubbles and of a small number of minute foreign bodies, and analysis by melting shows the ultimate structure to consist often of minute globules of ice. The stones are elastic, and rebound when they strike rock or pavement. They clash together in the air, so that the sound of an approaching or retreating hail-storm is very characteristic. Their size, which is larger than that of ordinary raindrops, permits them to have a great velocity in falling through the air, and this, with their solidity, makes hail-storms destructive. Not only do they break windows, but the larger stones beat down crops, tear the foliage from trees, and kill delicate animals. The stones generally fall obliquely, and sometimes they are driven nearly horizontally with such speed as to make round holes through panes of glass without shattering. The explanation of the formation of hail presents many difficulties. The prevailing theory is that powerful ascending currents carry raindrops or ball-snow upward, where they are frozen and chilled, forming bodies on which

rapid condensation takes place when they fall to a warm and moist stratum below. This process may be often repeated before the stone escapes from the turmoil and reaches the ground. This would explain the successive layering of structure so often found, but would not explain the angularity of many stones. See HAIL-STORM.

MARK W. HARRINGTON.

**Hailes**, Sir DAVID DALRYMPLE, Lord: judge, historian, and critic; b. in Edinburgh, Oct. 28, 1726; grandson of Viscount Stair; was educated at Eton and Utrecht; became a Scottish advocate Feb. 23, 1748; made a judge of the court of session in 1766, with the title of Lord Hailes, but was never a peer; became a lord of justiciary 1776. D. of apoplexy, Nov. 29, 1792. His works relate mostly to the history of Christianity or to the antiquities and history of Scotland, and his most important work is *Annals of Scotland* (1776–79); among his other numerous works are *Canons of the Scottish Church*; *Remains of Christian Antiquity* (1776–80); *An Inquiry into the Secondary Causes which Mr. Gibbon has Assigned to the Rapid Growth of Christianity* (1786), etc. See memoirs in later editions of the *Inquiry*; Boswell's *Life of Johnson*; Brunton and Haig's *College of Justice*. F. STURGES ALLEN.

**Hailes of Eton**, JOHN: See HALES, JOHN.

**Hailmann**, WILLIAM N.: See the Appendix.

**Hail-storm**: a storm in which hail falls. Hail-storms are secondaries (to cyclones or general storms) or local storms, of which the thunder-storm, tornado, and cloud-burst are other types. They are usually found to the S. or S. E. of a "low" or general storm, and several hundred miles from the center of the latter. They belong to the summer months and to sultry or humid weather. Hail-storms usually occur in the afternoon or early evening, and are followed by cooler weather. The barometer rises rapidly a few hundredths of an inch as the storm passes over. These storms are more common in temperate regions than in the tropics. Hail generally falls over only a narrow strip of land, which usually extends from S. W. to N. E., but the storms show themselves to be sensitive to local conditions. Hills form obstacles to their free motion, and they even avoid forests. Usually they are accompanied by marked electric phenomena, and indeed appear to be only intense thunder-storms. The theory of their mechanism is that they are small aspiration storms, like tornadoes, but this does not satisfactorily explain all their phenomena. See HAIL. MARK W. HARRINGTON.

**Hainan**, hī'năăn' (literally, south of the sea, i. e. of the sea or strait which separates it from the mainland): a large island belonging to China and separated from it by a shallow channel, 12 miles wide, which connects the Gulf of Tonquin with the China Sea. The name dates from the beginning of the Yuen dynasty (1280–1368), when the island formed the southern portion of a *tao* or circuit, which included the peninsula of Lei-chow, which lies to the N. of that channel and was called *Hai-peh*. Since 878 it has been known to the Chinese chiefly as K'iung-chow, from k'iung, a variety of jade found in its hills. It extends from 17° 52′ to 20° 8′ N. lat., and from 108° 36′ to 111° 15′ E. lon. Its greatest length (from N. E. to S. W.) is about 160 miles, and its breadth is 90; area, 13,600 sq. miles.

*Physical Features.*—The island is mountainous. The central mass, called Wu-chih-shan, or Five-Finger Mountain, takes its name from the five important spurs which it sends out. The highest peaks probably do not exceed 7,000 feet, but heights which reach above the snow-line are spoken of. The mountains are covered with dense forests, in which the tiger and other wild animals roam, but which have never been penetrated except by the Li or aboriginal inhabitants, who have for 2,000 years maintained their independence against the Chinese.

*Soil, Productions, etc.*—The country is well watered and the soil fertile. The chief river is the Ta-Kiang, which rises in the mountains of the interior, and flows N. E. into the Bay of Hoi-how. Sugar-cane, sesame, cotton, tobacco, and indigo flourish, as do mangoes, bananas, lichis, and other tropical fruits. The areca-palm grows everywhere, and the cocoanut-tree attains a height of 70 to 80 feet. The chief exports are sugar, sesame oil, fragrant woods, betel-nuts, cocoanuts, cocoanut-fiber, China-grass, and hides. Copper, lead, and silver are found, and gold is said to abound.

*Divisions.*—The island forms a department of the province of Kwang-tung, and is divided into 3 chow and 10 hien districts, each with its walled city either on the coast or within 20 miles of it. The capital is K'iung-chow-foo, situated near the northeast coast; lat. 20° 2′ 26″ N., lon. 110° 4′ 40″ E. In the treaties of 1858–60 it is designated as a treaty-port, but was not formally opened to foreign trade until 1876. The shipping lies off Hoi-how, 3 miles distant. See HOI-HOW.

*Inhabitants.*—The aborigines, a small, timid people of coppery color, occupy the mountains of the interior, from which they come down at stated times to the barter-stations to trade with the Chinese, giving deerskins, deerhorns and sinews, the skins of the scaly ant-eater and of other animals, buffalo-hides, rattans, timber, betel-nuts, etc., in exchange for manufactured articles and the productions of the plain. Money is unknown among them. They differ considerably from the aborigines of Formosa, and are more nearly allied to the Miao-tse of the mainland. The women wear a serang, or short skirt, part their hair in the middle, and tattoo their faces when engaged to be married. The young people make their own matches. The men wear a kind of apron before and behind. These are the sŭng-li, or "untamed" savages. The Chinese inhabit the coasts, while the Siao-li, who early submitted to the Chinese, but do not wear the queue, and the Miao-li, descendants of some aborigines from Kwangsi on the mainland, who settled on the island some centuries ago, inhabit the lower hills and engage in farming and pasturing cattle. The Miao-li dress somewhat like the Chinese, and wear the queue in token of their submission to Chinese rule. Many Hakkas are also found. Hainan was first settled by the Chinese in 110 B. C., and subsequent years by 23,000 military families. In 1370 the population was 291,030; in 1835 it was 1,350,000; and it is now estimated at 2,500,000.

Sû-t'ung-po, the famous poet and statesman, was banished to Hainan in 1097 and spent three years on the island, which is further noted as the birthplace of Hwang-tao-p'o, the woman who, about the close of the fourteenth century, taught the women of China to spin and weave the cotton which had just been introduced into China by the Mongols.

R. LILLEY.

**Hainaut** (formerly **Hainault**), ā'nō': province of Belgium; bounded W. and S. by France, E. and N. by the provinces of Brabant and Flanders. Area, 1,437 sq. miles. Pop. (1896) 1,100,345. The southern and eastern parts are hilly, occupied by the Ardennes; the northern and western parts are flat, but exceedingly fertile. The region around Mons contains very extensive coal-fields, and coal, together with porcelain, flax, hemp, tobacco, and linen, forms the main export. The old province of Hainault comprised also a territory which in 1678 was ceded to France, and now forms the department of the North.

**Hainburg**, hīn'boorch (anc. *Carnuntum*): town of Austria; in the province of Lower Austria; on the Danube; 27 miles S. E. of Vienna (see map of Austria-Hungary, ref. 5–E). It contains many interesting remains of antiquity, among which are a Roman aqueduct which provides the town-market with water, and the so-called Roman tower with the statue of Attila; and has an imperial manufactory of tobacco, employing over 1,500 persons. Pop. (1890) 5,075.

**Haiphong**, hī'fōng': the chief shipping-port for Tonquin, China; in lat. 20° 52′ N., lon. 106° 40′ E.; 14 miles from the sea in the delta of the Songka river, on a channel connecting the Cuakam and Cuatrai mouths, and in connection by steamer with Hanoi, the capital. It consists of houses and huts in swampy ground on both sides of the channel. A French official resident is stationed here, and coal mines are worked at Hongay, near by. Its prosperity has fallen off in consequence of French military operations near it. Pop. about 7,000, less than 1,000 Chinese, and about 150 French.

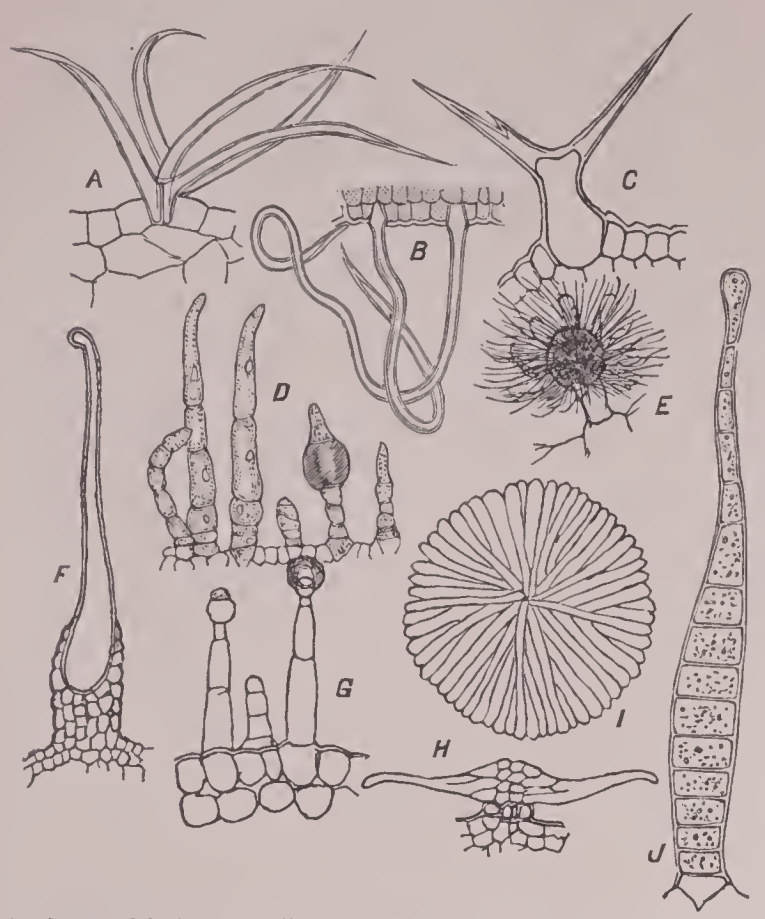
MARK W. HARRINGTON.

**Hair**: See KERATIN and HISTOLOGY.

**Hair, Diseases of**: See BALDNESS and BARBER'S ITCH.

**Hairs** (of plants): processes of many of the external cells of the larger plants, resembling hairs, and technically known as *trichomes*. Strictly speaking, these terms are restricted to such outgrowths from the outer layer of cells alone, and they are often confined to those which originate in a single cell, but between these simple forms and the massive outgrowths which involve several or many cells in area and depth no sharp line of demarkation can be drawn. Many hairs are single cells, which may be unbranched, or they may be branched. Root-hairs are of this kind, branching little if at all, and having very thin walls. More commonly

they are composed of a row of cells (D and J in the figure), and these again may be simple, as in the examples cited, or they may be more or less branched, a notable example being the much-branched hairs of the mullein (B). In glandular




A, clustered hairs of mallow; B, woolly hairs of hollyhock; C, stellate hair (in section) of *Camelina*; D, jointed hairs (one glandular) of *Cucurbita*; E, dusty-glandular hair of a fern (Gymnogramme); F, stinging hair of nettle; G, glandular hairs of primrose; H, sectional, and I, top view of shield-shaped hair of *Shepherdia*; J, a common form of hair, glandular above (from *Cistus*).

hairs (D and J) certain cells, usually the terminal one, or more, secrete a gummy, waxy, or oily matter, as in the primrose, petunia, tomato, etc. In stinging hairs the cell-sap contains an irritant poison which escapes by the breaking of the point of the cell, as in the nettle (F).

The uses of hairs are many. When young they are often aërating organs, exposing a large surface of living cells to the air. In many cases they protect the surface against the direct action of dry air, as in many white-woolly plants of the great plains of the U. S. Shield-shaped hairs (scales) doubtless have the same function. Glandular hairs are protective against insects and other animals, as are also the prickly and stinging hairs. Root-hairs are organs of absorption, and supply the plant with a large part of its watery solutions. The hairs on seeds, as in cotton, cottonwood, etc., are for the purpose of distributing the seeds by attaching them to moving objects, or by floating upon water or air currents. The hairs of the cotton-seed are long cells which soon lose their protoplasm, leaving them as flattish, collapsed tubes. For their economic importance, see FIBER.

CHARLES E. BESSEY.

**Hair-spring**: in a watch, the delicate spiral steel spring, the outer extremity of which is attached to the frame of the watch, the inner to the verge (or axle) of the balance-wheel, supplying the force for resisting the successive impulses given by the teeth of the escapement-wheel, and converting them into isochronous vibrations. The perfect manufacture (tempering included) of these springs, finer than hair (the combined weight of 4,000 being required to make an ounce), is one of the essentials to producing correct timepieces. See WATCHES.

**Hair'tails**: fishes of the family *Trichiuridæ*, genus *Trichiurus*. The silvery hairtail, *T. lepturus* (ribbon-fish, sword-fish), is from 2 to 4 feet long, of a shining, silvery color, and is caught along the Atlantic shores of the U. S.

**Hairworm**: See GORDIUS.

**Haiti**, or **Hayti** (Fr. *République de Haïti*): a republic occupying the western and smaller portion of the island of Santo Domingo, West Indies. For physical features, see SANTO DOMINGO.

*Area, Population, etc.*—The boundary with the Dominican republic is not well established. The best estimates give an area of 10,204 sq. miles, and an ecclesiastical census taken in 1894 gave the population as 1,210,625. Nine-tenths of the people are Negroes, or of nearly pure African blood, and nearly all the rest are mulattoes; the number of whites is very small, and they are prohibited by the constitution from holding real estate. The state religion is Roman Catholic. There are a few Protestant missionaries, who are tolerated. Forms of voudoo, or demon worship, are said to be practiced secretly in the interior, and there are stories of human sacrifices in connection with them; but such practices can only exist among the most debased class. Primary education is free, and there are over 400 national schools, but most of them are poor; the better classes send their children to private schools, of which there are many, and rich young men often finish their education in France or the U. S. The official language, and that of educated persons, is French; commonly a debased French patois is spoken. There is a constant rivalry between the Negro and mulatto inhabitants. The latter, though comparatively few in numbers, are socially and intellectually far in advance, and a large proportion of the property is held by them. While the mass of the people are ignorant, and easily led by political demagogues, Haiti has some statesmen, authors, lawyers, physicians, and merchants who would be an honor to any country, and who give bright hope for the future.

*Government and Finances.*—The government is republican. The constitution, founded on that of the U. S., has been several times changed and revised; the last revision was that of Oct. 9, 1889. The chief executive officer is a president, nominally elected by the people for seven years; practically he is generally chosen by congress—sometimes by the army—and his term is very liable to curtailment by revolution. He is assisted by a cabinet. Congress consists of a senate and a house of representatives, the latter elected for five years by the people; the thirty senators are chosen for six years by the house, from two lists presented by the executive and the electoral colleges. The only qualification for suffrage is a visible occupation. The republic is divided into five departments, and these again into *arrondissements* and *communes*. The capital, Port-au-Prince, is also the seat of the ecclesiastical chief, an archbishop. The highest judicial power is the tribunal of cassation at Port-au-Prince; there are civil and criminal courts in the principal towns. Owing to civil wars and the struggle with the Dominican republic the finances of Haiti have long been in very bad shape, and doubtless matters have often been made worse by bad management if not by irregularities. Under President Hippolyte affairs sensibly improved. On Jan. 1, 1899, the external debt was $13,141,751 in gold: the internal debt, $4,407,055 in gold, and $9,227,713 in currency. There were in circulation in 1899 $3,749,000 in paper money, and $3,500,000 silver gourdes, together with $225,000 in copper, and $1,200,000 in American gold. The revenue for the year ending Sept. 30, 1899, was estimated at $5,626,260 in currency and $2,337,205 in gold, and the expenditure, $5,633,068 in currency and $2,325,284 in gold. The Haitian dollar, or *gourde*, is equal to nearly 4*s.* sterling, or 96·5 cents U. S. currency. The national paper currency is depreciated, and subject to fluctuations; at the end of 1892 the paper dollar was quoted at 81½ cents. American and French gold and silver are freely used, and the Bank of Haiti issues notes.

*Industries and Commerce.*—Agriculture is the chief industry, all the trade of the republic and the few unimportant manufactures depending on it. In general, the methods of cultivation in use are very primitive, and there are few improved plantations. Coffee is the most important product. Cacao, cotton, tobacco, a little sugar-cane, maize, and the ordinary tropical fruits and vegetables are cultivated. Mahogany, logwood, and other timbers are obtained in the forest. The export of coffee in the year ending Sept. 30, 1898, was 67,437,593 lb.; of cacao, 4,037,129 lb.; of cotton, 1,276,946 lb.; of logwood, 66,603,168 lb. Minor exports, hides and skins, honey, and mahogany. In 1900 the exports to the U. S. amounted to $1,184,797; imports from the U. S., $2,296,689. Haiti has no railways, few good roads, and a very inadequate telegraph system. European and American steamers touch regularly at Port-au-Prince, Gonaïves, and Jacmel.

*Weights and Measures.*—The French metric system is used for measures, and to some extent for weights, for which, however, the old French system is still generally in vogue.

*History.*—(For history up to the separation of the Dominican republic in 1844, see Santo Domingo.) After the fall of Boyer in 1843 a period of confusion followed in the western part of the island. Hérard, Guerrier, and Pierrot successively held the presidency for brief periods; but in the constant struggle between the blacks and mulattoes there was little chance for peace. In 1846, under President Riche, a republican constitution was proclaimed, which has been the basis of succeeding ones; but in 1847 Riche was overturned by the Negro Soulouque, who, in 1849, proclaimed himself emperor as Faustin I. His tyranny and ridiculous vanity excited the hatred of the better classes, and especially of the mulattoes, who repeatedly revolted. He renewed the war with the Dominican republic, ruined the finances, provoked quarrels with foreign countries, and endeavored to establish a government monopoly of sugar and coffee. At length the mulatto Gen. Geffrard, whom he had condemned to death, revolted, and was proclaimed president at Gonaïves, Dec. 22, 1858. Soon afterward Soulouque was routed, and Geffrard re-established the constitution of 1846, with some changes. He was overturned in 1867 by Salnave, who on June 14 of that year promulgated a new constitution. Salnave was deposed and shot Jan. 15, 1870. He was succeeded by Nissage Saget (May, 1870), Dominique, and Boisrond-Canal. Salomon became president Oct. 22, 1879, and was re-elected in 1886, but deposed in 1888. A civil war between rival aspirants for the presidency resulted in the ascendency of Télémaque until the election of Hippolyte Oct. 9, 1889. Hippolyte died Mar. 24, 1896, and was succeeded in April by Gen. Tiresias Augustin Sam.

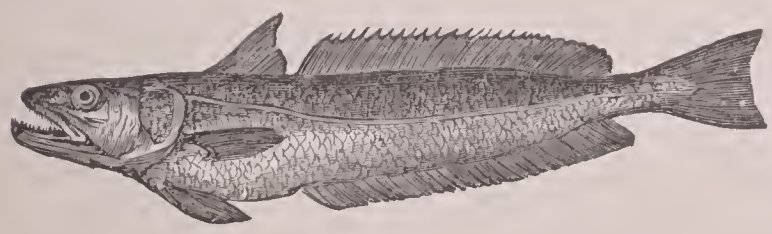
Bibliography.—(See also under Santo Domingo) Danté Fortunat, *Nouvelle géographie de l'île de Haïti* (1888); Handelmann, *Geschichte von Haiti* (1856); St. John, *Haïti, or the Black Republic* (1884); Gustave d'Alaux. *L'Empereur Soulouque et son empire* (1856); Bonneau, *Haïti, ses progrès et son avenir* (1862); La Selve, *La République de Haïti* (1871); Eldin, *Haïti, Treize ans aux Antilles* (1879); Hazard, *Santo Domingo, Past and Present, with a Glance at Hayti* (1873); Tippenhauer, *Die Insel Haiti* (1893).

Herbert H. Smith.

**Hajji**, or **Hadji**, **Khalifah** [from Arab. *hajj*, pilgrimage, deriv. of *hajja*, set out, go on a pilgrimage; cf. *hājjī*, pilgrim; *Khalifa*, successor]: the surname, or rather the title, of the Turkish historian and scholar Mustafah-ben-Abdallah. He was born in Constantinople toward the close of the sixteenth century, and died there in 1658. He held a government position, and in that capacity he accompanied the Turkish army in several campaigns. In 1638 he made a pilgrimage to Mecca, and on his return took the cognomen Hadji. In 1642 he resigned his position in order to devote himself exclusively to science and literature. About 1648 he became assessor (Khalifah) to the principal of the Imperial College. His principal works are *Lexicon Bibliographicum et Encyclopædicum*, containing the most complete bibliographical representation of the Persian and Arabic literatures, originally written in Arab, but translated into Latin by Flügel (Leipzig, 1835–54, 6 vols. in quarto); a *History of the World from the Creation to 1655*, principally occupied with the deeds and exploits of Asiatic dynasties; a *History of the Ottoman Empire*; and a *History of the Maritime Wars of the Turks*, which has been twice translated into English, first from the Persian version, and afterward from the Turkish original, by James Mitchell (London, 1831).

Revised by C. H. Toy.

**Hake** [M. Eng. *hake*, name of a fish; cf. Norweg. *hakefisk*, hook-fish, from shape of under jaw; Norweg. *hake*, hook; cf. Germ. *haken*. It is uncertain whether the word is of Scandinavian origin or English]: a name applied to the



Hake.

*Merluccius merluccius*, a fish of the cod family, caught along the coasts of North America and Europe. They are both coarse and poor. The name *hake* is also given in the U. S. to species of forked hake (*Phycis*) or Forked Beards (*q. v.*).

Revised by D. S. Jordan.

**Hakim-Ben-Allah**, haa'kim-ben-aal'laah' [Arab. (just), ruler, son of Allah], or **Ben-Ha'shem**: an Arabian impostor of the eighth century; also known under the name of Mokanna (the veiled) and Segende Nah (the moon-maker). The former of these surnames he received from his habit of wearing a veil before his face in order to hide his ugliness, or, as he said himself, in order to conceal the radiance of his eyes; the latter from a trick of legerdemain he once performed, causing a luminous body resembling a moon to issue from a deep well and remain visible for a whole week. He succeeded in gathering a number of adherents, with whom he seized several strong places near Nekshib and Kish. The Caliph Mahdi sent an army against him, and soon all his strongholds were taken. Shut up in the last of his fortresses, he poisoned his soldiers by wine at a banquet, and burned himself up in order to make people believe that he had ascended bodily to heaven. Moore has used the story of Hakim-Ben-Allah's life for the episode of the Veiled Prophet of Khorassan in *Lalla Rookh*.

Revised by J. R. Jewett.

**Hakkas** (literally, stranger families): a class of hardy and industrious but despised and much-persecuted people found in Southern China, chiefly in the provinces of Kwangtung and Fuh-kien, whence they have spread to the neighboring islands of Formosa, Hongkong, and Hainan. Their origin is unknown. They are supposed, however, by those who have studied their family records to be the descendants of certain bodies of Chinese who were early compelled by "bloody persecutions," or by the oppressions incident to the political disturbances of their own times (the third century B. C. is mentioned), to abandon their homes in Shantung and other northern provinces, and to seek peace and safety in the south. From the first they seem to have been the objects of much hostility on the part of the punti, or native populations, among which they tried to settle as they moved southward, and hundreds of thousands of them have lost their lives in the persecutions to which they have been subjected for centuries. The reasons for this hostility are as little known as are the causes of their migration southward.

The language of the Hakkas differs widely from the other dialects of the southern provinces, and is more akin to the "Mandarin," or official dialect spoken in the north. Their customs and dress also differ. The sexes are not so strictly separated in domestic life as they are among the other Chinese, and the women do not bind their feet.

The total number of Hakkas is not known. In the province of Kwangtung they form one-third of the population, and the prefecture of Kia-ying-chow in that province is entirely peopled by them. In many other localities they form from one-third to one-half of the population. Several thousands are found in Hongkong, where they are employed as stonemasons, blacksmiths, porters, barbers, etc. In 1891 out of a Chinese population of 227,989 Chinese found in the Straits Settlements, 16,736 were Hakkas. Hung-siu-tsiuen, the originator and the head of the Taiping rebellion, and most of his generals were Hakkas, but the great body of the Hakkas found in Kwangtung remained loyal to the Government. The Hakkas of Kia-ying-chow are noted for their learning. See the Hongkong *Daily Press* for 1886; *Notes and Queries on China and Japan*, vol. i.; *The China Review* (vol. ii., Hongkong, 1873–74); *The Chinese Recorder* (vol. ix., Shanghai, 1878); and *Things Chinese* (London and New York, 1893). R. Lilley.

**Hakluyt**, hak'loot, Richard: writer on geography; b. in London in 1553; studied at Oxford. He was master of arts and professor of divinity when in 1584 he accompanied the English ambassador to Paris, and there he published in 1587 an account of a voyage to Florida by Laudonnière, which he found in the library; also Peter Martyr's work, *De Novo Orbe*. But the greater part of his reputation he owes to his *Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation* (3 vols., 1598–1600), in which are accounts of 220 voyages, accompanied with many curious documents. He became prebendary (1602) and archdeacon (1603) of Westminster; subsequently was rector of a church at Wetheringset, Suffolk. In 1609 he published a translation of Fernando de Soto's discoveries in Florida, entitled *Virginia Richly Valued*. He died in London, Nov. 23, 1616, and was buried in Westminster Abbey. The Hakluyt Society was established in London in 1846 for the purpose of preserving and editing accounts of geographical or historical interest.

**Hakodate**, hăă-kō-daa'tā: a seaport of Japan, and the principal city in the island of Yezo; finely situated on the northern slope of a lofty hill known as the Peak (1,106 feet), and partly on the isthmus which joins the hill to the mainland (see map of Japan, ref. 3–E). The harbor, which is landlocked and magnificent in its proportions, attracts the trade in fish, seaweed, and other marine products of the whole Yezo coast; it is also a favorite naval resort. Hakodate is one of the open ports; has a small foreign settlement, several consulates, a Roman Catholic cathedral, a Greek church, and Protestant churches and schools. The fort in the immediate neighborhood, where the adherents of the Tokugawas made a final stand in 1868, is still in existence. There is daily steam-communication with Awomori, across the Straits of Tsugaru. Amount of exports in 1890, $5,088,710; of imports, $5,080,220. Native pop. (1890) 45,477; foreigners (not Asiatics), 40; (1895) 50,314. J. M. Dixon.

**Hakone**, hăă-kō'nā: a village and lake in Japan; on the shore high road between Tokio and Kioto; about 60 miles S. W. of the former city, and 2,100 feet above sea-level. Here the emperor has a summer residence on an island in the lake, and it is a favorite summer resort of foreigners.
J. M. D.

**Halacha** [Heb., rule of procedure, deriv. of *halakh*, go]: the Hebrew oral and traditional law, handed down, as Jews believe, from Moses and the other eminent teachers of antiquity, and first reduced to writing in the early centuries of the Christian era. The general code is called Mishna (*q. v.*), but the Halacha is much more extensive.

**Hal'berd** [from O. Fr. *halebarde*: Ital. *alabarda*, of Teuton. origin; cf. M. H. Germ. *helmbarte*; *helm*, handle (: Eng. *helm*, tiller) + *barte* > Mod. Germ. *barte*, broadax]: a weapon combining a long cutting edge on one or on each side with the head of the lance, and mounted on a long handle. During the Middle Ages and the sixteenth century it assumed many different forms, some extremely irregular and fantastic. It was once borne by bodies of troops called halberdiers and by various non-commissioned officers. Its use is now limited to ceremonial occasions. In Great Britain the partisan, one form of the halberd, is borne by the Yeomen of the Guard. Revised by Russell Sturgis.

**Hal'berstadt**: town of Prussia; in the province of Saxony, on the Holzemme; 29 miles S. W. of Magdeburg (see map of German Empire, ref. 4–F). It is an old town; many of its houses are ornamented with curious wood-carvings. Its cathedral, rebuilt in the thirteenth century, and restored between 1850 and 1871, is in the finest Gothic style, and contains many interesting antiquities; the Church of Our Lady, built in the eleventh century, is in the Byzantine style. Halberstadt has considerable manufactures of soap, oil, leather, gloves, etc. The most important educational institutions of the town are the gymnasium, which has a library, a first-class Realschule, the normal school, the deaf and dumb institute, and the provincial trade school. Pop. (1890) 36,501.

**Halbertsna**, Fjalling: gynæcologist; b. at Sneek, in Holland, July 15, 1841; educated at Universities of Leyden, Tübingen, Vienna, and Paris; professor in the University of Groningen 1866–67; since professor in the University of Utrecht; author of *The Services of the English to Gynæcology* (1867); *On Ovariotomy* (1873); *On Craniotomy* (1874), all published in Dutch; and several important professional essays and monographs. C. H. T.

**Halcyon**: See Kingfisher.

**Halcyone**: See Alcyone.

**Haldane**, James Alexander: clergyman; brother of Robert Haldane; b. at Dundee, July 14, 1768; educated at Edinburgh; in the navy 1785–94; began lay-preaching 1797; was ordained Congregational pastor in Edinburgh 1799, and continued there till death, Feb. 8, 1851. In 1808 he became a Baptist. He published numerous controversial works.
S. M. J.

**Haldane**, Robert: philanthropist; b. of Scottish parents in London, Feb. 28, 1764; served 1780–83 in the royal navy; was converted to Christianity, of the divine origin of which he had entertained doubts, and devoted his life and large fortune thenceforth to missionary work. Forbidden in 1796 by the East India Company to work in India as a missionary, he became a lay-preacher, and his field-preaching roused great religious feeling in Scotland. In 1799 he left the National Church and joined the Congregationalists, and in 1808 the Baptists. He built many "tabernacles" or places of worship, did much for the African and French missions, and for the Bible and continental evangelical societies. Among his works are *Evidence and Authority of Revelation* (Edinburgh, 2 vols., 1816; 2d ed. 1834); *Exposition of Romans* (3 vols., 1835; new edition, New York, 1853); *Books of the Old and New Testament Proved to be Canonical and their Verbal Inspiration Maintained and Established* (1830; 5th ed. 1845), etc. D. in Edinburgh, Dec. 12, 1842. See *Memoirs of R. and J. A. Haldane*, by Alex. Haldane (1852; 4th ed. 1855). Revised by S. M. Jackson.

**Hal'deman**, Samuel Stehman, A. M., LL. D.: naturalist; b. near Columbia, Pa., Aug. 12, 1812; pursued his studies at Dickinson College until 1830; was chosen assistant in the New Jersey Geological Survey (1836), and held the same office the ensuing year in the Pennsylvania Geological Survey. While engaged in this capacity he discovered the oldest fossil known at that time—viz., *Scolithus linearis*. He occupied the chair of Natural History in the University of Pennsylvania (1851–55); took the corresponding professorship in Delaware College 1855, and in the same year became Professor of Geology and Chemistry at the Agricultural College of Pennsylvania; was Professor of Comparative Philology in the University of Pennsylvania. His work entitled *Analytic Orthography*, which consists of investigations into the philosophy of language, obtained for him in England the highest Trevellyan prize over eighteen competitors (1858). D. at Chickies, Pa., Sept. 10, 1880.

**Hale**, Benjamin, D. D.: educator; b. at Newbury, Mass., Nov. 23, 1797; graduated at Bowdoin College (1818) with high honors, and at once became principal of the Saco Academy; studied theology at Andover Seminary, and began preaching in 1822; was elected tutor at Bowdoin College 1823, and principal of the Gardiner Lyceum 1822–27; in 1827 became Professor of Chemistry and Mineralogy at Dartmouth College, Hanover, N. H., remaining until the office was abolished by the trustees in 1835; took orders in the Protestant Episcopal Church; was chosen president of Geneva (now Hobart) College in 1837. He was author of *Scriptural Illustrations of the Liturgy* (1835); *Liberty and Law* (1838); *Education in its Relations to a Free Government* (1838); *Historical Notices of Geneva College* (1849); and other works. His *Life*, with selections from his sermons, was published by the Rev. Malcolm Douglass, D. D., in 1883. D. at Newbury, Mass., July 15, 1863.
Revised by W. S. Perry.

**Hale**, Charles Reuben, S. T. D., LL. D. (Griswold College, 1889): Episcopalian bishop; b. at Lewistown, Pa., Mar. 14, 1837; graduated from the University of Pennsylvania, Philadelphia, 1858; chaplain in the U. S. navy 1863; rector of churches in Pennsylvania, New York, and Maryland 1870; 1886–92 Dean of Davenport, Ia. He was secretary to the Italian Church reformation commission 1869; secretary to the Russo-Greek committee 1871; clerk to the commission of the House of Bishops on correspondence with the hierarchs of the Eastern Churches 1874; and with the Old Catholics 1873; secretary (for America) of the Anglo-Continental Society of England 1874; secretary to the commission of the General Convention on ecclesiastical relations 1877. In theology he was an Anglican. His published writings include *Reports* (of the Russo-Greek committee, New York, 1872 and 1875; of the committee on ecclesiastical relations, New York, 1881 and 1884); *Paper* (on the Russian Church, read before the Church Congress, Leicester, England, 1880; republished, Baltimore, 1881); *Sermons* (in St. Timothy's church, New York city, 1874, by appointment of the Most Rev. the Primus of Scotland, Oct. 5, 1884); *Report of the Committee appointed by the Philomathean Society of the University of Pennsylvania to Translate the Inscription on the Rosetta Stone* (privately printed, Philadelphia, 1858; 2d ed. 1859); *A List of all the Sees and Bishops of the Holy Orthodox Church of the East* (New York, 1872); *The Mozarabic Liturgy, and the Mexican Branch of the Catholic Church of our Lord Jesus Christ Militant upon Earth* (New York, 1876); *Russian Missions in China and Japan* (1878); *An Order for the Holy Communion, arranged from the Mozarabic Liturgy* (Baltimore, 1879; two supplements to the above 1879); *An Office for Holy Baptism, arranged from the Mozarabic and Cognate Sources* (1879); *The Universal Episcopate: a List of the Sees and Bishops in the Holy Catholic Church throughout the World* (Baltimore, 1882); *The Eucharistic Office of the Christian Catholic Church of Switzerland, Translated and Compared with that*

*in the Missale Romanum* (New York, 1882). He was consecrated Assistant Bishop of Springfield (with title of Bishop of Cairo), Ill., July 26, 1892. D. Dec. 25, 1900. W. S. PERRY.

**Hale**, EDWARD EVERETT, D. D.: philanthropist and author; b. in Boston, Mass., Apr. 3, 1822; educated at the Boston Latin School and at Harvard College; studied divinity in private; entered the ministry of the Unitarian denomination; was settled at Worcester, Mass., in 1846; became minister of the South Congregational (Unitarian) church of Boston in 1856. In his profession Dr. Hale is eminent for his interest in social and philanthropic movements, for pastoral activity, denominational zeal, and power of organization. To the general public he is best known through his writings, which include *The Rosary* (1848); *Margaret Percival in America*; *Sketches of Christian History*; *Kansas and Nebraska* (1854); *Letters on Irish Emigration*; *Ninety Days' Worth of Europe*; *If, Yes, and Perhaps* (1868); *Ingham Papers*; *Sybaris and other Homes*; *How to Do It*; *Ten Times One is Ten* (1870); *Reformation*; *His Level Best and other Stories* (1870); *Ups and Downs*; *Christmas Eve and Christmas Day*; *In His Name* (1874); *Our New Crusade*; *Workingmen's Homes*; *A Family Flight through Egypt and Syria* (1882); *About Home* (1884); *Through Mexico* (1886); the last three and *The Story of Spain* (1886) in collaboration with Susan Hale, and *Franklin in France* (1887) in collaboration with his son, Edward E. Hale; *The Story of Massachusetts* (1891); *East and West* (a novel, 1892). He edited the Boston edition of Lingard's *History of England*, was editor of *The Christian Examiner*, the organ of the Unitarian body, and founded in 1869 *Old and New*, a monthly magazine semi-theological in its character, which he edited until it was merged into *Scribner's Monthly*. Two of his shorter stories, *A Man without a Country* and *My Double and how He Undid Me*, have given him a brilliant fame, the former making a deep impression during the civil war. Dr. Hale is a popular lecturer, a counselor of Chautauqua University, and now (1894) chairman of the council of the National Conference of Unitarian and other Christian Churches. Revised by J. W. CHADWICK.

**Hale**, EDWIN MOSES, M. D.: b. at Newport, N. H., Feb. 2, 1826; became a printer in Newark, O.; graduated from the Cleveland Homœopathic Medical College; practiced twelve years at Jonesville, Mich.; became in 1863 Professor of Materia Medica in the Hahnemann Medical College, Chicago; in 1870 Professor of Medical Botany and Pharmacology; and in 1871 became also special lecturer in the same institution on diseases of the heart. From 1880 till 1884 he was Professor of Materia Medica and Therapeutics in Chicago Homœopathic College; long editorially connected with professional journals. Author of many monographs; *On Sterility* (1868); *Pocket Manual of Domestic Practice* (1870); *Lectures on Diseases of the Heart* (1871); *Treatise on Cerebro-spinal Meningitis* (1875), and other works.

**Hale**, GEORGE SILSBEE: See the Appendix.

**Hale**, HORATIO: ethnologist; b. in Newport, N. H., May 3, 1817. His father, David Hale, was a lawyer, and his mother, Sarah J. Hale (1788–1879), was a popular author. He graduated at Harvard in 1837, and the next year was appointed philologist to Capt. Wilkes's scientific expedition, which made a three-year exploration of the Antarctic and Southern Pacific seas. Here he studied native languages and customs, and so was led into the allied science of ethnology. After the return of Capt. Wilkes, Hale traveled widely and pursued investigations in literature and anthropology. Still later he was admitted to the Chicago bar, and practiced his profession at Clinton, Ontario, Canada, where he died Dec. 29, 1896. He was a member of many learned societies in America and Europe, and presided over the section of anthropology at one of the annual meetings of the American Association for the Advancement of Science. Some of his memoirs and monographs have provoked much discussion, notably that on *The Origin of Language and the Antiquity of Speaking Man*. Besides this he published *Ethnography and Philology* (Philadelphia, 1846), being the seventh volume of the Wilkes expedition reports; *The Iroquois Book of Rites* (Philadelphia, 1883); *Indian Migrations as Evidenced by Language* (Chicago, 1883); and a *Report on the Blackfoot Tribes*.

J. W. POWELL.

**Hale**, JOHN PARKER: U. S. Senator; b. at Rochester, N. H., Mar. 31, 1806; graduated from Bowdoin College, Maine, 1827; studied law, and was admitted to the bar in 1830; became a member of the New Hampshire Legislature 1832; member of Congress 1843–45; occupied the chair of U. S. Senator 1847–53 and 1855–65, and was U. S. minister to Spain 1865–69. He was the candidate of the Free-soil party for President in 1852, receiving 157,680 votes. D. at Dover, N. H., Nov. 19, 1873.

**Hale**, Sir MATTHEW: jurist; b. at Alderley, Gloucestershire, England, Nov. 1, 1609; orphaned at the age of five; studied at Oxford University (1626–29); entered Lincoln's Inn for the study of law 1628, and was there called to the bar; entered Parliament in 1654, and was made a judge of common pleas under Cromwell 1654–58; was in the convention Parliament 1660, and took an active part in the restoration of Charles II.; was made chief baron of the exchequer and knighted 1660; was chief justice of the king's bench 1671–76. He was the last English judge before whom persons were convicted and sentenced for witchcraft. He was, notwithstanding his belief in the existence of witches, a man of justice, moderation, wisdom, and wide learning, as well as of devout religious character. D. at Alderley, Dec. 25, 1676. He published a few works before his death, and left a great many manuscripts, concerning the publication of which he gave instructions in his will. He wrote on scientific, legal, and theological subjects, but left little of permanent value. Among his legal works are the *History of the Pleas of the Crown*; *History and Analysis of the Common Law*; *Analysis of the Law*. Among his religious works are *An Abstract of the Christian Religion*; *Contemplations, Moral and Divine*; *The Knowledge of Christ*, etc. See his *Works, Moral and Religious* (London, 1805, 2 vols.).

F. STURGES ALLEN.

**Hale**, NATHAN: soldier; b. at Coventry, Conn., June 6, 1755; in 1769 was sent to Yale College with a view to his entering the ministry; taught school at Moodus, East Haddam, and New London; on receipt of the news of the battle of Lexington joined an infantry company, and in July, 1775, was made a lieutenant in Col. Webb's regiment; took part in the siege of Boston, and on Sept. 1, 1775, was promoted to the rank of captain. On the reorganization of the forces in 1776 Hale received a commission in the regular army and joined the Nineteenth Continental Regiment of foot. On the evacuation of Boston by the British Mar. 17, 1776, he went to New York with his regiment, and on Aug. 27 took part in the battle of Long Island. Among his daring exploits was the capture at midnight of a British sloop loaded with provisions anchored under the protection of a man-of-war in the East river. About this time he was ordered to do scouting duty as captain of a company in the Connecticut Rangers, and hearing that Washington was anxious to obtain information of the situation, strength, and plans of the enemy on Long Island and in New York, Hale volunteered to act as a spy. Disguised as a Tory schoolmaster, he visited the British camps and obtained the desired information, but when about to return was recognized and seized. He was sentenced to death by Sir William Howe on Sept. 21, 1776, and on the following day was hanged near the present junction of Market Street and East Broadway. His last words were, "I only regret that I have but one life to lose for my country." The memorials of Hale include two statues at Hartford and one in City Hall park, New York city. See the *Life* by Stuart (Hartford, 1856), and *The Two Spies, Nathan Hale and John André*, by Lossing (New York, 1886).

**Hale**, NATHAN, LL. D.: journalist; b. at Westhampton, Mass., Aug. 16, 1784; graduated at Williams College 1804; began the study of law, but was two years instructor in the academy at Exeter, N. H., when he removed to Boston, and in 1810 was admitted to the bar; after practicing his profession four years and editing at the same time *The Weekly Messenger*, he purchased (Mar., 1814) the Boston *Daily Advertiser*, the pioneer daily in New England; Federal in politics at first, it subsequently became an advocate of the Whig and Republican parties, Mr. Hale remaining editor during his life. During the discussion of the Missouri (1820) and Nebraska (1854) bills the journal took a decided and influential stand in opposition, but was the first to advocate the free colonization of Kansas. He was the first president of the Boston and Worcester Railroad, and held the position nineteen years; was influential in promoting the introduction of water into the city of Boston, and at the head of the commission for that object; was one of the founders of *The North American Review*, also of *The Christian Examiner*; at various times elected to the Massachusetts Legislature. Mr. Hale was a nephew of NATHAN

Hale (*q. v.*), the Revolutionary patriot, and father of the Rev. Edward Everett Hale. D. in Brookline, Mass., Feb. 9, 1863.

**Hales**, John, M. A.: "the ever-memorable"; ecclesiastic and author; b. at Bath, England, Apr. 19, 1584; entered Corpus Christi College, Oxford, 1597; became a fellow of Merton 1605, of Eton 1613; Professor of Greek at Oxford 1612; went to the Synod of Dort 1618, and was there turned against Calvinism, and was thenceforth free from all sectarian prejudice; Canon of Windsor 1639; ejected 1642; dispossessed of his Eton fellowship 1649; was an irenic or latitudinarian, and one of the earliest of what is now called the Broad Church school, hence denounced in his own time as a trimmer; after his death was issued his *Golden Remains* (London, 1659; 4th ed. 1750), which shows that he had a quaint and vigorous style, but is hardly worthy of his great fame for learning and ability. D. at Eton, May 19, 1656. His complete works were published in three volumes at Glasgow in 1765. Revised by S. M. Jackson.

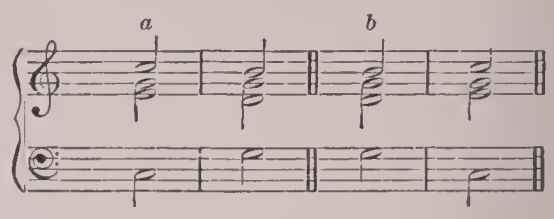
**Hales**, William, D. D.: author; b. in Cork, Apr. 8, 1747; became fellow of Trinity, Dublin, in 1768; Professor of Oriental languages 1782; rector of Killeshandra 1788. Among his scientific works are *Sonorum doctrina rationalis et experimentalis* (London, 1778); *Analysis æquationum* (Dublin, 1784); *Analysis fluxionum* (1800); *New Analysis of Chronology* (London, 1809–12, 3 vols.) Among his other writings are *Prophecies regarding our Lord* (1808); *The Holy Trinity* (1818); *Primitive Church of the British Isles* (1819). D. in Cork, Jan. 30, 1831. Revised by S. M. Jackson.

**Halévy**, ăă'lā'vee', Jacques François Élie Fromental: composer; b. in Paris, May 27, 1799. He was of Jewish parentage, and the family name was originally Lévi; studied successfully at the Conservatoire, and was a favorite pupil of Cherubini; was enabled to spend two years in Italy, having won a first prize for composition. There his opera *Pygmalion* was written; this was followed by others, *Phidias*, *The Artisan*, which had a local reputation. The opera *The Jewess* (1835) was the foundation of his fame. Other well-known works are *The Queen of Cyprus*, *Charles VI.*, *The Queen's Musketeers*, *The Wandering Jew*, *The Tempest*, *Valentine d'Aubigné*, and *The Sorceress*. He produced some thirty operas in all, tragic and comic. He was a talented and cultivated composer, painstaking and scholarly, but without the gift of genius. He was a writer on musical topics, and published also a volume entitled *Souvenirs and Portraits*. Louis Philippe and his family conferred distinction on him; he was made professeur de haute composition at the Conservatoire, member and perpetual secretary of the Academy of Fine Arts, and officer of the Legion of Honor. D. in Nice, Mar. 17, 1862.

**Halévy**, Léon: author; brother of Jacques Fromental Halévy; b. in Paris, Jan. 14, 1802; was Professor of French Literature at the École Polytechnique from 1831 to 1834, and afterward held a position in the administration from 1837 to 1853, when he retired in order to devote himself exclusively to literature. He produced many works on literature, philosophy, history, foreign languages, etc. One of these works appeared with the remarkable epigraph: "The golden age, which a blindfold tradition has placed behind us, is in front of us." His principal works are *Literary, Philosophical, and Industrial Opinions* (which appeared anonymously in 1825, and was written with the co-operation of Olinde Rodriques, Comte, and other adherents of Saint-Simon); *The Barcelona Plague*, *Summary of the History of the Hebrews* (1827–28); *Summary of the History of French Literature*. He wrote also many plays for Paris theaters: *The Spy*, *Czar Demetrius*, *Indiana*, *Beaumarchais at Madrid*, *The Golden Broomstick*, *Electra*, etc. Still greater attention was attracted by his translations from Horace (his literary *début*), the Greek tragedy, and Shakspeare (*Macbeth*), and his two collections of fables. D. at St.-Germain-en-Laye, Sept. 3, 1883.

**Halévy**, Ludovic: son of Léon Halévy; dramatic author and novelist; b. in Paris, July 1, 1834; held for nine years a position in the administration, which he resigned in 1861. He is one of the most popular authors of light plays or vaudevilles for the French stage. He wrote, chiefly in connection with Henri Meilhac, nearly all the librettos of the opéra-bouffe composer Offenbach. Among the works of these authors are the following: *La Belle Hélène* (1865); *Orphée aux Enfers* (1866); *Barbe-bleue*, *La Vie Parisienne* (1868); *La Grande Duchesse de Gérolstein* (1867); *Les Brigands* (1869); *Carmen* (1875). In connection with Meilhac he produced a large number of dramatic works, including *Le Menuet de Danaé* (1861); *Le Brésilien*, *Tout pour les Dames!* (1868); *Froufrou*; *Le Roi Candaule* (1873); *La Cigale* (1877); *La Roussotte* (1881). He has, in addition, published numerous romances, among which *L'Abbé Constantin* (1882) is notable. In 1886 he was admitted to the French Academy.

**Half Cadence** [from Lat. *cadentia*, a falling, deriv. of *ca'dere*, fall]: in music, the name sometimes applied to a cadence on the dominant, otherwise called the "imperfect" cadence, as contradistinguished from the perfect on the tonic. In the examples see the half (or imperfect) cadence at *a*, and the perfect at *b*:




**Half-castes**: See Eurasians.

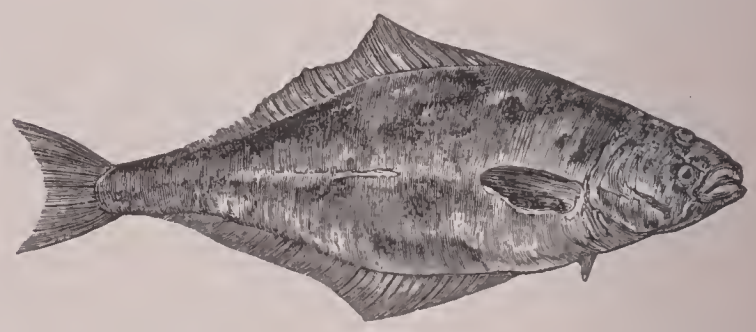
**Half Note**: the designation of a minim, as having half the duration of a semibreve, the latter being regarded, in modern music, as the standard of measure, and hence called a *whole* note. See Note.

**Hal'iburton**, Sir Arthur L.: See the Appendix.

**Haliburton**, Robert G.: See the Appendix.

**Haliburton**, Thomas Chandler: author; b. in Windsor, Nova Scotia, in 1797; educated at King's College, Windsor; called to the bar in 1820; practiced in Nova Scotia, and became judge of the court of common pleas. He wrote *The Clockmaker, or Sayings and Doings of Samuel Slick of Slickville* (1837), which was popular in the U. S. and Great Britain; *Traits of American Humor* (1852), and other books. In 1842 he removed to England and represented Launceston in Parliament 1859–65. D. Aug. 27, 1865.

**Halibut** [for older *holibut* < M. Eng. *halybutte*; *haly*, holy + *butte*, a flounder. Perhaps named from being eaten especially on holidays]: the *Hippoglossus hippoglossus*, a large fish of the family *Pleuronectidæ*, sometimes found to weigh more than 600 lb. It is caught on both sides of the Atlantic, and especially near Greenland and Iceland and



The halibut.

on the Banks of Newfoundland in the winter season. It is also abundant in the waters of Alaska, and is found on offshore banks as far southward as Monterey. Its flesh is justly prized. Its upper side is dark, its lower white, the eyes being both upon the upper side, as in the other flounders. See Fisheries.

**Halicarnas'sus** [via Lat. from Gr. Ἁλικαρνασσός. The modern name is *Budrun*]: a Greek city of Caria, the birthplace of Herodotus, situated in a crescent-shaped bay on the northern side of the Ceramian Gulf. The approach to the city was protected by the fortified island of Arconnesus (now Orak Adasi). It was colonized by Dorians from Trœzene, and once belonged to the Dorian Hexapolis, but was rejected in consequence of a quarrel at one of the conventions, and afterward became the great center of Persian influence. It fell under the power of a line of Carian princes, vassals of the Persians, of whom Mausolus (Satrap of Caria in 378 B. C.) was the most celebrated. Though Greek in language and culture, it was Persian in politics. Alexander was unable to take its citadel, Salmacis (so called from a spring that arose on the height), but destroyed the rest of the town, which never regained its greatness. The tomb of Mausolus (see Mausoleum), which was erected by his wife Artemisia (about 350 B. C.), was reckoned by the Greeks as

one of the seven wonders of the world. In 1857 C. J. Newton excavated Halicarnassus, and besides the site of the mausoleum discovered the statue of Mausolus, and many of the sculptures that adorned the tomb. These sculptures were executed by the first artists of the day: Scopas, Leochares, Bryaxis, and Timotheus. They are preserved in the British Museum.

LITERATURE.—Mrs. Mitchell in her *History of Ancient Sculpture* (New York, 1888, pp. 463–474), describes the site of Halicarnassus, and gives an account of its history down to modern times; see also Newton, *A History of Discoveries at Halicarnassus* (London, 1862–63), and his *Travels and Discoveries* (ii., pp. 84–137); Droysen, *Geschichte des Hellenismus* (Gotha, 1877, i., pp. 208–218).

J. R. S. STERRETT.

**Halicor'idæ** [Mod. Lat., liter., tribe of the sea-maids; Gr. ἅλς, ἁλός, salt, sea + κόρη, girl, maiden + patronymic ending -ίδαι, descended from]: a family of mammals of the order SIRENIA (*q. v.*), having a fish-like form, with the tail emarginated or forked behind; the head moderate; intermaxillary bones with the anterior portion deflected, and with the branches prolonged backward; with two upper incisors, in the male at least; and with the molars successively increasing in size backward, with simple hollow roots, and with crowns capped by few tubercles. A single living genus (*Halicore*) represents this family; its species are found in the Red Sea and along the eastern coasts of Africa and the shores of the Indian Ocean, Australia, etc. The best-known species is the DUGONG (*q. v.*), *Halicore dugong*, of the Red Sea, the taschasch of the Bible, the skin of which was employed in the construction of the tabernacle, whence the name given by Rüppell, *Halicore tabernaculi*.

THEODORE GILL.

**Halifax**: town of England; in the county of York, on the Hebble; 194 miles N. N. W. of London (see map of England, ref. 7–H). It is a flourishing and rapidly growing town with very large manufacturing interests. Its carpet-works are the largest in the world, and its manufactures of woolen and worsted rank next to those of Leeds and Bradford. There are also manufactures of chemicals, iron, boots, and mill-machinery. It has several parks, a free library and museum, a grammar school, a bluecoat school, a flourishing co-operative society, a mechanics' institute, home and school for orphans, a handsome town-hall, a market-hall erected in 1779, and a number of handsome churches. The first recorded mention of Halifax was made in the twelfth century. Its manufacturing importance began in the fifteenth century. Pop. (1901) 104,997. It sends two members to Parliament.

**Halifax**: capital and chief city of Nova Scotia; situated near the center of the southeast or Atlantic coast of the province; lat. 44° 39′ 42″ N., lon. 63° 35′ 30″ W. (see map of Quebec, etc., ref. 3–B). It is built on the eastern slope of a peninsula formed by Halifax harbor and an inlet called Northwest Arm. Halifax harbor, formerly called Chebucto Bay, extends 16 miles in from the ocean. It is one of the finest harbors in the world, is easy of access, and is admirably sheltered. The water is so deep that the largest ships can lie within a few feet of the shore, and the rise and fall of the tide are slight. The older portion of the city extends along the harbor for about 3 miles, the main streets are parallel to the water's edge and rise one above the other up to the citadel, a massive fortification on a hill. To the N. and S. of the citadel the city extends westward, and is rapidly nearing the water of the Northwest Arm. Dartmouth, on the other side of the harbor, a town of 6,249 inhabitants, is practically a suburb of Halifax. Halifax is the chief naval station of Great Britain in North America, and is the only town there garrisoned with British troops. It was founded by Lord Cornwallis in 1749, and was named after the Earl of Halifax, who, as president of the board of trade and plantations, took an active part in fitting out the expedition for the founding of the city. The entrance to the harbor is guarded by large forts and batteries of the most modern construction, mounted with the heaviest ordnance, rendering Halifax one of the strongest positions held by Great Britain.

During a large part of the year the war-ships of the North American station, comprising some of the finest frigates and ironclads of the royal navy, make Halifax their headquarters. The dockyard covers 14 acres. The dry dock, which serves the purposes of the royal and mercantile navy, is the largest in America. It was constructed at the cost of $1,000,000. The city limits cover an area of 4,363 acres. A park lying to the S. of the city covers a space of 200 acres, and is bounded on three sides by the Atlantic Ocean. The public gardens lie to the S. W. of the citadel, covering a space of 15 acres. Many houses are built of wood, but the center or business portion of the city contains a large number of handsome buildings of brick and stone. The provincial building, the city-hall, Government house, the university, the academy, the post-office, the hospitals, clubs, banks, and a number of the public schools would do credit to any city.

Halifax is the residence of a Roman Catholic archbishop and an Anglican bishop. It has 28 public schools with 127 departments, which afford accommodation for 7,550 pupils. It has a well-equipped academy and a university (Dalhousie), with faculties of art, science, law, and medicine; also a Presbyterian theological college, a ladies' college, a convent, a school for the blind, and a school for the deaf, besides many other benevolent and charitable institutions. The city is amply supplied with pure water brought from a chain of lakes about 5 miles distant, and has a regular system of sewerage. It is one of the most healthful cities in the world, and is becoming a favorite watering-place.

Halifax carries on a large business with the West Indies, exporting fish, lumber, and agricultural produce, receiving in return sugar and other tropical products. It is also a distributing center for the imports of a large part of the maritime provinces and is the chief winter port of Canada. The exports for 1900 were valued at $6,758,403, and the imports at $6,051,250.

Lines of steamers connect the city with the different ports of the maritime provinces, the leading ports of Great Britain, the West Indies, Boston, and New York. The number of vessels registered at the port for 1900 was 462, with a net tonnage of 21,630. The number of vessels entering the port was 6,190, with a tonnage of 2,196,233. Halifax is connected with the railway system of the continent, being the Atlantic terminus of the Canadian Pacific and Intercolonial Railways. There are two large sugar-refineries, a cotton-factory, a rope-walk and twine-factory, and shoe-factory, together with a large number of smaller industries. There are five local banks, besides branches of the Bank of Montreal and the Bank of British North America.

The city was incorporated in 1842. It is governed by a council consisting of a mayor elected annually by the votes of the citizens, and eighteen aldermen, also elected by popular vote, each for a term of three years. The valuation for assessment in 1900 was $23,329,402. The city debt is $3,073,590, but almost every dollar of it is represented by the water-works and other valuable public property. Pop. (1891) 38,495.

Revised by H. WIER.

**Halifax**, CHARLES MONTAGUE, Earl of: politician; b. Apr. 16, 1661, at Horton, Northamptonshire, England, and educated at Cambridge. He entered the House of Commons as member for Malden during the convention Parliament, and was appointed a commissioner of the treasury in 1692, and First Lord of the Treasury in 1698. His most famous measures were the incurring of the English national debt in 1694 and the establishment of the Bank of England in 1695. In 1699 he was made Baron Halifax, but in 1701, and again in 1703, he was impeached by the House of Commons, and escaped only by the protection of the House of Lords. During the reign of Queen Anne he was without office, but he took part very actively in the negotiations for the union between Scotland and England and for the succession of the House of Brunswick. On the accession of George I. he was made Premier, Earl of Halifax, Knight of the Garter, etc., but died soon after (May 19, 1715). He wrote poetry and patronized authors and artists.

**Halifax**, GEORGE SAVILLE, Marquis of: statesman; b. in 1630. During three reigns he held the highest offices and played a most conspicuous part in politics. In 1668 he was made Baron Saville and Viscount Halifax for his participation in the Restoration, and in 1680 it was due to his eloquence that the House of Lords rejected the bill excluding the Duke of York from the succession. This won him the confidence of King Charles, who retained him in the council for the rest of the reign, but James II. distrusted him, and when in 1685 he opposed the repeal of the Test Act and the Habeas Corpus Act, he was dismissed from office. He gave in his adherence to the Prince of Orange, and after the latter's accession Halifax was made Lord Privy Seal, but afterward joined the opposition and even entered into negotia-

tions with the Jacobites. His party was contemptuously called the Trimmers, a name which he adopted and defended. He wrote *Character of a Trimmer*; *Anatomy of an Equivalent*; *Maxims of State*, etc. D. in 1695.

**Halifax River**: a salt-water tidal channel, in Volusia co., Fla., running N. 30 miles. It is a mile wide throughout, and communicates with the sea through Mosquito Inlet. It is sometimes called Mosquito North Lagoon. It is continuous southward with Hillsborough river. It is navigable, and abounds in fish and oysters.

**Halio'tis** [Mod. Lat., from Gr. ἅλς, sea, οὖς, ὠτός, the ear]: the genus of molluscs which contains the abalones or ear-shells. See EAR-SHELL.

**Halite**: native rock-salt. See SALT.

**Halitheri'idæ** [Mod. Lat., liter., belonging to the tribe of sea-beasts; Gr. ἅλς, ἁλός, salt, sea + θηρίον, wild animal + patronymic ending -ίδαι, descended from]: a family of extinct mammals belonging to the order *Sirenia* and closely related to the HALICORIDÆ (*q. v.*), from which they principally differed in the molars having each two or three roots (they were mostly three-rooted above and two-rooted below), and their crowns being studded with obtuse tubercles arranged in transverse yoke-like eminences, and in the posterior ones having an additional narrower tuberculated yoke behind the principal ones. The family was represented in Europe from the Eocene to the Pliocene by several species which appear to be reducible to one genus—*Halitherium*. T. G.

**Hall**, ARTHUR CRANSTAY ALLISON, D. D.: ecclesiastic; b. in England in 1847; graduated at Christ Church College, Oxford; became a member of the Society of Mission Priests of St. John the Evangelist at Cowley, near Oxford; was sent in 1872 to the Church of the Advent, Boston, in connection with which, and the Mission Church of St. John the Evangelist, he labored until his recall by the head of the society in 1891. At a special convention of the diocese of Vermont, held at Burlington Aug. 30, 1893, Father Hall was elected to the vacant see. He was released by his superior from his obligations to the Cowley order, and was consecrated bishop Feb. 2, 1894. W. S. P.

**Hall**, ASAPH: astronomer; b. at Goshen, Conn., Oct. 15, 1829. After studying astronomy under Brunnow at the University of Michigan, he became assistant to Prof. W. C. Bond at the observatory at Harvard; was appointed aide at the Naval Observatory at Washington, D. C., 1862, and commissioned Professor of Mathematics in the navy the year following. His principal work at the observatory was done with the equatorial telescopes, but he took part in several expeditions for astronomical observations, the most important being that to Vladivostok, in 1874, to observe the transit of Venus. In 1875 he succeeded Prof. Newcomb in charge of the great equatorial, with which in Aug., 1877, he made his well-known discovery of the satellites of Mars. Until his retirement in 1891 he employed the equatorial in measures of the satellites of the outer planets, determining the masses of Saturn, Uranus, and Neptune, and the orbits of their satellites. He also determined the parallax of α Lyræ, and inaugurated a series of measures of double stars. In 1879 the gold medal of the Royal Astronomical Society of London was awarded him for his discovery and observations of the satellites of Mars, and his determination of their orbits.

S. NEWCOMB.

**Hall**, BASIL: navigator; b. in Edinburgh, Scotland, Dec. 31, 1788; entered the royal navy 1802; became post-captain 1817. His principal works are *A Voyage to the West Coast of Corea and the Great Loo-Choo Island* (1818); *Extracts from a Journal* (written on the Pacific coast of America, pub. in *Constable's Miscellany*); *Travels in North America* (3 vols., 1829, a work which excited great indignation in the U. S.); *Fragments of Voyages* (9 vols., 1831–40, his best work); and several other volumes of travels. D. at Haslar, Gosport, Sept. 11, 1844.

**Hall**, CHARLES CUTHBERT, D. D.: Presbyterian clergyman; b. in New York, Sept. 3, 1852; graduated at Williams College 1872; studied at Union Theological Seminary 1872–73, and at the Presbyterian College, London, and the Free Church College, Edinburgh; was pastor of Union Presbyterian church, Newburg, N. Y., 1875–77, and of First Presbyterian church, Brooklyn, N. Y., 1877–97, when he became president of Union Theological Seminary, New York. He has published *Into His Marvelous Light* (1892); *Does God send Trouble?* (1894); *Qualifications for Ministerial Power* (1895); and *The Gospel of the Divine Sacrifice* (1896).

**Hall**, CHARLES FRANCIS: Arctic explorer; b. at Rochester, N. H., in 1821; became a blacksmith, but removed to Cincinnati, where he was a stationer and journalist. He for a time paid great attention to the subject of caloric engines. He afterward became deeply interested in the fate of Sir John Franklin, and in 1860 sailed from New London in the ship George Henry, Capt. James Buddington, the expedition being fitted out chiefly at the expense of Henry Grinnell, of New York. Hall remained two years with the Esquimos, and in 1862 returned. He published his *Arctic Researches* in 1864, and soon sailed again for the north in the Monticello, Capt. James Buddington, again at the expense of Mr. Grinnell. He remained in the polar regions until 1869, when he returned, bringing many undoubted relics of the Franklin party. In 1871 he sailed on his third expedition in the steamer Polaris, fitted up by the U. S. Government for polar exploration. Capt. Hall died about Oct. 30, 1871, in Greenland, and after great privations and many dangers the Polaris was abandoned in Oct., 1872, a portion of her crew under Capt. Tyson having drifted away on floating ice, from which they were rescued by the steamer Tigress Apr. 30, 1873, after floating 195 days. The remainder of the crew constructed boats, put to sea, and were picked up June 23, 1873, by a whaler, and carried to Dundee, Scotland.

**Hall**, CHARLES HENRY, D. D. (Hobart and Columbia), LL. D. (Yale), D. C. L. (Trinity): clergyman; b. at Augusta, Ga., Nov. 7, 1820; studied at Phillips Academy, Andover, Mass.; graduated at Yale in 1842, and studied at the General Theological Seminary, New York city; was ordained deacon in the Protestant Episcopal Church 1844, and priest 1845; and after holding various positions became rector of Holy Trinity, Brooklyn, N. Y., 1856. He occupied a distinguished position in the governing bodies of the American Episcopal Church. He published *Notes on the Gospels* (2 vols., New York, 1871); *True Protestant Ritualism* (Philadelphia, 1867); *Spina Christi, or Musings in Holy Week* (1875); *Church of the Household* (1877); *Valley of the Shadow*; *Sermons on the Doctrine of Future Punishment* (1878). D. in Brooklyn, N. Y., Sept. 12, 1895. W. S. P.

**Hall**, CHRISTOPHER NEWMAN, LL. B., D. D. (Edin.): b. at Maidstone, Kent, England, May 22, 1816; graduated B. A. and LL. B. at University of London, winning a law-scholarship; was 1842–54 a Congregational pastor in Hull, and in 1854 became minister of Surrey chapel, Blackfriars Road, London, the congregation of which afterward removed to a fine new church in the Westminster Bridge Road; pastor emeritus 1893. He is the author of a tract, *Come to Jesus* (1846) which has circulated in millions of copies, of other tracts, also widely circulated, of a *Memoir of Rowland Hill*, and of other writings, mostly devotional in their character.

Revised by GEORGE P. FISHER.

**Hall**, EDWARD H.: Unitarian clergyman; b. in Cincinnati, O., Apr. 16, 1831; educated chiefly at Harvard College (A. B. 1851) and Harvard Divinity School; pastor of the First church, Plymouth, Mass., of Second church, Worcester, Mass., and of First parish and church, Cambridge, Mass.; chaplain of the Forty-fourth Regiment Massachusetts Volunteer Militia; has contributed to *The Unitarian Review*, *The New World*, and published *Orthodoxy and Heresy in the Christian Church* (Boston, 1883).

**Hall**, FITZEDWARD, D. C. L. (Oxford, 1860): philologist; b. in Troy, N. Y., Mar. 21, 1825; graduated at Harvard 1846; immediately thereafter went to India, where he studied and taught, rising to the position of school inspector for the Saugor and Nerbudda territories 1856–62. From 1862–69 he was professor of Sanskrit in King's College, London, but since has lived in literary retirement. He was an authority in philology, on which he wrote much. D. in 1901.

**Hall**, GEORGE HENRY: See the Appendix.

**Hall**, GORDON: missionary; b. in Granville (now Tolland), Hampden co., Mass., Apr. 8, 1784. He graduated at Williams College in 1808 with first honors. He studied theology at Andover (1811–12); was ordained to the Congregational ministry, and set apart to the foreign missionary work by the A. B. C. F. M. with his brethren and colleagues, Messrs. Nott, Rice, Judson, and Newell, Feb. 6, 1812, at Salem, and in the same month sailed on his mission to India. He reached Calcutta in August of the same year, but the East India Company refused to allow him and his fellow missionaries to remain. After having been subjected to the greatest embarrassments through the arbitrary measures of the Government, he succeeded in getting a foothold

in Bombay, where he labored with absorbing devotion and great success, and where he died of cholera, Mar. 20, 1826. He published several tracts and volumes on missionary work, and revised the Mahratta New Testament. He wrote, in connection with Samuel Newell, *The Conversion of the World; or, the Claims of Six Hundred Millions* (Andover, 1818). See his *Memoir* by H. Bardwell (Andover, 1834).

**Hall**, Granville Stanley, Ph. D., LL. D.: educator; b. at Ashfield, Mass., 1846; educated at Sanderson Academy, Ashfield, and Williston Seminary; A. B., Williams College, 1867, and A. M. 1870; Ph. D., Harvard University, 1878; lectnrer in Harvard and Williams Colleges 1880–81; Professor of Psychology, Johns Hopkins University, 1881–88; LL. D., University of Michigan, 1888, and Williams College 1889; president of Clark University since 1888; author of *Aspects of German Culture* (1881); *Bibliography of Education* (1886); *How to Teach Reading and What to Read in Schools* (1887); and numerous articles on psyehology and education in reviews and magazines; editor of *The American Journal of Psychology* and *The Pedagogical Seminary*.
C. H. Thurber.

**Hall**, Isaac Hollister, LL. B., Ph. D., L. H. D.: Orientalist; son of Edwin Hall, D. D.; b. in Norwalk, Conn., Dec. 12, 1837. He graduated at Hamilton College 1859, and was tutor there 1861–63; was a lawyer in New York city 1864–75; Professor in the Syrian Protestant College of Beirut 1875–77; and in 1877 became an associate editor of *The Sunday-school Times* in Philadelphia. He published in various periodicals an important series of articles on the Cypriote writing and language, having been one of the first to read an entire inscription, and was the author of numerous articles on Greek, Phœnician, Himyaritic, and other inscriptions and Oriental matters. In 1876 he discovered in Beirut a Syriac manuscript of the Gospels, Acts, and most of the Epistles, an account of which, with three facsimile pages, he published in 1884. The date of the manuscript is between 700 and 900 A. D., and its Gospels constitute the long-lost Philoxenian version. He discovered in 1884 the Antilegomena Epistles in the "Williams manuscript," and published them in phototype. In 1884 he published a *Critical Bibliography of the Greek New Testament as Published in America*. In 1885 Dr. Hall became curator in the Metropolitan Museum of Art, New York. D. in Mount Vernon, N. Y., July 2, 1896. Revised by C. H. Thurber.

**Hall**, James: author and journalist; b. in Philadelphia, Aug. 19, 1793; served 1812–18 in the army on duty on the northern frontier, and in the expedition of Decatur against Algiers; became in 1820 a lawyer and editor at Shawneetown, Ill.; was four years public prosecutor, and three years judge of a State circuit court; removed to Vandalia; was four years State treasurer, and was also a successful lawyer and editor there; went in 1833 to Cincinnati, where he edited *The Western Monthly Magazine* 1833–37; was a bank president 1853–65. Author of *Letters from the West* (1829); *Legends of the West* (1832); *The Soldier's Bride*, etc. (1832); *The Harpe's Head* (1833); *Tales of the Border* (1835); *Statistics of the West* (1836); *Life of W. H. Harrison* (1836); *History of the Indian Tribes* (3 folio vols., 1838, written jointly with T. L. McKenny); *Notes on the Western States* (1839); *The Wilderness and the Warpath* (1845); *Life of Thomas Posey* (1846); *Romance of Western History* (1857); *Works* (4 vols., 1853–56). D. July 5, 1868.

**Hall**, James, LL. D., Ph. D.: geologist and paleontologist; b. at Hingham, Mass., Sept. 12, 1811; studied under Amos Eaton in the Polytechnic Institute of Troy, N. Y., 1831–36. Joining the Geological Survey of New York as an assistant in 1837, he was soon promoted and given charge of the work in the western distriet of the State. After the completion of the geological reports he was appointed State paleontologist (1843), and in that capacity he devoted the greater part of his life to the fossils of the older North American strata. For a short time he was State geologist of Iowa, and he contributed to the paleontologic work of other State and national surveys. He was ealled "the Nestor of American geology." He was the first president of the Geological Society of America (1889), and honorary president of the International Congress of Geologists at Washington (1891). His leading works are *The Geology of the Fourth District of New York* (1842) and *The Paleontology of New York*, in eight volumes, of which seven are complete (1847–88). D. in Bethlehem, N. H., Aug. 7, 1898. Grove K. Gilbert.

**Hall**, James Barclay: See the Appendix.

**Hall**, John, D. D., LL. D.: clergyman; of Scottish descent; b. in County Armagh, Ireland, July 21, 1829; entered Belfast College in 1842; repeatedly won the Hebrew prize; was licensed to preach in 1849, going as a missionary into the west of Ireland; in 1852 became pastor of the First Presbyterian church in Armagh, and in 1858 was called to the Church of St. Mary's Abbey, now Rutland Square, in Dublin. By royal appointment he was commissioner of education for Ireland. In 1867 he went as a delegate from the Presbyterian Church in Ireland to the Presbyterian Churches in the U. S., and soon after returning to his native land was called to take charge of the Fifth Avenue (Nineteenth Street) Presbyterian church in New York. In 1875 a splendid church edifice was erected for him on the corner of Fifth Avenue and Fifty-fifth Street. He was chancellor of the University of the City of New York 1882–90. He published *Family Prayers for Four Weeks* (New York, 1868); *Papers for Home Reading* (1871); *Questions of the Day* (1873); *God's Word through Preaching*, Lyman Beecher lectures (1875); *Foundation Stones for Young Builders* (Philadelphia, 1880); *A Christian Home: how to Make and how to Maintain it* (1883). D. in Bangor, Ireland, Sept. 17, 1898.

**Hall**, John Smythe: See the Appendix.

**Hall**, Joseph: divine and author; "the Christian Seneca"; b. at Ashby-de-la-Zouch, Leicestershire, England, July 1, 1574; became a fellow of Emmanuel College, Cambridge, 1595; Dean of Worcester in 1617; went in 1618 to the Synod of Dort; was consecrated Bishop of Exeter in 1627; translated to Norwich in 1641, but before he could visit his new see he was imprisoned for six months in the Tower by the Puritans in 1642; on his release he went to Norwich, but was ejected in 1646; removed to Higham, Norfolk, where he died Sept. 8, 1656. He was a man of great wisdom, piety, and moderation. His principal works are *Mundus alter et idem* (1607); *Contemplations* (1612–15, on the Old and New Testaments); *Virgidemiarum Liber* (1597–98, a collection of satires); *Epistles* (1608–11); *Explication of Hard Texts* (Exeter, 1633–34); *Christian Meditations* (1640), one of his best works. See n. e. of his complete works by P. Wynter (10 vols., Oxford, 1863), which contains his autobiography.

**Hall.** Lyman, M. D.: a signer of the Declaration of Independence; b. in Connecticut, 1725; graduated at Yale College 1747; settled near Sunbury, Ga., in 1752; was influential in inducing Georgia to join the other colonies in asserting their independence; was elected a delegate, and then a member to Congress from Georgia 1775–79; and in 1783 was elected Governor of that State. D. in Burke co., Ga., Oct. 19, 1790.

**Hall**, Robert, M. A.: author; b. at Arnsby, Leicestershire, England, May 2, 1764; the son of a Baptist preacher; was distinguished in childhood for precocity of intellect; was educated at the Bristol College and at King's College, Aberdeen, where he passed M. A. with first honors 1784. He served as a tutor in the Bristol Academy, and later as pastor of the Broadmead Baptist chapel; took a pastorate at Cambridge 1791; was several times between 1804 and 1807 temporarily insane by reason of severe illness; was pastor of a church in Leicester 1807–26; and then again pastor of the Broadmead chapel, Bristol, until his death Feb. 21, 1831. Mr. Hall was an eloquent preacher, and was a man of broad and generous principles. He published political tracts of liberal tendencies; opposed Socinianism and the so-called close communion; and published many sermons, reviews, lectures, etc. His *Works*, with a memoir by Olinthus Gregory, were published in 6 vols., 1831–33.

**Hall**, Samuel Carter: author; b. at Topsham, Devonshire, England, in 1801; studied law and entered upon his literary career as a parliamentary reporter for the London *Times*. In 1824 he established *The Amulet*, an illustrated annual, and edited many illustrated books; for instance, *The Book of Gems*, *British Ballads*, *Baronial Halls*, *Ireland*, etc. He became the editor of the London *Art Journal* in 1839. His *Trials of Sir Jasper* (1873), a temperance poem, proved very popular. D. Mar. 16, 1889.—In 1824 he married Anna Maria Fielding, b. at Dublin in 1804, who, besides assisting him in many of his literary undertakings, achieved a literary fame by her *Sketches of Irish Character* (1828); *Lights and Shadows of Irish Character* (1838); *Story of Irish Peasantry* (1840); *The Buccaneer*, *Uncle Horace*, and other volumes of stories and sketches to the number of thirty; also wrote two dramas—*The French Refugee* and *The Groves of Blarney*. D. Jan. 30, 1881.

**Hal'lam**, Arthur Henry: son of the historian Hallam; b. in London, Feb. 1, 1811; was educated at Eton and Trinity, Cambridge, where he passed B. A. in 1832; studied law in the Inner Temple in 1832; went to Germany for his health, and died at Vienna, Sept. 15, 1833. He is memorable as the subject of Tennyson's *In Memoriam*. A volume of his writings in prose and verse appeared in 1834.

**Hallam**, Henry: historian; b. at Windsor, England, July 9, 1777; educated at Eton and at Oxford; called to the bar and practiced for several years, but his scholarly tastes soon led him to give up the law. He was appointed commissioner of stamps, a position imposing light duties and giving him a fair salary, which, supplemented by his private means, enabled him to devote himself almost wholly to study. A review of Scott's *Dryden* in *The Edinburgh Review* is ascribed to him, but the first of his great works, *A View of the State of Europe in the Middle Ages*, did not appear till 1818, when he at once took a place among the foremost historians of his time. This was followed in 1827 by the *Constitutional History of England, from the Accession of Henry VII. to the Death of George II.*, which takes up the narrative at the point to which he had traced the history of England in a chapter of his former work. In 1837–39 appeared his *Introduction to the Literature of Europe in the Fifteenth, Sixteenth, and Seventeenth Centuries*, a work somewhat unsatisfactory from its wide range necessitating a cursory treatment of important subjects, but remarkable for the diligence and enormous reading of its author and valuable for the good sense of many of his conclusions. Very little has been recorded of his life, which, despite his many friends among prominent men of letters and his influence with the Whig politicians of the time, was for the most part devoid of noteworthy incident. The death of his children, especially of his eldest son, Arthur Henry Hallam, in 1833, saddened his later years. While Hallam's Whig principles appear in his history of England, and his cold analysis of the acts of royalist and High Church heroes provoked Tory indignation, his work is generally regarded as a model of fairness and liberality, and is still a standard, in spite of the researches of later specialists. In the politics of his own day he had little sympathy with what he considered radical tendencies, and, though a Whig, deprecated the Reform Bill as embodying revolutionary principles. D. in London, Jan. 21, 1859. F. M. Colby.

**Hal'le**: town of Prussia; in the province of Saxony, on the Saale; 21 miles by rail N. W. of Leipzig (see map of German Empire, ref. 4–F). Among the buildings of note are the churches of Our Lady and of St. Maurice, the latter dating from the twelfth century and containing some fine wood-carving; in the market-place is a clock-tower 276 feet high. Halle has some manufactures of agricultural machinery, sugar, woolens, and starch, and very extensive salt-works. The vicinity is rich in salt springs, and the inhabitants around these springs (the so-called Halloren), who are employed in the manufacture of salt, form a peculiar race in features, character, and customs; they are supposed to be of Wendish or Celtic origin. The university (founded in 1694), with which that of Wittenberg (founded in 1502) was united in 1817, has ranked high, especially in theology. Gesenius was one of its professors from 1810 to 1842. In his time there were 1,300 students, subsequently less than 600; in 1892 there were 1,522. The Francke Institution (*Franckesche Stiftungen*) is a remarkable organization which takes care of several thousand orphan children. Its schools are celebrated, and it carries on an extensive publishing business. Halle attained commercial importance in the eleventh century, and during the twelfth and thirteenth centuries it was a member of the Hanseatic League. Pop. of Halle (1900) 156,611.

**Hallé**, Sir Charles: pianist and conductor; b. near Elberfeld, Germany, in 1819. He studied in Paris and gave concerts there. In the Revolution of 1848 he went to London, and afterward to Manchester, where he became director of the musical institution. From 1857 onward he directed with much renown an annual series of orchestral and choral concerts. In 1888 he was knighted, and married the famous violinist Madame Norman-Néruda. D. Oct. 25, 1895.

**Hallé**, Wilma, Lady: See the Appendix.

**Hal'leck**, Fitz Greene: poet; b. at Guilford, Conn., July 8, 1790. His mother was a descendant of the missionary John Eliot. He studied in the academy of his native town, and in 1811 became, and remained for twenty years, a clerk in the house of Jacob Barker, of New York. He was afterward (1832–49) employed by John J. Astor, who named him a trustee of the Astor Library. In 1849 he returned to Guilford, Conn., where he died Nov. 19, 1867. The best-known of his poems are that on the death of his friend, J. R. Drake, which appeared in 1820; *Fanny* (1819; enlarged 1821), his longest production; *Alnwick Castle* (1827); *Marco Bozzaris* (first published in *The New York Review* in 1825); and *Burns* (1827). The *Croaker Papers* (1819), by himself and his friend Drake, were first published in a complete edition in 1860. See his *Life* by J. G. Wilson (1869).

Revised by H. A. Beers.

**Halleck**, Henry Wager, LL. D.: soldier; b. at Westernville, Oneida co., N. Y., Jan. 16, 1815; graduated at West Point Military Academy July 1, 1839; entered the army as second lieutenant of engineers; first lieutenant 1845: captain 1853; he was retained at West Point as Assistant Professor of Engineering till June, 1840, and for a year subsequently was assistant to a board of engineers at Washington, D. C., during which time he prepared a work on *Bitumen, its Varieties, Properties, and Uses*. From Washington he was transferred as assistant in charge of the construction of fortifications in New York harbor, where he remained till 1846, except while absent in 1845 on a tour of examination of public works in Europe. On his return he delivered a course of twelve lectures on the science of war before the Lowell Institute at Boston, which were published in 1846 under the title of *Elements of Military Art and Science*, a second edition of which, with large additions, including notes on the Mexican and Crimean wars, was issued in 1858, and largely used as a manual during the civil war. In 1850 he became director-general of the new Almaden quicksilver mines; in Aug., 1854, he left the army by resignation, and devoted himself to the practice of law. Aug. 19, 1861, at the solicitation of Lieut.-Gen. Scott, Halleck was appointed major-general of the regular army, and assigned to the command of the department of the Missouri, embracing the States of Missouri, Iowa, Minnesota, Wisconsin, Illinois, Arkansas, and Western Kentucky. After the battle of Shiloh, Halleck's forces moved on Corinth by slow and regular approaches, so that it was not until May 27 that his army appeared before that fortified city, to which stronghold the army of Gen. Beauregard had fallen back. Active preparations were made by Halleck on the 28th and 29th for an attack, but on the morning of the 30th it was found that Beauregard had evacuated this stronghold during the previous night, and Corinth was occupied without resistance. After the campaign of Corinth, Halleck was called to Washington as general-in-chief, and exercised that command until the grade of lieutenant-general was revived. He then continued under assignment as chief of staff of the army until transferred to the command of the military division of the James in Apr., 1865. Upon the termination of the war, Halleck was ordered to the military division of the Pacific, assuming command Aug., 1865, and Mar., 1869, was transferred to that of the South, which he retained till his death, which occurred at Louisville, Ky., Jan. 9, 1872. Degrees of A. M. and LL. D. were conferred by Union College, New York. Among the more important of Gen. Halleck's published works may be mentioned his great treatise on *International Law, or Rules Regulating the Intercourse of States in Peace and War* (1861), and a translation of Jomini's *Vie Politique et Militaire de Napoléon*.

**Halleck**, Reuben Post: See the Appendix.

**Halleflinte**, haa'le-flin-te: See Felsite.

**Hallelujah** [Heb., praise ye Jah, i. e. Jehovah; adopted into Greek in the form ἀλληλούια]: an ancient formula of praise, universally adopted by the Christian Churches.

**Haller**, haa'ler, Albrecht, von, M. D., F. R. S.: the father of the science of physiology; b. at Berne, Switzerland, Oct. 16, 1708; studied divinity at Tübingen, medicine under Boerhaave at Leyden, and mathematics with the Bernoulli family at Basel; made a botanical exploration of the Alps with Gesner; practiced medicine at Berne 1729–36; held important professorships at Göttingen 1736–53, declining calls to several of the most renowned universities of Europe; became physician to the King of England 1729; retired to private life in Berne 1753. He was a voluminous writer on physiology, anatomy, botany, surgery, and practical medicine; author of several romances and poems, and many reviews and scientific papers. His hypotheses were often short-lived and inadequate, but admirable for their scientific spirit, and for the stimulus which they gave to

physiological study throughout Europe. Among his works are *Icones Anatomicæ* (1743–50); *Opuscula Pathologica* (1755); *Opuscula Botanica* (1749). See the *Life* by Frey (1879). D. in Berne, Dec. 12, 1777.

**Hallettsville**: town; capital of Lavaca co., Tex. (for location of county, see map of Texas, ref. 5–I); on the Lavaca river and the San Ant. and Aran. Pass Railway; 101 miles W. of Houston, 137 miles E. of San Antonio. It is in a cotton region; contains 3 cotton-gins and a cottonseed-oil-mill; and has water-works, electric lights, Roman Catholic, Baptist, Methodist Episcopal, Lutheran, and Protestant Episcopal churches for white people and several for colored, Roman Catholic and public graded schools, and 3 weekly newspapers. Pop. (1880) 588; (1890) 1,011; (1900) 1,457.

EDITOR OF "HERALD."

**Hal'ley**, EDMUND, LL. D., F. R. S.: astronomer and mathematician; b. at Haggerston, near London, Oct. 29, 1656; was educated at Queen's College, Oxford, where he chiefly studied mathematics, physics, and astronomy; published in 1675 a method for finding aphelia and planetary eccentricities; was in St. Helena 1676–78, cataloguing the southern stars; published *Catalogus Stellarum Australium* (1679); while traveling on the Continent in 1680 discovered the great comet which bears his name; published in 1683 a paper giving his theory of the variation of the magnet; became a captain in the royal navy 1699, and conducted expeditions to observe the variations of the magnetic needle; became Savilian professor at Oxford 1703, a position which had previously been refused him on account of his alleged infidelity; was secretary of the Royal Society 1713–21, and was appointed astronomer-royal in 1720. Halley was a friend and collaborator of the great Newton, and a member of many learned societies, and one of the ablest physicists of his time. D. at Greenwich, Jan. 14, 1742.

**Halley's Comet**: See COMET.

**Halliwell-Phillipps**, JAMES ORCHARD: scholar and antiquarian; son of Thomas Halliwell; b. at Chelsea, England, June 21, 1820; studied for a time in Cambridge, and in 1839 began his great work of the editing and publication of old English authors and MS. texts. He produced numerous works, many of them original. Among these are *Shakspeariana* (1841); *A History of Freemasonry* (1842); *Dictionary of Provincial and Archaic Words* (1844–45); and many volumes of Shakspearian literature, including *Outlines of the Life of Shakspeare* and a folio edition of the *Works of Shakspeare* (16 vols., 1853–65). In 1863 he interested himself in the purchase of New Place for the town of Stratford-upon-Avon. In 1872 he changed his surname to Halliwell-Phillipps. D. near Brighton, Jan. 3, 1889.

Revised by H. A. BEERS.

**Hallow-day**: See ALL SAINTS' DAY.

**Halloween'**, or **All Hallows' Eve** [short for *All Hallows' Even* < O. Eng. *ealra hālgena æfen*, liter., all saints' evening]: the night of Oct. 31—i. e. the *eve* of All Saints' or All Hallows' Day, which is the first day of November. The word *hallow* is the Anglo-Saxon *halig* and the German *heilig* (holy, sacred, etc.), nearly equivalent to the Latin *sanctus*, from whence comes our word *saint*. All Saints' (All Hallows' or All Hallow Tide) Day takes its origin from the conversion in the seventh century of the Pantheon at Rome into a Christian place of worship, and its dedication to the Virgin and all the martyrs. First celebrated on May 1, the date was subsequently changed to Nov. 1, and under the designation of Feast of All Saints set apart as a general commemoration in their honor, and as such retained by the Anglican and American Episcopal Churches, the collect for which day supplicates God for "grace so to follow Thy blessed *saints* in all virtuous and godly living," etc. On that day it is a custom of Roman Catholic countries (still practiced in Louisiana) to visit the cemeteries for devotions or for laying floral tributes on the graves of relatives. But the "Halloween" has nothing churchly about it, and seems to be a relic of pagan times, or perhaps of mediæval superstitions. It was regarded as the time of all others when supernatural influences prevail, and as a night which was set apart for a universal walking abroad of spirits both of the visible and invisible world; for on this mystic evening it was believed that even the human spirit might detach itself from the body and wander abroad. Halloween seems clearly allied to the "Walpurgis Night" of the Germans, the witch-festival or assembling of evil spirits on the summit of the Brocken in the Hartz Mountains on the eve of May 1—the day, as already noticed, originally dedicated to the Christian martyrs or saints. The Walpurgis legend being almost coeval and early associated with the latter day, it is probable that in England the transference of the festival-day to Nov. 1 carried with it the superstitions attributed to its preceding night. Practically, so far as it is recognized at all, as it is still in Great Britain and in the U. S. in localities where Church usages and traditions survive (as in Maryland and Virginia), it is devoted to sports and practical jokes. Nuts and apples are in requisition, the former giving the name "Nutcrack Night" to Halloween in the south of England. They are not only cracked and eaten, but are made the means of vaticination in love affairs. But the especial sport of Halloween is that of "ducking" or "bobbing" for apples set afloat in a tub of water. The forms "Hallow e'en" and "Hallow-eve" are found in Prof. F. J. Childs's *Ballads*, while Burns uses the simpler form of "Halloween."

Revised by W. S. PERRY.

**Hallowell**: city; Kennebec co., Me. (for location of county, see map of Maine, ref. 9–C); on the Kennebec river and the Me. Cent. Railroad; 2 miles S. of Augusta, 58 miles N. E. of Portland. The principal industry is granite quarrying and cutting for building and monumental purposes. There are two large oilcloth-works, several iron-foundries, wood-working shops, shoe-factory, sandpaper-factory, lumber-mills, and manufactures of soap and leached ashes. The city has excellent facilities for travel and transportation by steam and electric railways, the Boston steamboat line and various steamboats plying on the river. Among the public buildings is a free library. Pop. (1880) 3,154; (1890) 3,181; (1900) 2,714.

EDITOR OF "REGISTER."

**Hallow-fair**: a market held in various parts of Scotland at Hallowtide.

**Hallowmas**: an abbreviated form used by Shakspeare (*Measure for Measure*, ii., 1) for All Hallows' Mass.

**Hallucination**: See ILLUSION and INSANITY.

**Hallue**, ăă'lü'ă': a small river of Northern France, which enters the Somme from the right above Amiens; is noticeable on account of the indecisive battle which took place here Dec. 23, 1870, between the German army under von Manteuffel and the French army under Faidherbe.

**Halluin**, ăă'lü'ăn': a town of France; department du Nord; on the right bank of the Lys; 10 miles N. N. E. of Lille (see map of France, ref. 1–F); contains several religious and benevolent institutions, and has manufactures of linen and cotton goods, chemicals, bricks, and oil. Pop. (1896) 15,781.

**Halm**, haalm, FRIEDRICH: a pseudonym. See MÜNCH-BELLINGHAUSEN, ELIGIUS FRANZ JOSEPH, Baron von.

**Halm**, KARL FELIX: philologist; b. in Munich, Apr. 5, 1809; d. Oct. 5, 1882; was head librarian and professor ordinarius of the University of Munich, and one of the most noted text-critics of the nineteenth century. Among his many editions of classical authors may be mentioned the works of Cicero, in conjunction with Baiter; *Rhetores Latini Minores* (1863); Quintilian (2 vols., 1868); Nepos, Velleius, Valerius Maximus, Florus, and Tacitus (2 vols., 1851; 4th ed. 1883). See Bursian's *Biogr. Jahrbücher* (vol. v., p. 1 ff., 1882).

ALFRED GUDEMAN.

**Halmahera**: See GILOLO.

**Halmstad**, haalm'staăd: a town of Sweden; capital of the province of Halland; on the Cattegat, at the mouth of the Nissa; 75 miles S. S. E. of Gothenburg (see map of Norway and Sweden, ref. 13–D); has very important salmon-fisheries, and carries on quite a brisk trade in deals, lumber, pitch, and tar. It was formerly fortified, and has been the scene of important events in Scandinavian history, being often chosen as the meeting-place of the rulers and representatives of the three northern states. Pop. (1895) 13,362.

**Halo** [= Fr. *halo* : Ital. *alone* < Lat. *halos* = Gr. ἅλως, disk, especially disk of sun or moon, halo around sun or moon, liter., a threshing-floor (which was disk-shaped)]: the popular term applied to bright circles and attendant optical phenomena seen when the sun or moon shines through or upon fog, haze, or cloud. For the purposes of scientific description in meteorology, halos are classified as greater or lesser halos; the former are the halos proper, while under the lesser halos are included the small rings, aureolæ, or glories known as coronæ and anthelia. According to the numerous physicists who have contributed to the explanation of the phenomena in question, these are all the result

of certain modifications which light undergoes by reflection, refraction, dispersion, diffraction, and interference when it falls upon the crystals of ice, the raindrops, or the minute particles that constitute fog and clouds. The phenomena and their explanations may be considered under the following heads:

(1) A *corona* is a simple ring or concentric rings of light surrounding the sun or other luminary. These rings are generally tinged with colors, the inner being blue or purple, and the outer red; several series of such rings, separated by white spaces, are included within a distance of from one to five degrees from the sun. Fraunhofer first explained the origin of these rings as being the result of the diffraction of the rays of light in passing between the particles of a cloud or fog; by careful experiments upon coronæ artificially produced he rendered his explanation perfectly acceptable; and the undulatory theory of light enables us to conclude the average diameter of the drops of vapor from the measured diameter of the colored rings. The results of this investigation were carefully collated by Kämtz, who showed that the higher the temperature of the air the smaller is the diameter of the vapor-particles, so that, for instance, in winter, the average diameter is 0·00095 of an inch, but in summer 0·00061. Some physicists have maintained that fog-particles are hollow vesicles of vapor, but Bravais has shown that if the thickness of the shell of the vesicle is greater than one-third the exterior diameter of the particle, the latter will then produce halos closely resembling, if not identical with, those of a solid drop. The internal structure of vapor particles need not be considered in the explanation of coronæ, which, being due to diffraction only, depend simply upon the exterior diameter; but is, on the other hand, of importance in explaining the phenomena of aureolas or glories.

(2) *Aureolas or Glories.*—This term includes the bows, circles, etc., surrounding the shadow of the observer when it is projected upon a cloud or fog-bank or dew-covered grass. These colored rings are observed upon the upper surface of clouds by aëronauts, and have been well described by Flammarion. (See Glaisher, *Travels in the Air*, London, 1871.) The phenomena in question are doubtless produced by the diffraction of the light reflected at a nearly perpendicular incidence from the surfaces of the particles of vapor. Aureolas and coronæ are seen in greatest perfection when the vapor-particles are of comparatively large and regular dimensions; the smaller the diameter, and the less of uniformity in the size of the particles, the larger is the breadth of the colored rings, and the more perfectly do they overlap, thereby producing a more perfect commingling of the individual colors, resulting in a simple white and faint fog-bow. The existence of this bow, in connection with the absence of colored bands, is held to be an argument against the existence of vesicles. For an account of the arguments for and against the vesicular theory, see Kober in *Pogg. Ann.* (1871).

(3) *Halos proper* consist of more or less complicated arrangements of arcs and circles of light surrounding the sun or moon, accompanied by others tangent to or intersecting them; near the points of tangency and intersection there appear spots of special brightness, known as parhelia, paraselenæ, sun-dogs, etc. Of these arcs of light, some are colorless, while others are composed of parallel colored bands; the light of some arcs is polarized, while that of others is not. The very various appearances of these halos can only be properly appreciated by means of colored drawings; in general they are due to reflection and refraction from crystals of ice floating in the air; among the prominent features, whose origin has been satisfactorily explained, the following may be noted: (1) A circle of 22° radius, the inner edge well defined red, the outer edge ill defined blue; the light polarized in the direction of a tangent to the circumference. This halo is formed by light passing through the alternate faces of hexagonal prismatic ice-crystals in the direction of minimum deviation. (2) A circle of 46° radius, the inner edge red and the outer edge pale blue. This is formed by the rays passing in the direction of minimum deviation through the base and sides of right prisms of ice. (3) A circle of about 90° radius, of white light. This is probably due to rays that after entering an ice-prism are totally reflected, and emerge through an opposite face of the prism. (4) The parhelic circle. This is a colorless arc extending from the sun to the right and left, parallel to the horizon, and is produced by simple reflection of the sun's light from the outer vertical surfaces of such ice-prisms as are slowly settling down through tranquil air. (5) A vertical arc is similarly produced by the reflections from the horizontal surfaces of ice-crystals. The arc extends to a distance of 5° to 20° above and below the sun. (6) The parhelia and paraselenæ. These are spots of special brightness that are seen at the mutual intersections of the circular arcs; it is a sufficient explanation of these to consider that at these points two causes are combining to turn toward the eye a double portion of the solar rays, thereby producing the increased apparent brightness. This at least suffices to explain the parhelia that are distant 22° and 46° from the sun's center. Anthelion (Germ. *Gegensonne*) would be a term properly applicable to the parhelion that is seen at a point on the parhelic circle directly opposite the sun, and which is probably sometimes due to the combination of reflections from sets of surfaces oblique to the horizon. (7) Tangential arcs. Of these, which are numerous and have variable positions, the most brilliant is that which touches the halo of 46° at its summit; this arc is only seen when the sun's altitude is between 12° and 30°, and is due to a refraction of the sun's light through prisms whose refracting edges are horizontal. (8) The rainbow may be very properly considered as a halo due to the action upon the sun's light of large drops of water, instead of smaller drops or of crystals of ice, and differs from a corona in that it is not due to diffraction. The rainbow phenomena consist principally of one, two, or three main arches of prismatic colors, known as the primary, secondary, and tertiary bows, whose radii, reckoned from a point opposite the sun, are respectively 41½°, 82¼°, and 136¼°, and which are respectively formed by those rays that experience a minimum deviation after one, two, or three total reflections within the drop. The secondary bow is sometimes erroneously spoken of as a reflection of the primary. These arches are, especially near their summits, fringed on their concave sides by narrow supernumerary belts of color, due, as was first explained by Dr. Thomas Young (1804), to the interferences of those rays that enter and leave the drops very nearly at the angle of minimum deviation.

CLEVELAND ABBE.

**Hal'ogens** [Gr. ἅλς, ἁλός, salt + *gen-*, producing, from root of γεννάειν, beget]: those elementary substances which by combination with a metal produced the compounds which Berzelius called haloid salts. The halogens are chlorine, bromine, iodine, and fluorine (simple halogens), while cyanogen was called a compound halogen. The simple halogens form a very natural and strongly marked group. Cyanogen is strongly analogous to them in its character.

**Haloid Salts** [*haloid* is from Gr. ἅλς, ἁλός, salt + εἶδος, form, likeness; so called because they are analogous in composition to common salt]: a name given by Berzelius to compounds of some halogen with a metal, like common salt and iodide of potassium. The metallic chlorides, iodides, bromides, and fluorides are haloid salts, and to these the metallic cyanides have a close relationship.

**Hal'pine**, CHARLES GRAHAM: soldier and poet; b. at Oldcastle, County Meath, Ireland, Nov. 20, 1829; graduated at the University of Dublin in 1846. His father was a Protestant clergyman, and editor of the Dublin *Evening Mail*. Young Halpine entered upon the life of a journalist, and in 1847 came with his wife to New York, without money or friends. He was for a long time connected with the New York *Herald*, *Times*, and other papers. For the *Tribune* he wrote that famous piece, *Tear Down the Flaunting Lie*. He also wrote for the Boston *Post*, and was for a time one of the editors of *The Carpet Bag* in that city. In 1861 he enlisted in the Union army, in which he speedily rose, reaching in 1864 a brigadier-generalship of volunteers. He was also a major in the regular army and brevet major-general. He resigned his army commissions in 1864. It was while in the army that he wrote the humorous pieces in prose and verse under the name of "Private Miles O'Reilly," which were universal favorites. In 1864 he became editor and then proprietor of *The Citizen* newspaper. He was afterward register of the county of New York. D. Aug. 3, 1868. A complete edition of his poetical works was published in 1869.

Revised by H. A. BEERS.

**Hals**, haals, FRANS: painter; b. probably at Antwerp, 1580, or perhaps 1584. He is said to have been a pupil of Rubens; he lived chiefly in Antwerp and Haarlem, and left the reputation of having been dissipated and reckless in life. Against these assertions are to be set his long life, the great number of pictures which he painted, and their extraordinary merit. He was one of the greatest of portrait-painters, and he had

an exceptional power of combining a number of portrait-figures in a large composition, such as several of those named below. From 1620 to 1660 is his great epoch, and during that time he was always a colorist and a consummate painter in the technical sense, while his manner changed gradually from a fuller to a paler tone of coloring, and tended more and more toward a kind of luminous monochrome. D. at Haarlem, 1666. Among his many important pictures are the several large canvases in the Haarlem Museum, *Banquets of the Haarlem Marksmen*, and other associations, each picture containing a number of portraits; at Amsterdam a portrait group of *Hals and his Wife*; in the Louvre a celebrated *Portrait of Descartes* and two groups of members of *The Beeresteyn Family*; in the Cassel Gallery the *Jolly Topers*, so called; and the three pictures of a jovial old woman called *Hille Bobbe*, one of which, and perhaps the best, is in the Metropolitan Museum of Art, New York. As his pictures are generally of moderate size and so solidly painted as to be remarkably well preserved, they have been much sought for by wealthy men, and many of the finest are in private collections.

RUSSELL STURGIS.

**Halsey**, LEROY JONES, D. D., LL. D.: clerical writer; b. in Goochland co., Va., Jan. 28, 1812; graduated at the University of Nashville, Tennessee, 1834, and at Princeton Theological Seminary 1840. After serving churches in Selma, Ala., in Jackson, Miss., and in Louisville, Ky., he became in 1859 Professor of Pastoral Theology, Church Government, and Homiletics in the Presbyterian Seminary in Chicago (now McCormick Theological Seminary), being one of the four original professors. He was made emeritus professor 1882. For some years he was also associate editor of *The Interior*. He has published *Literary Attractions of the Bible* (New York, 1857); *Life Pictures of the Bible* (Philadelphia, 1860); *The Beauty of Immanuel* (1861); *Life and Works of Dr. Philip Lindsley* (1862); *Life and Sermons of Lewis Warner Green, D. D.* (New York, 1868); *Living Christianity* (Philadelphia, 1878); *Scotland's Place in Civilization* (1885).

WILLIS J. BEECHER.

**Hal'stead**: town of England, in Essex; on the Colne; 56 miles N. E. of London (see map of England, ref. 12–J). It has a grammar school and manufactures of crape, silk, and paper. Pop. (1891) 11,226.

**Halstead**: city; Harvey co., Kan. (for location of county, see map of Kansas, ref. 7–G); on the Little Arkansas river and the A., T. and S. Fé Railroad; 10 miles S. W. of Newton. It is in an agricultural region, and water-power from the river operates several flour-mills. It is the site of a prosperous Mennonite settlement and the center of a Russo-German immigration movement. Pop. (1890) 1,071; (1900) 914.

**Halstead**, MURAT, LL. D.: journalist; b. in Butler co., O., Sept. 2, 1829; graduated at Farmers' College, College Hill, O., in 1851; taught district schools in Hamilton and Butler Counties, and wrote for the papers of his native county and of Cincinnati before his education was completed. After graduation he became a local reporter on the Cincinnati *Enquirer*, then the news-editor of the Cincinnati *Atlas*, and literary editor of *The Columbian and Great West*. In Mar., 1853, he became connected with the Cincinnati *Commercial*. He soon became an important editorial contributor, and in 1856, after the death of his partner, M. D. Potter, the chief editor and proprietor. When the Cincinnati *Commercial* and *Gazette* were consolidated, in 1882, he continued as chief editor. He became editor of *The Standard-Union*, Brooklyn, N. Y., in 1890.

**Halsted**, BYRON DAVID, D. Sc.: botanist; b. in Cayuga co., N. Y., June 7, 1852; educated in Michigan Agricultural College and Harvard University; for many years editor of *The American Agriculturist*; Professor of Botany in Iowa Agricultural College (1885–88), in Rutgers College (1888). He has written many articles in botanical and agricultural journals, especially on fungi injurious to vegetation and on the weeds of the U. S., and has published *A Century of American Weeds* (1892).

CHARLES E. BESSEY.

**Halteres**: See ENTOMOLOGY.

**Halys**: See KIZIL-IRMAK.

**Ham**: town of France; in the department of Somme; on the Somme; about 40 miles S. E. of Amiens (see map of France, ref. 2–F). Its old fortress, built in 1470, is now used as a state prison. Louis Napoleon was confined there from 1840 to 1846. Pop. (1891) 3,082.

**Ham**: a son of the patriarch Noah, and the brother of Shem and Japheth; also, according to Genesis, the father of those nations which inhabited the southern countries, Egypt, Libya, etc. The Coptic or native name of Egypt is *Kem*, Χήμια with Plutarch, *Chemé* in the Rosetta inscription, which signifies hot or burnt; and this corresponds with the Hebrew name *Ham*, derived from *haman*, to be hot, to be burnt. But it must be remembered that the descendants of Ham were not all African. The Canaanites and Phœnicians, the Cushites of the Euphrates valley, a South Arabian race of importance, all were Hamitic. Some of these peoples were closely associated with the Semitic races, and their languages belonged to the class now described as Semitic.

Revised by WILLIS J. BEECHER.

**Hamadan'**: town of Persia; in the province of Irak-Ajemee; lat. 34° 50′ N. and lon. 48° 32′ E.; at the base of the Elwund Mountains. Its location on one of the routes from Bagdad to Erivan, Teheran, and Ispahan makes it a trading-place of considerable importance; it has many caravanseries and extensive bazaars. The beautiful gardens and orchards which surround it diminish somewhat the dreary aspect of the ruins which cover the ground in the vicinity. Among its most remarkable monuments are the reputed tomb of Mordecai and Esther, and that of Avicenna, yearly visited by crowds of pilgrims. Hamadan occupies the site of Ecbatana (*Achmethan* of the Septuagint), the ancient capital of Media, which, according to the Apochrypha (Jud. i. 2–4), was built by Arphaxad. It was captured by Cyrus in 549 B. C., and became the summer residence of the Kings of Persia. During the reign of the Sassanidæ it lost its importance. Pop. (1891) 27,000.

**Hamadry'ads**, or **Dry'ads** [*hamadryads* is deriv. of Gr. ἅμα, together with + δρῦς, oak: Teuton. *triu* > Eng. *tree*; *dryads* is deriv. of Gr. δρῦς]: in Greek mythology, the nymphs who were attached to particular trees, with which they came into existence and died. They lived in the deep forests, out of which they never came; they were therefore sometimes called Oreades (from ὄρος, mountain). In the guise of huntresses and shepherdesses they often lay with Apollo, Hermes, Pan, and the Satyrs. They were often named from mountains, rivers, springs, and caves—e. g. the Peliades from Mt. Pelion. They differed from most other nymphs in not possessing immortality.

Revised by J. R. S. STERRETT.

**Hamah**: modern Arabic name of HAMATH (*q. v.*).

**Hamaker**, haa'maă-ker, HENDRIK ARENS: Orientalist; b. at Amsterdam, Feb. 25, 1789; studied first the classic languages, then Oriental philology, and was in 1815 appointed Professor in Arabic, Chaldæan, and Syriac at the Academy of Franeker, whence he removed in 1817 to the University of Leyden. Here he died Oct. 10, 1835. He was a very prolific writer and a man of original ideas, but his knowledge was more multifarious than exhaustive, and his representation more striking than accurate. One of his principal works is *Specimen catalogi codicum MSS. orientalium Bibliothecæ academicæ Lugduno-Batavæ* (1820), in which he gives a description of each volume, a *résumé* of its contents, the biography of its author, the manner in which it was acquired, etc. Specially noteworthy among his many other writings are his Punic researches, *Diatribe philologica-critica* (1822); *Lettre à M. Raoul Rochette* (1825); *Miscellanea Phœnicia* (1828).

Revised by C. H. TOY.

**Hamamelis Virginica**, or **Witch Hazel** [Gr. ἁμαμηλίς, name of a tree or shrub, the medlar-tree]: an indigenous shrub belonging to the order *Hamamelaceæ*. It is found in damp woods and by streams in many parts of the U. S.; grows from 5 to 15 feet in height, and has straight veined obovate or oval leaves and small yellow perfect or polygamous flowers which blossom late in autumn. The bark yields a sedative used both internally and externally for the purpose of controlling hæmorrhage and for influencing diseased blood-vessels, as, for example, dilated veins. Examination by Dr. John Marshall fails to show that it possesses any alkaloid, but there is no doubt that it has remedial powers.

H. A. HARE.

**Ha'mann**, JOHANN GEORG: b. at Königsberg, Aug. 27, 1730; studied theology, law, philosophy, poetry, and philology in a miscellaneous manner; accepted in 1752 a place as tutor in a noble family in Livonia; changed it next year for another position of the same kind in Courland; entered in 1755 into the service of a commercial house in Riga, and visited on business Berlin, Lübeck, Holland, and England,

in which latter country he spent about a year. After 1759 he lived for several years in his father's house in Königsberg in leisure, studying theology and philosophy, but from 1763 to 1787 he held various small offices in the tax department in his native city. In 1787 he was discharged. He then lived alternately in Düsseldorf and Münster, where he died June 21, 1788, and was buried in the garden of the Princess Galizyn. The public at large took no notice of him as the writer of numerous pamphlets and essays. He was in strong opposition to the reigning fashion of enlightenment. The depth of his religious intuitions, the eccentricity of his humor, and the numerous allusions which crowd his pages made him unintelligible to the general reader and earned for him the title *der Magus im Norden*; but upon men like Herder, Goethe, and F. H. Jacobi he exercised great attraction, and in the subsequent generations all the most prominent minds have studied him with great attention. His influence upon Herder's views and language was especially great. Hamann was a great admirer of *Volkspoesie* and original genius, and his discovery that poetry was the mother-tongue of the human race can in its inspiring influence be traced as far as the Romanticists. His writings were collected and published in eight volumes, in Berlin (1821–43), by Roth. See also Gildemeister, *Hamanns Leben u. Schriften* (1874); Poel, *Johann G. Hamann* (1876); Minor, *Hamann in seiner Bedeutung für die Sturm- und Drangperiode.*

Revised by JULIUS GOEBEL.

**Ha'math** [Heb., fortress; the *Epiphaneia* of the Greeks and Romans, now called *Hamah*]: one of the oldest cities in the world; in Upper Syria; about halfway between Baalbek and Antioch; founded by the youngest (or last-named) of the eleven sons of Canaan (Gen. x. 18). The "entrance of Hamath" (Num. xxxiv. 8), named at first as the northern boundary of the Promised Land, probably was the low screen of hills between the sources of the Leontes (*Litany*) and the sources of the Orontes. The small kingdom or province of which Hamath was the capital was in alliance with David and tributary to Solomon, but regained its independence after the revolt of the ten tribes (975 B. C.). Hamath was reconquered and dismantled by Jeroboam II. (823–772 B. C.), and not long afterward fell under the power of Sennacherib (702–680 B. C.) of Assyria, and became insignificant. Antiochus Epiphanes gave it the name of Epiphaneia, and it was so known to the Greeks and Latins. In 638 A. D. it was taken by the Saracens, and in 1517 came into the hands of the Turks. Under the Arabs it was a place of considerable importance. Aboolfeda, the Arab geographer and historian, was born there in 1273. The city now has 42,200 inhabitants, one-fourth of whom are Greek and Jacobite Christians, and the rest Mohammedans, noted for their bigotry and fanaticism. The Orontes (*el-Asy*), spanned at this point by four bridges, divides the city into two parts. Huge Persian water-wheels (*nâ-ûrah*), 70 or 80 feet in diameter, turned by the current, supply the houses and gardens with water. The houses are built of sun-dried bricks and wood. The city keeps up a lively trade with the Bedouin. Several black basalt stones with hieroglyphic inscriptions, supposed to be Hittite, discovered at Hamath (the first by Burckhardt in 1812), have excited much interest among archæologists, but thus far no clew has been discovered to their decipherment. The stones were removed to Constantinople in 1873. A few seals from Nineveh in the British Museum have the same characters. See E. Robinson's *Later Biblical Researches* (Boston, 1856); R. F. Burton and Drake's *Unexplored Syria* (London, 1872); and the Palestine Exploration Society's *Second Statement* (Sept., 1873).

Revised by S. M. JACKSON.

**Hambato**: same as AMBATO (*q. v.*).

**Hamburg** (Germ. pron. haam'boorch): a state and a city of the German Empire (see map of German Empire, ref. 2–E). The state, which has a total area of 158 sq. miles, comprises (1) the city of Hamburg, which with its suburbs had a population of 705,738 in 1900; (2) the neighboring territory of Bergedorf and some smaller districts; and (3) Ritzebüttel (including Cuxhaven), at the mouth of the Elbe, and had a total population in 1900 of 768,349, including a garrison of two battalions. The free city of Hamburg was one of the principal members of the old Hanseatic League and is the most important commercial port of the German empire. It is the first seaport of the mainland of Europe, and after London and Liverpool the most important commercial center of Europe. The imports into the port of Hamburg by sea for the year 1890 equaled 1,376,929,000 marks, and the exports by sea were valued at 1,260,475,000 marks, exclusive of the precious metals. The vessels entering and clearing the port of Hamburg during 1890 numbered 16,361, and had a tonnage of 10,417,096. The extent and value of the commerce of the city is more than double that of any other city in the empire. The manufactures are also very important. Jan. 1, 1882, the lower Elbe was included in the Zollverein or Customs Union, and on Oct. 15, 1888, the whole of the city, with the exception of a small portion of the actual port and warehouses connected with it, became incorporated in the Zollverein. The alterations in the port necessitated by this change involved the expenditure of some $30,000,000, to which the imperial Government contributed one-third. For 1891 the revenue was estimated at 55,341,500 marks, and expenditure 55,889,600 marks, leaving a deficit of 548,100 marks. The largest source of income is direct taxes, amounting to more than one-third of the whole revenue, and next to that of proceeds of domains, quays, railways, etc. The largest item in the expenditure in 1891 was for the debt, 10,095,000 marks; for education the expenditure was 5,460,000 marks. The direct tax amounts to 30 marks per head of the population. The public debt of Hamburg on Jan. 1, 1891, amounted to 233,963,656 marks. The debt was incurred chiefly for the construction of public works. A large number of German emigrants pass through Hamburg, the aggregate from that port in 1890 being 99,350. The Government is republican in form. The present constitution came into force Jan. 1, 1861, and was revised Oct. 13, 1879. The Government consists of two chambers of representatives, the Senate, and House of Burgesses. The executive power is exercised chiefly but not entirely by the Senate, which is composed of eighteen members, elected for life by the House of Burgesses; a first and second burgomaster, chosen annually in secret ballot, preside over the meetings of the Senate. The House of Burgesses consists of 160 members, elected half by secret ballot of all tax-paying citizens, half of the remainder by the owners of a certain amount of city property, and the remainder appointed by various guilds, corporations, and courts of justice. A military convention was entered into with Prussia Sept. 30, 1867. With Lübeck and Bremen, Hamburg furnishes as its military contingent the Seventy-fifth and Seventy-sixth Regiments of infantry.

The city forms a semicircle on the right bank of the Elbe, the depth of whose waters at high tide allows sea-going vessels drawing not more than 18 feet to enter the harbor, while an extensive river-traffic establishes a brisk communication with the interior. Hamburg, which formerly was fortified, consists of the old and the new city, the former suburb of St. Georg, situated to the N. E., and the suburb of St. Pauli, situated to the W. Besides the Elbe, it has two other small rivers: the Alster, which, coming from the N., forms within the city a small basin, called Binnen-Alster, and outside of it a larger one, called Aussen-Alster and the Bille. Both are finally discharged through canals into branches of the Elbe. The harbor affords room for 400 sea-going vessels and 400 large and several hundreds of small river-craft. The westernmost part of the harbor is chiefly occupied by British coal-ships and the Hamburg-American Steamship Company steamers; the lower harbor, situated more to the E., and safe against drifting ice, is especially intended for sailing vessels; farther to the E. stretch the Sandthorhafen and the Grasbrookhafen, with fine quays for steamboats. The easternmost part, the Brookthorhafen, the upper harbor and the lumber harbor, consist of shallow basins, and are occupied by lumber-craft and other small vessels coming down the river. The great station belonging to the railway line through Bremen, Osnabrück, Wesel, and Maestricht to Paris, is situated between the Brookthorhafen and the upper harbor. The Berlin station is situated in the eastern part of the old town.

The best view of the city and the river is from the Elbe Hill, near the harbor. The finest part of the city is the Binnen-Alster, generally called the Alster Basin, and its surroundings. The quadrangular basin, nearly 1⅓ miles in circumference, is on three sides lined with elegant buildings, among which are the best hotels, and has fine quays planted with trees—Jungfernstieg and Alsterdamm. The northern side of the basin is formed by a dike which separates the Binnen-Alster from the Aussen-Alster, over which is a promenade that crosses the channel connecting the two basins by the Lombard bridge, to the W. of which stands a column with the bust of Prof. Büsch, and to the E. a statue

of Schiller by Lippelt. At the northeast corner of the Alster Basin, on the Alster Hill, the art gallery is situated. The fortifications, extending from the art gallery to the Berlin station, have been transformed into promenades. Similar promenades stretch from the other end of the Lombard bridge to the Elbe Hill and the harbor, separating the city proper from the suburb of St. Pauli, and connecting with the fine botanical garden and with the zoölogical garden one of the best in Germany, having been organized by the famous naturalist Brehm. Other remarkable buildings are the Bourse, which contains a commercial library; the bank; the Nicolai church, built in 1842 after the plan of Gilbert Scott, of London; the Catharine church, containing a remarkable altar and fine glass-paintings; the Grosse Michaelis church, built in the middle of the eighteenth century; the Johanneum, containing a library of 400,000 volumes and 5,500 manuscripts; and the Thalia theater, built in 1842, in the Renaissance style. The vicinity of Hamburg, especially the right bank of the Elbe, is covered with fine villas, beautiful promenades, and charming villages, such as Blankenese, Flottbeck, and others.

It is probable that Hamburg originated from one of the castles which Charlemagne built against the Slavi, and more especially from the so-called Gammerburg. In 831 it was made a bishopric, and in 834 an archbishopric, although at that time it was only a miserable fishing-village. In 980 it had grown into a small town, but in that year it was destroyed by the Obotrites. In 1215 it was made a free city by the Emperor Otho IV., but in 1223 it was taken by the Danish king Knut VI. His son Waldemar sold it for 700 marks silver to the Count of Schaumburg-Orlamunde, and he sold it again for 1,500 marks silver to the citizens. Thus Hamburg again became a free city. It chose Count Adolph IV. of Holstein for its patron, and he protected it successfully against the Danes, leaving it all its rights and conferring many benefits on it. In 1242 it made a covenant with Lübeck, by which the foundation was laid for the Hanseatic League, to which Hamburg owes much of its commercial importance and all of its political influence. After the fall of the league it still increased, and during the Thirty Years' war no foreign soldier entered it. After a series of internal disturbances, caused by the jealousy between the Senate and the citizens, it formed a new constitution in 1712, and in 1770 it acquired a vote in the German Diet. Its commerce increased immensely during the North American war of independence, as Great Britain allowed neutral vessels free entrance to the colonies. On Dec. 13, 1810, it was incorporated into France, and suffered very much during the sieges of 1813 and 1814. In 1842, by a terrible conflagration, 4,219 houses were burnt. In 1867 Hamburg became a member of the North German Confederation, and in 1871 of the German empire. Revised by C. H. Thurber.

**Hamburg**: city; Fremont co., Ia. (for location of county, see map of Iowa, ref. 7–D); at the junction of the Missouri and the Nishuabotua rivers, and on the Chi., Burl. and Q., and the Kan. City, St. J. and C. B. Railroads; 50 miles S. of Council Bluffs. It is in an agricultural, fruit-growing, and stock-raising region, and contains 6 churches, large public school, several flour-mills, and 1 monthly and 2 weekly periodicals. Pop. (1880) 2,036; (1890) 1,634; (1900) 2,079. Editors of "Democrat."

**Hamburg**: borough; Berks co., Pa. (for location of county, see map of Pennsylvania, ref. 5–I); on the Schuylkill river and canal and the Penn. and Phila. and Reading Railroads; 18 miles N. by W. of Reading, 76 miles N. W. of Philadelphia. It is at the foot of the Blue Mountain, and has a rolling-mill, iron-foundries, stationary-engine works, hat-factories, handle and bending works, and three brick-manufacturing plants. There are incandescent and arc electric-light plants, an improved system of water-works, new public-school building that cost $25,000, and 1 semi-weekly and 2 weekly newspapers. Pop. (1880) 2,010; (1890) 2,127; (1900) 2,315. Editor of "Item."

**Hamburg White**: See Baryta.

**Hameln**, haa'meln: town of Germany; in Hanover, on the right bank of the Weser, which here is crossed by a suspension bridge 780 feet long; 25 miles S. W. of Hanover (see map of German Empire, ref. 3–E). It has a very interesting aspect of antiquity with its walls and towers, and its old houses ornamented with wood-carving with their gables turned toward the streets. It has large breweries, foundries, and manufactures of paper, chemicals, and leather. The legend set forth in an inscription on the Rattenfängerhaus (built in 1642) is familiar to English readers from Browning's *Pied Piper of Hamelin*. Pop. (1890) 13,676.

**Hamerik**, haa'mereĕk, Asger: composer; b. in Copenhagen, Apr. 8, 1843; was a student under Gade, Berlioz, and von Bülow. He settled in Baltimore, Md., 1871, as director of the Peabody Conservatory of Music, where he has remained teaching and composing, and exercising a powerful influence on the musical life of that city. His principal compositions are *Symphonie Poétique* in F (1880); *Symphonie Tragique* in C minor (1884); *Symphonie Lyrique* in E (1884); *Friedenshymne*, cantata (1868); *Christian Trilogy*, oratorio, and some minor works. In June, 1890, he was knighted by the King of Denmark in recognition of his services to musical art. D. F. Hervey.

**Hamerling**, Robert: poet; b. at Kirchberg am Wald, an Austrian village, near the Bohemian border, Mar. 24, 1830; studied at the gymnasium in Vienna, and while still a mere lad wrote several dramas. After the insurrection of 1848, during which he was a member of the "Academic Legion," he devoted himself to the study of philology and philosophy, became teacher in the academic gymnasium in Vienna, held a similar position in Graz, and in 1855 was appointed professor in the gymnasium at Trieste, where he taught till 1866, when ill-health compelled him to resign. Returning to Graz, he devoted the rest of his life to authorship. His first volume, *Ein Sangesgruss vom Strande der Adria* (1857), was followed by a collection of lyical poems, *Sinnen und Minnen* (1860; 7th ed. 1886). Later he published *Schwanenlied der Romantik* (1862; 4th ed. 1873); *Germanenzug* (1864; 4th ed. 1873); *Ahasver in Rom* (1866; 14th ed. 1884); *Der König von Sion* (1869; 8th ed. 1879); *Danton und Robespierre* (1871; 4th ed. 1877); *Die sieben Todsünden* (1873; 4th ed. 1876); *Aspasia* (1875; 3d ed. 1884); *Die Waldsängerin* (1880); *Amor und Psyche* (1882); *Hesperische Früchte* (1884); *Die Atomistik des Willens* (1891); *Stationen meiner Lebenspilgerschaft* (2d ed. 1889). D. in Graz, July 13, 1889.

**Ham'erton**, Philip Gilbert: artist and author; b. in Manchester, England, Sept. 10, 1834; devoted himself to landscape-painting, living much in the wildest parts of Scotland; married a French lady in 1859, and thereafter lived chiefly at Autun; brought forward a new process for etching; and in 1869 established *The Portfolio*, an art review, devoted mainly to etching. Author of *Observations on Heraldry* (1851); *Isles of Loch Awe* (poems, 1855); *Painter's Camp in the Highlands* (1862); *Thoughts about Art* (1862), these two having been issued together as one work, but separated in later editions; *Etching and Etchers* (1866), an important and useful treatise which has been twice re-issued with important changes in the form and the illustrations; *Contemporary French Painters* (1867); *Etcher's Handbook* (1868); *Painting in France* (1869); *Wenderholme* (a novel, 1869); *The Unknown River*† (1870); *The Intellectual Life* (1873); *Chapters on Animals*† (1873); *Round my House* (1876); *Modern Frenchmen*, a volume containing biographies of artists and thinkers (1878); *The Life of J. M. W. Turner* (1879); *The Graphic Arts*, a large quarto, treating of the different kinds of drawing and painting, their peculiarities, and what should be expected of each, and finely illustrated (1882); *Human Intercourse* (1884); *Landscape*, a similar treatise, illustrated by forty admirable full-page prints (1885); *Imagination in Landscape Painting*† (folio, 1887); *Man in Art*, a work of the same class as *The Graphic Arts* and *Landscape*, but treating of figure-painting, etc., and illustrated in the same thorough way (1892). The titles marked † are of books reprinted from *The Portfolio*. A collected edition of his works appeared in Boston in 1882, in 10 vols. D. in London, Nov. 6, 1894.

**Hamil'car**: the name of several Carthaginian generals, the most celebrated of whom was Hamilcar Barca (lightning), the father of Hannibal. While very young he was appointed commander of the Carthaginian army in Sicily (247 B. C.) during the first Punic war. At this time the Romans had nearly succeeded in driving the Carthaginians from the island, but Hamilcar took up positions on Mt. Ercta and Mt. Eryx successively, from which he could not be dislodged, until in 242 B. C. the Romans offered battle on the open sea off the Ægates islands, and succeeded in defeating the Carthaginian fleet and in compelling the capitulation of Hamilcar. Peace was concluded shortly after, and Carthage lost Sardinia and Sicily. On his return to Carthage he was called upon to suppress the mutiny of the mercenary troops, and after a most obstinate struggle, last-

ing for more than three years, he succeeded. In order to procure for his native city territory that should at once compensate for the loss of Sardinia and Sicily, and afford a vantage ground for operations against Rome, he entered upon his Spanish campaigns in 236 B. C. He was eminently successful, and had brought the whole southern and eastern part of Spain under Carthaginian rule when he was killed in a battle against the Vettones, in 228 B. C.

Revised by G. L. HENDRICKSON.

**Hamilton**: town of Scotland; in the county of Lanark, on the Clyde; 11 miles S. E. of Glasgow (see map of Scotland, ref. 12–G). Close by is Hamilton Palace, a fine building in the midst of extensive pleasure-grounds. Pop. (1901) 32,775.

**Hamilton**: city, port of entry, and capital of Wentworth County, Ontario, Canada (for location, see map of Ontario, ref. 5–D); on Hamilton Bay, the W. extremity of Lake Ontario and the Grand Trunk Railway; 40 miles S. W. of Toronto, 43 miles W. N. W. of Suspension Bridge. The bay, which constitutes a capacious harbor, is connected with the lake by a canal, and a deepened channel, locally known as Desjardins Canal, leads to the town of Dundas. The city has a large trade and manufactures of machinery, cotton goods, tobacco, cigars, whisky, beer, paper, sewing-machines, carriages, fertilizers, wire goods, glass, gunpowder, screws, nails and tacks, etc. It is the see of an Anglican and of a Roman Catholic bishop, and has 8 chartered banks, electric street railways, inclined railway to the top of the mountain, and 3 daily, 4 weekly, 1 semi-monthly, and 2 monthly periodicals. Pop. (1881) 35,961; (1891) 48,980. EDITOR OF "SPECTATOR."

**Hamilton**: capital of the Bermuda islands; on the Great Bermuda, at the head of Great Sound. It was founded in 1790, and consists essentially of an irregular half street fronting a line of wharves. Pop. 8,000.

**Hamilton**: city; Hancock co., Ill. (for location of county, see map of Illinois, ref. 5–B); on the Mississippi river and the Tol., Peo. and W. and the Wabash Railways; opposite Keokuk, Ia. It is at the foot of the Des Moines rapids, has an immense water-power, and contains a number of important manufacturing establishments. The adjacent country is noted for fruit-growing. Pop. (1880) 1,025; (1890) 1,301; (1900) 1,344.

**Hamilton**: town (founded in 1858); Caldwell co., Mo. (for location of county, see map of Missouri, ref. 2–E); on the Ham. and Kings. and the Han. and St. J. Railroads; 50 miles E. of St. Joseph, 69 miles N. E. of Kansas City. It is in an agricultural, fruit-growing, and stock-raising region, and is an important point for shipping cattle, horses, swine, and grain. There are 8 churches, 3 public schools, 2 grain elevators, 2 feed-mills, roller flour-mill, planing-mill, canning and cider factories, 3 weekly newspapers, 2 coal mines in operation, and fair-grounds with a half-mile race-track. Pop. (1880) 1,200; (1890) 1,641; (1900) 1,804.

EDITOR OF "HAMILTONIAN."

**Hamilton**: village; Madison co., N. Y. (for location of county, see map of New York, ref. 5–G); on the Chenango river and the N. Y., Ont. and W. Railway; 30 miles S. W. of Utica. It is the seat of COLGATE UNIVERSITY (*q. v.*), and has 1 bi-monthly and 2 weekly periodicals. Pop. (1880) 1,638; (1890) 1,744; (1900) 1,627.

**Hamilton**: city; capital of Butler co., O. (for location of county, see map of Ohio, ref. 6–C); on both sides of the Great Miami river, and on the Cin., Ham. and Day., and the Pitts., Cin., Chi. and St. L. Railways; 25 miles N. of Cincinnati. The river and the Erie Canal (which passes through it) afford unlimited water-power for manufacturing purposes, and among its industries are the manufacture of railway supplies, burglar and fire-proof safes, reapers, mowers, threshers, engines, wood-working machinery, cordage, paper, woolen goods, flour, bent wood, bran dusters, sash and blinds, etc. It has a board of trade, paid fire department, electric fire-alarm telegraph, electric street railway, 3 parks, and 3 daily, 1 semi-weekly, and 4 weekly newspapers. Pop. (1880) 11,122; (1890) 17,565; (1900) 23,914. EDITOR OF "NEWS."

**Hamilton**, ALEXANDER: statesman; b. in Nevis, an island of the West Indies, Jan. 11, 1757. His father was from Scotland; his mother was of Huguenot stock. His father failed in business, and his mother died while her son was a child. He was sent to the mother's relatives in Santa Cruz, where in 1769 he became a counting-house clerk of Mr. Nicholas Cruger; but on his manifesting some literary taste, he was sent in 1772 to a grammar school at Elizabethtown, N. J. In 1773 he entered King's (now Columbia) College. In 1774 his speeches, pamphlets, and newspaper articles on the political affairs of the day attracted very general attention and admiration. In 1776 he received a captain's commission in the artillery, and served with honor in the army of Washington, whose aide-de-camp he became in 1777, with the rank of lieutenant-colonel. In this capacity he was employed by the commander in the most delicate and important trusts. In 1780 he married Eliza, a daughter of Gen. Schuyler. In 1781 he resigned his commission in consequence of a reproof received from Gen. Washington. He next received command of a New York battalion of light infantry, of which he was lieutenant-colonel, and at the battle of Yorktown charged the redoubts at the head of his troop. With this brilliant exploit his military career came to an end. He then studied law, was a member of Congress (1782–83 and 1787–88), and served in the convention which drew up the Federal Constitution, where all his powers were exerted to give strength to the federal authority in opposition to the independent authority of the individual States. He was the principal author of the papers afterward called collectively *The Federalist* (see FEDERALIST); and thus exerted a very powerful influence in behalf of the adoption of the Constitution by the several States. He was (1789–95) the first Secretary of the U. S. Treasury, and as such was the author of the funding system, the founder of the U. S. bank, and restorer of public credit. He afterward had some share in the preparation of Washington's farewell address. In consequence of his political doctrines as leader of the Federalists, he was at about this time involved in personal and political controversies with Jefferson and Monroe; but subsequently, when the House of Representatives was called upon to choose between Jefferson and Burr for the presidency, he used his powerful influence for the former. In 1798, during the troubles with France, he was made inspector-general of the army, with the rank of major-general, and was for a short time in 1799 commander-in-chief. In 1800 he was chosen president-general of the Cincinnati. He declined the chief justiceship of the U. S. In 1804, when Aaron Burr unsuccessfully sought the governorship of New York, he was opposed earnestly, though not actively, by Hamilton, to whose influence Burr ascribed his defeat. Burr, smarting under his supposed injuries, challenged Hamilton; and the latter, though repudiating the code as barbarous and wrong in principle, accepted the challenge. The parties met at Weehawken, N. J., July 11, 1804. Hamilton did not fire at his adversary, but at Burr's first fire was mortally wounded, and died on the following day. The importance of Hamilton's work in the formation of the government, and especially in the organization of the Treasury Department, has become more and more obvious with the passage of time. See his *Life*, by his son, John C. Hamilton (1834–40); by J. Renwick (1841); Hamilton's complete *Works* (7 vols., 1851; 8 vols., 1888); Morse, *Life of Alexander Hamilton* (2 vols., 1876); Lodge, *Alexander Hamilton* (1882).

Revised by C. K. ADAMS.

**Hamilton**, FRANK HASTINGS, A. B., A. M., M. D., LL. D.: physician; b. at Wilmington, Vt., Sept. 10, 1813; graduated in medicine at University of Pennsylvania in 1835; in 1846 became Professor of Surgery at Buffalo Medical College; in 1858 Professor of Principles and Practice of Surgery in Long Island College Hospital, Brooklyn, N. Y.; in 1861 Professor of Military and Clinical Surgery in Bellevue Hospital Medical College, New York; from 1868–75 Professor of Principles and Practice of Surgery with Operations in same institution; military surgeon and medical director for two years during civil war. Dr. Hamilton was one of the consulting surgeons in the case of President Garfield (assassinated). He was the author of many valuable books on surgery, among which are *Treatise on Fractures and Dislocations* (1st ed. 1860; 7th ed. 1884); *General Treatise on Military Surgery* (1862); and *The Principles and Practice of Surgury* (1872; revised ed. 1886). He invented many surgical instruments, and was president of many medical societies. D. in New York, Aug. 11, 1886.

**Hamilton**, Lord GEORGE FRANCIS: b. at Brighton, England, Dec., 1845; educated at Harrow; entered the army 1864; returned to Parliament 1868 and 1874 as a Conservative at the head of the poll in what had formerly been a strong Liberal district. He was Under Secretary of State for India in Disraeli's administration 1874; First Lord of the Admiralty in Lord Salisbury's administrations 1885–86 and 1886–92.

C. H. T.

**Hamilton**, James: politician; b. at Charleston, S. C., May 8, 1786; the son of Maj. James Hamilton of Washington's staff. The younger Hamilton received a good education, became a lawyer, served as a major in the war of 1812, and was for some years mayor of Charleston, besides holding other public offices. In 1822 he detected a Negro conspiracy headed by Denmark Vesey. As a member of Congress (1822–29) he earnestly advocated State rights, free trade, direct taxes, and armed resistance to the tariff of 1828. As Governor of South Carolina (1830–32) he recommended the passage of the Nullification Act. Afterward he was made major-general commanding the State troops; removed to Texas; was influential in securing the recognition of the republic by Great Britain and France; appointed minister plenipotentiary from Texas to the European powers; elected from Texas to the U. S. Senate in 1857. On Oct. 15, 1857, he was drowned off the coast of Texas by the collision of the steamers Opelousas and Galveston.

**Hamilton**, James Clelland: See the Appendix.

**Hamilton**, Schuyler: soldier; b. in New York, July 25, 1822; a son of John Church Hamilton (b. 1792), and a grandson of Gen. Alexander Hamilton; Schuyler Hamilton was graduated at West Point in 1841, and was appointed second lieutenant of infantry; first lieutenant Mar., 1848; served on frontier duty and at Military Academy 1841–44. In the Mexican war he was twice wounded—once at Monterey, and again near Milflores, while in command of a scouting-party, with which he fought desperately a superior force. He was (1847–54) an officer on the staff of Gen. Scott. In 1855 he resigned and removed to Branford, Conn. In 1861 he enlisted as a private in the Seventh New York, but soon received a commission; became in 1861 a colonel and aide to the general-in-chief, and afterward a brigadier-general of volunteers. He took a prominent part in the actions at New Madrid, Mo., and Island No. 10, for meritorious conduct at which he was promoted major-general of volunteers, Sept. 17, 1862. On account of ill-health he resigned from the service in 1863. He published in 1853 a *History of the American Flag*, and in 1877 *Our National Flag, the Stars and Stripes, its History in a Century*.

Revised by James Mercur.

**Hamilton**, Sir William, Bart.: philosopher; b. in Glasgow, Scotland, Mar. 8, 1788. He was the elder of two sons of Dr. William Hamilton, Professor of Anatomy and Botany in the University of Glasgow. The only brother of Sir William was Capt. Thomas Hamilton, who served for a time in the British army. Having been severely wounded in the Peninsular war, Capt. Hamilton retired on half-pay and became a literary man. He was a frequent contributor to periodical literature. He was author of *Cyril Thornton*, a novel, and a book of travels in America. Sir William Hamilton belonged to an ancient Scotch family, several members of which are distinguished either in Church or state. One of these, Sir Robert Hamilton, was the commander of the Covenanters at Drumclog and Bothwell Bridge. (See Scott's notes to *Old Mortality*.) In 1603 the head of the family was made a baronet, but the family estate having been lost, the title had been in abeyance for nearly a century before Sir William's time, no one caring to claim the title. In 1816 Sir William made good his claim to it in the Scottish courts. From 1803 to 1806 Hamilton attended the yearly sessions of the University of Glasgow. In 1807 he entered Balliol College, Oxford, on the Snell foundation. This endowment was made for the education of students of Scottish birth, and it is worthy of remark that it secured the intellectual training (in addition to many others) of Adam Smith and Sir William Hamilton. Hamilton graduated at Oxford in 1810 with unprecedented honor, both for the extent of his reading and the difficulty of the authors which he presented for examination. Up to the time of his leaving Oxford he had been destined for the medical profession, and had made considerable progress in anatomical and physiological studies. Soon after this time, however, he decided upon the study of law, and in 1813 passed his examination as an advocate. In 1817 he visited Germany and again in 1820. He does not seem to have been eminently successful as an advocate, and in 1820 he became a candidate for the chair of moral philosophy in the University of Edinburgh, made vacant by the death of Dr. Thomas Brown, but was not elected by the town council. The following year, however, Hamilton was elected Professor of Civil History in the University of Edinburgh by the Faculty of Advocates. In 1826 he read a paper before the Royal Society of Edinburgh on phrenology, which had found strenuous advocates in Scotland under the leadership of George Combe. This was followed by another paper in 1827, and by a controversial correspondence with Mr. Combe on the subject. In preparation for these papers he dissected a great number of brains, and made detailed examinations of the whole subject, which he published from 1831 to 1850. Sir William says that his tables gave the results of an examination extended to 1,000 brains of 50 species of animals—a wider examination "than had hitherto been instituted by any professional physiologist." In Oct., 1829, he wrote for *The Edinburgh Review* his celebrated criticism of Cousin's *Cours de Philosophie*, under the general title of the *Philosophy of the Unconditioned*. This was followed in 1830 by his criticism of Brown; in 1831 by his discussion of the authorship of the *Epistolæ Obscurorum Virorum*, and by two articles on the state of the English universities. In 1832 he wrote his articles on the revolutions of medicine and on Johnson's translation of Tennemann. From 1833 to 1836 he wrote five articles upon general and professional education. In 1836 the chair of Logic in the University of Edinburgh became vacant, and Hamilton presented himself as a candidate. After an exciting canvass he was elected by a majority of two. In 1846 he published his edition of the works of Reid. In 1856 he completed his edition of the works of Dugald Stewart. It was his intention to add to this edition a memoir of Stewart, but he did not live to complete it. He continued to lecture till Apr., 1856. Although he had been stricken by paralysis in 1844, his intellectual capacity continued unabated to the last. D. May 6, 1856.

Hamilton seems never to have been willing to give the results of his own reflection upon any subject in a systematic form without previously studying the entire literature of the subject. He often exhausted his powers of production in the process of accumulating materials, and as a consequence has left no coherent systematic treatises which adequately represent either his learning or his power of thought. His mind was critical and dialectic, rather than constructive. He approached every subject from the point of view of an intellectual gladiator. This attitude of mind, connected with great power for clear and vigorous expression, renders his writings stimulating and suggestive almost without parallel. For the same reason they do not furnish safe guidance to a learner or to a person untrained in the processes and history of speculative thought. He manifestly had a constitutional dislike to regular and systematic composition. His works are all comparatively incomplete and fragmentary. In fact, with a partial exception in favor of his lectures on logic, his works are a series of magnificent torsos, grandly suggestive of range of learning and intellectual power.

Logic.—In the department of logic he awakened an interest which has steadily increased to the present time. In the reaction against the authority of Aristotle which marked the period of the renaissance a prejudice was excited against the works of that great thinker which was unintelligent and undiscriminating. In Scotland this reaction took the form of opposition to the study of logic in any vigorous or systematic form. Though it formed a part of the Oxford curriculum, the subject was studied through meager and inadequate manuals totally deficient in breadth of view and range of application. Hamilton's review articles and his lectures to his classes created a new epoch in the study of logic in Great Britain. The publication of his lectures since his death has opened up an immense range of logical literature, illustrated the history of the science, and vindicated its uses as a means of academic discipline and as a test of right thinking in all departments of human inquiry. The actual advances in logical science due to Hamilton are not easily estimated. He never fully developed the doctrines which he claimed as new, and possibly overrated their importance. It is claimed for him that he simplified logical processes by his quantification of the predicate and by extending the possible significance of the copula, and thus has enabled teachers of logic to dispense with the cumbrous apparatus of figures and the complicated terminology which they involved. It is in great part due to the impulse which he communicated and left behind him that so many able and vigorous works have been written on the subject since his death.

Philosophy.—The relations of Sir William Hamilton to psychology also are not easily defined. In his lectures and in the supplementary dissertations to his edition of Reid

and his review articles he has left on record a great amount of acute discussion and profound remark, illustrated by an immense range of philosophical learning. These hold a distinguished place among the contributions which the present century has made to psychological science. But he has left no logically developed and coherent system. He began his philosophical career as a critic of the fundamental principles of Schelling so far as they had been expounded and adopted by Cousin. The celebrated article in *The Edinburgh Review* which contains this criticism was written hurriedly, under pressure, with a distinctly polemical aim. His object was to annihilate by one crushing blow that philosophy of the absolute which had seized the control of continental thinking. For the purposes of this discussion he availed himself of the methods and formulas of Kant. In his anxiety for a victory that should be complete he denied to man all knowledge of the infinite whatever, and set aside as untrustworthy those facts in the human consciousness which impose upon us the belief in an infinity of real existence, which quantitatively the same consciousness affirms itself unable to define and measure. In his anxiety to show the inability of our powers to comprehend or "go around" the infinite in the form of time, space, or power, he was led to a positive denial of the existence of the notion as an ineradicable element in the human consciousness. See INFINITE for a discussion of his supposed refutation of the doctrine of the conceivability of the infinite.

Hamilton sought also, through his doctrine of the Unconditioned, to explain the origin and nature of the causal judgment. He makes the causal judgment the mere inability to think an absolute beginning. This statement is purely negative. The causal judgment comes into the mind in the presence of a change in what already exists. It is a change, a manifestation of power. No new existence appears. It affirms the event or the change to have had a cause. This affirmation is positive, both as a law of thought and a law of the objective change which calls out the affirmation from the mind of the observer. This effort on the part of Hamilton to account for the positive causal judgment by referring it to the impotence of the human mind, purely negative in its character, must be admitted to be a failure, The causal judgment is in the most emphatic sense positive, and no acuteness of psychological analysis can resolve it into a "fasciculus of negations."

In like manner, the doctrine of the "relativity of knowledge" which plays so large a part in Hamilton's discussions is a distinctly Kantian doctrine, and entirely foreign from the teachings, spirit, and aims of Scottish philosophy properly so called. It is equally irreconcilable with that doctrine of "natural realism" which, in his lectures and his celebrated criticism of Brown, Hamilton so emphatically taught. This word "relativity," as connected with the theory of knowledge, is used in different senses. If by "relativity" we mean that the knowledge of any object is impossible unless that object comes into relation with the mind, the term is simple and contains an intelligible idea. But if by "the relativity of knowledge" is meant that the external object as existing, and the internal percept which that object has determined in the mind, are different from each other in such a sense that our knowledge of the object is untrustworthy, the notion strikes at the foundation of all evidence and all knowledge. It is, besides, an assumption purely gratuitous. For if it be a fact that our mental apprehension of external objects is different from the objects themselves, and that the "thing in itself" is for ever shut out from our knowledge, how can we ever know the fact? How can we legitimately affirm that the form of our percept is unlike that of the object, which by its relation to our minds has marked out and determined our knowledge? By the conditions of the hypothesis the "thing in itself" is unknowable, consequently a comparison between it and the percept is impossible. No dialectic skill can harmonize this Kantian "relativity" with "natural realism" in any proper sense of the term.

There are few facts in the history of philosophy more remarkable than the attempt of Hamilton to combine into one system the Kantian doctrine of "relativity" and the direct and immediate knowledge of the external world which Hamilton taught with so much earnestness and zeal. The truth seems to be that the criticism on Cousin in *The Edinburgh Review* was so able, so learned, and so profound that it startled the British public into admiration, and made Hamilton famous all over the Continent. When he had once taken a position he was as incapable as any one of his old Covenanting ancestors of receding from it. When he took the position against Brown of a defender of the Scottish philosophy of Reid, he was called upon to defend a system in many essential particulars entirely foreign from that which furnished him with his weapons in his battle with the absolutists. He was publicly committed to the defense of two antagonistic systems. Instead of rejecting either, he attempted to hold to both and reconcile them. In this he failed, for the task was simply impossible. The Kantian portion of Hamilton's philosophy, formulated as the Philosophy of the Unconditioned, has been adopted by Spencer and Mill, for it harmonizes with the "reasoned" materialism which is the basis of the psychology which they hold in common with their masters, Hobbes and James Mill. It was accepted also by Mansel as the foundation-principle of his *Limits of Religious Thought*, but it has been very generally repudiated by cautious psychologists, who are as earnest as Hamilton in repudiating the extravagant claims for the human capacities which distinguished the system of Cousin and the earlier teachings of Schelling.

Hamilton's effort to clarify, supplement, and give systematic form to the doctrine of immediate perception somewhat vaguely set forth by Reid is a clear contribution to psychological science. For this purpose he revived and defended that doctrine of the relation of the soul to the body which the mediæval philosophers adopted from Aristotle, and which has since then been adopted by Stahl and Berard, and is now known under the designation of Animism. Unfortunately, Hamilton failed to perceive that the analysis of the qualities of body into primary and secondary is unnecessary in a system which recognizes sensible knowledge as the result of a face-to-face relation established between the different human senses and the various forms of matter. This discussion of Hamilton, which has been so much admired by his unquestioning followers, is also defective in confounding facts of physics and facts of psychology. The "natural realism" which in one part of his *Psychology* Hamilton so rigorously taught, requires and receives no aid from such an analysis of the qualities of body. Sound-waves are directly apprehended. The instrumentality which sets them in motion is, so far as the ear is concerned, a matter of inference. A similar statement may be made regarding the senses of smell and sight. In vindicating the doctrine of synchronous perception, and making clear the analysis of the formula of consciousness, as a condition of all forms of perception, Hamilton's labors are beyond all praise. It is true that he has limited the application of this formula to the case of perception of what he calls the primary qualities of body. In this limited range of application he has discussed it with great clearness and power. Although the formula of consciousness is implicated with greater or less clearness in all psychological systems, and in all analyses of the elements necessary in the construction of sentences in every human language, we know of no writer who has discussed this formula so successfully as Hamilton. He has failed only in limiting its application to the most obstrusive and emphatic forms of perception. Herbert Spencer, in his *First Principles*, has taken notice of this limited application of the formula by Hamilton, and for this reason has set aside as valueless the argument which Hamilton founded upon it for the real existence of the conscious self as distinct from all forms of matter.

In respect to the doctrine of consciousness, Hamilton departed somewhat from his immediate Scotch predecessors. With him consciousness is not a distinct faculty of the soul, but that fundamental fact of which all powers of the mind are so many different modifications. He affirmed also, as a consequence, the direct and immediate consciousness of all forms of matter coming into relation with their appropriate senses. See J. H. Stirling's *Sir William Hamilton, being the Philosophy of Perception* (London, 1865); John Stuart Mill's *Examination of Hamilton's Philosophy*; Veitch's *Memoir of Hamilton* (ed. 1869); and Prof. Seth's *Scottish Philosophy* (1890).

Revised by WM. T. HARRIS.

**Hamilton**, Sir WILLIAM ROWAN, LL. D.: mathematician; b. in Dublin, Aug. 3, 1805: educated at the Dublin University, graduating with high mathematical honors; became Professor of Astronomy and astronomer-royal for Ireland in 1827; was knighted in 1835; became president of the Royal Irish Academy in 1837. He was author of valuable papers

on physics and mathematics, but his fame rests upon his great invention, the calculus of quaternions. His principal works are *Lectures on Quaternions* (1853) and *Elements of Quaternions* (1866). (See QUATERNIONS.) See *Life* by Graves (3 vols., 1883–89). D. in Dublin, Sept. 2, 1865.

**Hamilton College**: a college at Clinton, Oneida co., N. Y., founded in 1793 as the Hamilton Oneida Academy by the zeal and labor of Rev. Samuel Kirkland, whose earlier influence with the Oneida Indians had been of great account in winning them from the British side. The cornerstone was laid by Baron de Steuben. Alexander Hamilton was the generous helper and first trustee. The college charter was granted by the State in 1812. It is thus the twenty-eighth in the line of colleges in the U. S. The first class graduated in 1814. It has sent more than 800 men into the ministry, and more than 500 into the law; 142 have become college professors and presidents, and 183 served in the war for the Union. The whole number of classical graduates is 2,002, of graduates of the Maynard Law School 261, of all its alumni (including honorary degrees) 2,780.

The college has two courses, classical and Latin-scientific, and its standards of admission, personal instruction, hours of work, close examinations, and impartial exclusion of persistent low-grade students establish its thoroughness. Its faculty numbers sixteen. Particular attention has always been given to rhetoric and oratory. The prize system is elaborate. The college societies are strong. The Alpha Delta Phi was founded here in 1832. The Perry H. Smith Library Hall contains a rapidly growing library of 40,000 volumes. The Soper gymnasium is a model for amplitude and equipment. The campus, 300 feet above the Oriskany, is a romantic park of 40 acres with stately and historic trees, and commands a fine view. The climate is dry and wholesome.

The Edwin Litchfield observatory has long held an important scientific repute. Here Dr. Christian H. F. Peters discovered forty-eight asteroids, and did other work even more valuable and of international fame. Special attention is given to physics, biology, social statics, pedagogy, and American history and geology. The college is pronouncedly Christian, but is under no ecclesiastical control. By affinity it is largely Presbyterian, but its administration is wholly undenominational. *The Literary Monthly* is the official publication of the students. The commencement is always the last Thursday of June. For recent years the classes have averaged forty-five entering men.

The presidents of the college have been Rev. Azel Backus, D. D., 1812–16; Rev. Henry Davis, D. D., 1817–33; Rev. Sereno Edwards Dwight, D. D., 1833–35; Rev. Joseph Penney, D. D., 1835–39; Rev. Simeon North, D. D., LL. D., 1839–57; Rev. Samuel Ware Fisher, D. D., LL. D., 1858–66; Rev. Samuel Gilman Brown, D. D., LL. D., 1866–81; Rev. Henry Darling, D. D., LL. D., 1881–91; Rev. Melancthon Woolsey Stryker, D. D., LL. D., 1892.

Revised by M. W. STRYKER.

**Hamilton Group**: in the geology of North America a division of rocks corresponding to the middle portion of the Devonian period. The name was derived from the town of Hamilton, N. Y. In a narrow sense it includes a heavy body of dark shale, with some layers of limestone, which traverses the State of New York from its western extremity to its southern, being limited above by the Genesee shale and below by the Marcellus. More broadly it includes these shales also, and thus comprises all rocks between the Corniferous and Portage formations. Southwestward from New York the Hamilton outcrop follows the Appalachian uplands, acquiring locally a more sandy character in Pennsylvania and Virginia. In Ohio it is recognized as a thin shale, and farther West it appears to be represented by calcareous rocks. Among its fossils are plants, both terrestrial and marine, invertebrates in great abundance, and fishes. Its harder layers include flagstones of excellent quality, which under the name of bluestone are extensively used, especially in New York city. Many of its shaly members are bituminous, and these, lying deep beneath the oil districts of Pennsylvania, West Virginia, and Eastern Ohio, are believed to be the most important original source of the petroleum and natural gas stored in the overlying sandstones.

G. K. GILBERT.

**Hamirpur'**: a district in Allahabad division, Northwestern Provinces, British India; between 25° 5′ and 26° 10′ N. lat., and 79° 23′ and 80° 25′ E. lon.; S. of the Jumna and E. of the Betwa and Dhasan rivers. It incloses the three native states, Sarila, Jigni, and Bihat. Area, 2,289 sq. miles. It is a part of the great plain of Bundelkhand, and incloses the picturesque artificial lakes of Mahoba constructed about 1100 A. D. The soil is deep, black, and fertile, and there is little waste land. The staple crop is grain, and cotton is extensively grown. The climate is hot and dry; the rainfall is 37 or 38 inches, but fluctuating and severe droughts are occasionally experienced. The towns are all small, only six having a population exceeding 5,000. From the ninth to the fourteenth century this district was the basis of the Chandal kingdom, with its center at Mahoba, which was then an important and beautiful city. From this time it became the possession of the Mohammedans, the Bundelas, and the Mahrattas successively. It was the scene of a fierce rebellion during the mutiny. The population numbers about 500,000, and is decreasing. Nearly all are Hindus. Capital, Hamirpur (see map of North India, ref. 6–F), with a population of 7,200.

MARK W. HARRINGTON.

**Hamlet** and **Hamleth**: See AMLETH.

**Hamlin**: See HAMELN.

**Hamlin**, ALFRED DWIGHT FOSTER: architect; b. at Constantinople, Turkey, Sept. 5, 1855; son of Cyrus Hamlin, D. D., founder of Robert College; educated at Amherst College and Massachusetts Institute of Technology and at the École des Beaux-Arts, Paris; instructor 1887–89, assistant professor 1889–90, adjunct professor 1891, all of Architecture in School of Mines, Columbia College. Author of series of papers on *Architectural Shades and Shadows* and *Handbook of the History of Ornament*.

C. H. T.

**Hamlin**, CYRUS, D. D., LL. D.: missionary and scholar; b. at Waterford, Me., Jan. 5, 1811; graduated at Bowdoin College 1834 and at Bangor Theological School (Congregational) 1837. He was a missionary of the American Board of Missions in Turkey 1838–59, when he became president of Robert College (1860–76), which he placed on a sure footing after a long struggle with the Turkish authorities. In 1877 he became Professor of Dogmatic Theology in Bangor Theological School; was president of Middlebury College, Vermont, from 1880 to 1885, when he removed to Lexington, Mass. His writings are partly in the Armenian language. In 1877 he issued in New York *Among the Turks*, and in 1893 in Boston *My Life and Times*. D. Aug. 8, 1900.

GEORGE P. FISHER.

**Hamlin**, HANNIBAL, LL. D.: Vice-President of the U. S.; b. at Paris, Me., Aug. 27, 1809; was for a time a printer; admitted to the bar in 1833, and several times was elected Speaker of the Maine House of Representatives. He was (1843–47) a Democratic representative in Congress; U. S. Senator 1848–57, 1857–61, and 1869–81; Governor of Maine in 1857, to which position he was chosen as a Republican, but resigned on his re-election to the U. S. Senate. He was (1861–64) Vice-President of the U. S. during Mr. Lincoln's first term, and in 1865 was for a time collector of the port of Boston. He was again elected U. S. Senator in 1869, and re-elected 1875; U. S. minister to Spain 1881–83. D. in Bangor, Me., July 4, 1891.

**Hamlin**, TEUNIS SLINGERLAND, D. D.: preacher; b. in Glenville, N. Y., May 31, 1847; studied at Charlton Academy; graduated at Union College 1867 and at Union Theological Seminary 1871. He taught in Ypsilanti, Mich., 1867–68; was pastor of a Presbyterian church in Troy, N. Y., 1871–84, and in Cincinnati, O., 1884–86; and in 1886 became pastor of the Church of the Covenant, Washington, D. C. He has been one of the editors of *The Presbyterian Observer*, and is a trustee of the United Society of Christian Endeavor. His work is mainly that of an active preacher and organizer of Christian work, but he has published various sermons, articles, and addresses, and one volume, *Denominationalism versus Christian Union* (New York, 1891).

W. J. BEECHER.

**Hamline University of Minnesota**: a collegiate institution under the auspices of the Methodist Episcopal Church; located at Hamline, St. Paul, Minn., and named in honor of Bishop L. L. Hamline, of the Methodist Episcopal Church, who established the nucleus of its endowment; was founded in 1854 and opened the same year at Red Wing, Minn., where it continued in operation fifteen years. Owing to financial embarrassment, instruction was suspended 1869–80, during which time its board of trustees decided to change the location of the institution, and erected on the present site of the university a college building which was opened in 1880 with Rev. D. C. John, D. D., as president; in 1883

it was destroyed by fire, but was immediately rebuilt, instruction being continued without a day's interruption. In 1883 Rev. G. H. Bridgman, D. D., became president. During the first two years of his administration three buildings for the university were completed at a cost of $90,000, the debts of the university were paid in full, and large additions were made to the chemical and philosophical apparatus and to the library. The grounds and buildings of the university are valued at $180,000; in addition to these the corporation owns other unencumbered real estate of the value of $200,000, and has $26,000 invested in securities. The corps of instruction consists of Rev. G. H. Bridgman, D. D., president, and sixty-five professors and instructors.

The university is open to both sexes, and has a preparatory department embracing music. The collegiate department offers two courses of study, the classical and the scientific, each extending through four years.

**Hamm**: town and railway center of Prussia; province of Westphalia, on the Lippe at its junction with the Ahse; 22 miles N. W. of Arnsberg (see map of German Empire, ref. 4–D). It has extensive wire-factories, also puddling and rolling works, foundries, machine-shops, and manufactures of gloves, baskets, wadding, sago, starch, chemicals, varnish, oil, beer, linen, and leather. Hamm was formerly a fortified town, and belonged to the Hanseatic League. Pop. (1890) 24,975.

**Hammamat**: the Wadi or valley extending from Koptos (26° N. lat.) on the Nile to Kossier, a seaport on the Red Sea (about 110 miles), used in ancient times as a caravan route. It was of importance as the avenue of communication in the trade in spices and incense carried on with the inhabitants of the land of Punt (*q. v.*). In the valley were valuable quarries, whence was obtained all the dark-green or black diorite used by the Egyptians for statues. These quarries were worked during the fifth, sixth, eleventh, twelfth, and thirteenth dynasties, and also during the New Kingdom. Record is preserved of several large expeditions sent out to quarry large blocks for various Pharaohs, one of which consisted of a total of 8,368 men commissioned by Ramses IV. It is significant that among these men were 800 "Aperiu," a name long considered to be the Egyptian designation of the Hebrews. The god of the region was Min (*q. v.*), the Greek Pan. Charles R. Gillett.

**Hammer**, Julius: poet and author; b. in Dresden, Germany, June 7, 1810; studied literature and philosophy in Leipzig; conducted the feuilleton of the *Sächsische Konstitutionelle Zeitung* from 1851 till 1859; in 1853 was one of the founders of the "Schiller-Stiftung" in Dresden. Among his works are the comedies *Das seltsame Frühstück* (1834); *Das Leben ein Tanz* (1841); *Auch eine Mutter* (1859); the play *Die Brüder* (1856); the poems *Schau um dich und schau in dich* (1851; 30th ed. 1886); *Zu allen guten Stunden* (1854); *Fester Grund* (1859); *Lerne, liebe, lebe* (1862); the collections *Unter dem Halbmond* (1860); *Psalmen der Heiligen Schrift in Dichtungen* (1861); *Leben und Heimat in Gott* (10th ed. 1886). D. in Pillnitz, Aug. 23, 1862.

**Ham'merfest**: town of Norway; in Finmark (see map of Norway and Sweden, ref. 1–H). It is the northernmost town in Europe; situated in lat. 70° 40′ N.; it was founded in 1787. In the summer, during which the sun does not set from May 13 till July 29, the harbor of Hammerfest is the rendezvous of more than 200 fishing-vessels; the fishing can be carried on, however, the whole year round. Furs and eiderdown are exported. The place suffered severely from fire in 1890, but was rebuilt. Pop. 2,160.

**Hammerhead**: any shark of the genus *Sphyrna*. These sharks when adult have the two sides of the head produced

Hammerhead shark.

laterally till the head has somewhat the shape of a double-headed hammer. There is an eye on each end of the head. These fishes are very voracious, and extremely prolific, especially in warm seas. The *Sphyrna zygæna*, a man-eating shark, has been often caught on both sides of the North Atlantic.

**Hammerich**, haa'me-rĕĕk, Martin Johannes: philologist; b. in Copenhagen, Dec. 4, 1811; studied philology and mythology; was director of the gymnasium of Christianshavn 1842; retired in 1868 to his estate, Islinge, in the island of Seeland. D. there Sept. 20, 1881. His principal works are *On the Myth of Ragnarokr* (1836); translation of the *Sakúntala* (1845); *Life of Thorwaldsen* (1870); besides a great number of minor essays relating to the Danish language and literature, and distinguished as much by their sound and broad views as by their elegant form.—His elder brother, Peter Frederik Adolph Hammerich, b. in Copenhagen, Aug. 9, 1809, studied theology, and became a minister in 1845, and in 1858 Professor in Theology at the University of Copenhagen, where he represented the ideas of Grundtvig. He published several works relating to the history of Denmark and Scandinavia—*Danmark under Waldemarerne* (1847); *Danmark under Adelsvælden* (1854); *Den hellige Birgitta* (1863); distinguished alike for their novel ideas and for their vigorous style. D. Feb. 9, 1877.

**Hammer-Purgstall**, haa'mer-poorch'staăl, Joseph, von, Baron: b. at Grätz, Austria, June 9, 1774; studied the Eastern languages at the Oriental Academy, Vienna; became in 1799 interpreter to the internuncio at the Porte; inspector of consulates 1800; secretary-dragoman in the Anglo-Turkish army 1801; secretary of Austrian legation in Turkey 1802; consular agent at Jassy 1806; court interpreter at Vienna 1816; aulic counselor 1817; baron 1837; president of the Academy at Vienna 1847–49; grand officer of the Medjidie 1855. He was an earnest student and furtherer of Oriental learning, publishing a very large number of learned works on Eastern history, etc. Among them are *Encyklopädische Uebersicht der Wissenschaften des Orients* (1804); *Die Staatsverfassung und Staatsverwaltung des Osmanischen Reichs* (1815–16); *Geschichte der schönen Redekünste Persiens* (1818); *Umblick auf einer Reise von Konstantinopel nach dem Olympos* (1818); *Geschichte der Assassinen* (1818); *Montenebbi* (1824); *Geschichte des Osmanischen Reichs* (2d ed. 1834–36, 10 vols.); *Geschichte der Osmanischen Dichtkunst* (1836–38, 4 vols.); *Geschichte der goldenen Horde* (1840); *Literaturgeschichte der Araber*, his most important work (7 vols., 1850–56). D. at Vienna, Nov. 24, 1856. Revised by C. H. Toy.

**Hammersmith**: parliamentary borough; in Middlesex, on the Thames; 4 miles above London; since 1885 a part of the metropolis (see map of England, ref. 12–J). A suspension bridge was opened in 1827, and another in 1887. One member is returned to Parliament. Pop. (1901) 112,245.

**Hammond**: city; Lake co., Ind. (for location of county, see map of Indiana, ref. 2–B); on the Grand Calumet river, and the Erie, the Penn., the Mich. Cent., and the Louisv., New Alb. and Chic. Railways; 20 miles E. of Chicago. It contains 15 churches, 20 schools, 3 daily and 4 weekly newspapers, 25 manufacturing establishments, extensive steel-works, nail-mills, distillery, axle and spring factories, foundry, starch-works, and improved system of water-works, electric street railways, and electric lights. Pop. (1880) 699; (1890) 5,428; (1900) 12,376. Editor of "Leader."

**Hammond**, Edward P.: See the Appendix.

**Hammond**, Henry, D. D.: prelate; b. at Chertsey, Surrey, England, Aug. 18, 1605; educated at Eton and Oxford, took holy orders in 1629, and was in 1633 made rector of Penshurst in Kent, in 1643 Archdeacon of Chichester. He was a stanch adherent of Charles I., and, having taken part in the unsuccessful rising at Tonbridge, he fled to Oxford, at that time the headquarters of the royalists. He served as chaplain to the king 1645–47, and was in 1648 made sub-dean of Christ Church; in the same year he was expelled by the Parliament, and even kept in prison for a short time. In 1649 he removed to Westwood, where he spent the remainder of his days. He published *A Practical Catechism* (1644); *Paraphrase and Annotations upon the New Testament* (1653), etc. His *Miscellaneous Theological Works* were published at Oxford (1847–50, 3 vols.). The edition also contains the *Life* by Fell. D. at Westwood, Worcestershire, Apr. 25, 1660.

**Hammond**, William Alexander, M. D.: b. at Annapolis, Md., Aug. 28, 1828; graduated M. D. at the New York University in 1848, and entered the U. S. army as assistant

surgeon in 1849, in which he remained till Oct., 1860, when he resigned and accepted the appointment of Professor of Anatomy and Physiology in the University of Maryland at Baltimore, where he also obtained a large practice. At the outbreak of the civil war he offered his services to the Government, and was reappointed assistant surgeon May, 1861; on the reorganization of the medical department in 1862 he was appointed surgeon-general of the army, in which capacity he displayed great energy and ability. In the midst of these official duties he prepared and published *Physiological Memoirs* (1863) and *Lectures on Venereal Diseases* (1864). Leaving the service, he became a professor in Bellevue Hospital Medical College, New York. Author of *Military Hygiene* (1863); *Sleep and its Nervous Derangements* (1869); *The Physics and Physiology of Spiritualism* (1870); *A Treatise on Diseases of the Nervous System* (1871); *Insanity in its Relations to Crime* (1873); *Mental Work and Emotional Disturbances* (1878); *Cerebral Hyperæmia* (1878); *Fasting Girls* (1879); the novels, *Dr. Grattan* (1884); *Mr. Oldmixon, A Strong-minded Woman* (1885); *Tales of Eccentric Life* (1886); *On the Susquehanna* (1887), and other works. D. Jan. 5, 1900.

**Hammonton**: town; Atlantic co., N. J. (for location of county, see map of New Jersey, ref. 7–C); on the Cam. and Atl. and the Phila. and Read. Railroads; 28 miles S. E. of Camden. It is in a remarkably rich agricultural region, and is widely known for the extent and variety of its orchard productions. Pop. (1880) 1,776; (1890) 3,833; (1900) 3,481.

**Hamon**, ăă′mōn′, Jean Louis: genre-painter; b. near Plouha, Côtes-du-Nord, France, May 8, 1821. Pupil of Paul Delaroche and Gleyre; third-class medal, Salon, 1853; second-class, Paris Exposition, 1855; Legion of Honor 1855. His work lacks robustness, but is graceful in drawing. His *The Elder Sister* and *Mountebank* are in the Nantes Museum; *Among the Flowers* is in the Metropolitan Museum, New York. D. at St.-Raphaël, Var, May 29, 1874. W. A. C.

**Hampden**, Sir Henry Bouverie William Brand, Viscount: statesman; b. in Dec., 1814; entered the House of Commons 1852; Parliamentary Secretary to the Treasury 1859–66; 1859 became senior whip of the Liberal party, and filled the office with great energy for nine years; elected Speaker of the House of Commons Feb., 1872; re-elected when the Conservatives came into power Mar., 1874; third time elected Apr. 29, 1880; retired from the Speakership 1884, when he was created Viscount Hampden. C. H. T.

**Hampden**, John: statesman; b., it is believed, in London, in 1594. His father, William Hampden, of Hampden, Buckinghamshire, belonged to an old Saxon family; his mother, Elizabeth Cromwell, of Hinchingbrooke, Huntingdonshire, was the aunt of Oliver Cromwell. When he was three years old his father died and left him a fortune, consisting chiefly of landed property. He entered the University of Oxford in 1609, where he pursued his classical studies with earnestness and success, and in 1613 began the study of law in the Inner Temple. In Jan., 1621, he took his seat in the House of Commons as member for Grampound. He sat for Wendover in the first three Parliaments of Charles I. (June, 1625, Feb., 1626, and Mar., 1628), and for Buckingham in the last two (Apr., 1640, and Nov., 1640, the Long Parliament). He allied himself with the party in opposition, and took part, under James I., in the protest against the marriage of Prince Charles with a Spanish princess, in the impeachment of Bacon, etc.; and under Charles I. in all the measures which Parliament took against the encroachments and arbitrary rule of the crown. But his position was in the beginning subordinate, and later, although always respectable, still in the second rank, until in the spring of 1637 he at once arose to great popularity. He was no republican; he considered royalty as the natural, consequently as the best, form of government. But the royal power, whether more or less circumscribed, must be clearly defined and kept strictly within its legal boundaries. If the crown encroached on the rights of the subjects, he considered it their duty to resist such encroachments, first by what legal means they might possess, and, if this proved ineffectual, then by rebellion. These ideas he adhered to with unconquerable firmness, and when attacked he defended them with undaunted courage, and even with fierceness. In 1636 the king, in order to procure money, which Parliament would not vote him, and in spite of the fact that the kingdom was at peace, arbitrarily extended the so-called "ship-money" tax to the inland countries. Hampden was taxed twenty shillings, but refused to pay, and asked for a decision by the courts. In May, 1637, process was opened and lasted for thirteen days; but, although Hampden was condemned by a bare majority of the judges, the impression which the procedure produced on the English people was fatal to the king. It now became apparent that private property was not safe in England, and when, shortly after, the revolution broke out in Edinburgh, it found in England, too, the popular mind prepared for armed resistance against the king. Shortly after his condemnation, Hampden, Pym, Cromwell, and others determined to migrate to America, and even were about to embark, when they were detained by royal order. In the Parliament of Apr., 1640, and in the Long Parliament of November of the same year, he stood as one of the most prominent leaders of the opposition; and he was one of the five members of the House of Commons whom the king accused of high treason (Jan. 3, 1642), but whom the House refused to deliver up for imprisonment. The king gave order to arrest the five members in their seats, but they were warned and concealed themselves. In August the civil war began. Hampden showed great energy and wisdom during the contest, and great bravery as colonel in the parliamentary army, especially at the battle of Edgehill and in the capture of Reading. But on June 18, 1643, in an encounter at Chalgrove Field between the royal cavalry under Prince Rupert and that of Parliament under Hampden, the latter was mortally wounded, two balls entering his body at the first charge. He was taken to the house of one of his friends at Thame, and died there six days after (June 24, 1643).

Revised by C. K. Adams.

**Hampden**, Renn Dickson, D. D.: Anglican theologian; b. in Barbados, Mar. 29, 1793; graduated B. A. as double first at Oriel College, Oxford, 1813; became a fellow of Oriel 1814; public examiner 1829, 1831, and 1832; delivered 1832 the Bampton lecture on *The Scholastic Philosophy in its Relation to Christianity*, the orthodoxy of which was sharply assailed; principal of St. Mary's Hall, Oxford, 1833; Professor of Moral Philosophy 1834; Regius Professor of Divinity 1836, greatly to the discontent of the Anglo-Catholic party, then dominant at the university, the convocation of which in the same year passed a vote of censure upon him, High and Low Church parties uniting in the vote; but in 1842 he was unanimously chosen to the theological examining board, and in 1847, after a bitter controversy, he was consecrated Bishop of Hereford. He contributed able philosophical and biographical matter to the *Encyclopædia Britannica* and the *Encyclopædia Metropolitana*; and was author of *Philosophical Evidence of Christianity* (London, 1827); *Lectures on Moral Philosophy* (1836); *Sermons* (1836, 1847); *Lecture on Tradition*; *The Fathers of Greek Philosophy* (1862). D. in London, Apr. 23, 1868. Revised by S. M. Jackson.

**Hampden-Sidney College**: a college in Prince Edward co., Va., 7 miles from Farmville; founded in 1775 by the presbytery of Hanover, and incorporated 1783 by the Legislature of Virginia. Its first president was Rev. S. S. Smith, D. D., afterward president of the College of New Jersey. Among its incorporators were James Madison, Patrick Henry, Paul Carrington, William Cabell, Sr., Nathaniel Venable, and others illustrious in the history of Virginia and of the U. S. While undenominational, the college has ever been affiliated with the Presbyterian Church. It has adhered strictly to college methods and to the college curriculum, allowing proper latitude in the selection of studies. It is the only college in Virginia S. of the James river and E. of the Blue Ridge. It is beautifully located on a tract of land given by Peter Johnston in 1773, which has been increased by purchase and gifts, so that the college now owns about 250 acres. The standard of scholarship has always been high, and the alumni have filled some of the most important positions in the U. S. In 1901 the president was Richard McIlwaine, D. D.; the faculty numbered nine and the students 116. The library contained 15,000 volumes. Richard McIlwaine.

**Hamp'shire, Southamp'ton**, or **Hants**: county of England; bordering S. on the English Channel, comprising, together with the Isle of Wight, which belongs to it, an area of 1,625 sq. miles. It is traversed by the North and South Downs, but the soil is in most parts sandy or gravelly, and not very fertile. Hops are extensively cultivated, and a fine breed of sheep is reared. The southwestern portion is covered by the New Forest, from which the dockyards of the British navy are supplied with oak and beech timber. Pop. (1901) 459,508.

**Hamp'stead**: ancient village of England, now part of the suburbs of London. It is a parliamentary borough and returns one member to Parliament. The mineral wells (discovered or rediscovered about 1620) were long famous. In the churchyard lie Sir James Mackintosh (d. 1832), Joanna Baillie (d. 1851), and Constable, the painter (d. 1837). In a tavern at Hampstead the famous Kit-Cat Club, of which Addison, Steele, and Pope were members, held its first meetings. Hampstead Heath is a favorite resort for holiday parties.

**Hamp'ton**: village of England; in the county of Middlesex, on the left bank of the Thames; about 15 miles W. S. W. of London (see map of England, ref. 12–J). A mile from the village lie the palace and park of Hampton Court, erected by Cardinal Wolsey in 1514, afterward presented by him to Henry VIII., and thereafter, until the time of George III., a royal residence. The palace contains an interesting collection of pictures, including specimens by Holbein, Lely, Kneller, and West.

**Hampton**: town; capital of Franklin co., Ia. (for location of county, see map of Iowa, ref. 3–H); on the Chi., Gt. W. and the Ia. Cent. Railway; 28 miles S. of Mason City, 60 miles N. of Marshalltown. It is in an agricultural and stock-raising region, and has water-works, electric lights, 5 churches, excellent high school, and 3 weekly newspapers. Pop. (1880) 1,598; (1890) 2,067; (1900) 2,727.

EDITOR OF "CHRONICLE."

**Hampton**: town (incorporated as Kecoughtan in 1705); capital of Elizabeth City co., Va. (for location of county, see map of Virginia, ref. 7–I; on Hampton river and the Ches. and O. Railway; 3 miles N. W. of Fort Monroe, 16 miles N. by W. of Norfolk. It has a good harbor for small craft, several public and private schools, a college for women, three periodicals, and in its suburbs a national cemetery and asylum for disabled soldiers. It has a large trade in lumber, fish, oysters, canned crabs, and garden produce. Pop. (1880) 2,684; 1890, 2,513; (1900) 3,441.

EDITOR OF "HOME BULLETIN."

**Hampton**, WADE: soldier; b. in South Carolina in 1754; served under Sumter and Marion; was a member of Congress 1795–97 and 1803–05; became a colonel in the U. S. army in 1808, a brigadier-general in 1809, and was major-general 1813–14; commanded (1809–12) at New Orleans and (1813–14) on the Canadian frontier. He resigned in 1814, and afterward acquired great wealth, at one time owning 3,000 slaves. D. at Columbia, S. C., Feb. 4, 1835.

**Hampton**, WADE: grandson of Gen. Wade Hampton; b. at Columbia, S. C., 1818; graduated at South Carolina College; has served as member of both Houses of the Legislature of South Carolina. Commanded the Hampton Legion at the first battle of Bull Run, July, 1861, where he was wounded; promoted to be brigadier-general, and in command of a brigade at Seven Pines, May 31, 1862, where he was again wounded; engaged at the battle of Antietam, Sept., 1862, and upon the raid into Pennsylvania the following month; at Gettysburg, July, 1863, and a third time wounded; promoted to be lieutenant-general, and in command of body of cavalry in Lee's army during campaign of 1864, being frequently engaged; subsequently transferred to South Carolina, where in 1865 he commanded the cavalry forming the rear-guard of the Confederate army retiring before Gen. Sherman's advance northward; a spirited correspondence regarding the destruction of the city of Columbia by fire established the fact that it was not ordered by either Gen. Hampton or Gen. Sherman, but was owing to the vast quantity of cotton and other combustibles which had been accumulated here, and ordered to be destroyed before the evacuation of the city. He was prominent in the Democratic national convention in New York city in 1868 that nominated Seymour and Blair for President and Vice-President. He was Governor of South Carolina 1878; U. S. Senator 1879–1891; and became U. S. commissioner of railways 1893.

**Hampton Roads**: the broad and deep channel leading from Chesapeake Bay into the James, Nansemond, and Elizabeth rivers. Its name is derived from Hampton, Va., a village situated on Hampton creek, an arm of the roads. Forts Monroe and Wool serve for defense. Lat. of Thimble Shoal light, north side of entrance, 37° 42′ N., lon. 76° 14′ 5″ W. Hampton Roads was Mar. 8 and 9, 1862, the scene of important naval operations—the sinking of the U. S. frigates Congress and Cumberland, and the contest between the ironclads Monitor and Virginia.

**Hamsters**: rodent mammals of Europe and Asia of the rat family and of the genus *Cricetus*. *C. frumentarius* is the best known, but there are a number of other species. They all have large cheek-pouches, and all are very destructive to grain, which they store away in great quantities in

The hamster.

their holes. They are vigorously hunted, not only for their skins, which are valuable, but for the grain they have buried. They are found throughout the dry region of Central Europe and Asia, from the Rhine eastward to the river Ob, and southward to Persia and the Caucasus.

**Hamuli** [Lat., little hooks]: See FEATHERS.

**Han'aford**, PHEBE ANN: daughter of Capt. George W. Coffin; b. in the island of Nantucket, May 6, 1829; educated in the public schools and under Rev. Ethan Allen, rector of St. Paul's Episcopal church there; became a teacher and writer at fifteen; in 1849 married Joseph H. Hanaford, a teacher; in 1868 ordained as minister in the Universalist church in Hingham, Mass.; called to New Haven, Conn., in 1870, thence to Jersey City. In 1870–72 she was at various times chaplain of the Connecticut Legislature. She has been grand worthy chaplain of the Good Templars, and represented the grand lodge in the right worthy lodge at Detroit in 1867. Besides poems, addresses, and contributions to current literature, she has published *Lucretia the Quakeress* (Boston, 1853); *Leonette, or Truth Sought and Found* (Philadelphia, 1857); *The Best of Books and its History* (1857); *Abraham Lincoln* (Boston, 1865); *Frank Nelson, the Runaway Boy* (1865); *The Soldier's Daughter* (1866); *The Captive Boy of Terra del Fuego* (New York, 1867); *Field, Gunboat, Hospital, and Prison* (Boston, 1867); *The Young Captain* (1868); *George Peabody* (1870); *From Shore to Shore and other Poems* (1870); *Charles Dickens* (1870); *Women of the Century* (1877); *Ordination Book* (New Haven, 1887).

Revised by C. H. THURBER.

**Hanau**: a town of Hesse-Nassau, Southwestern Prussia; at the confluence of the Kinzig river with the Main; 12 miles E. of Frankfort, and junction of the railways from that city to Fulda and Würzburg (see map of German Empire, ref. 5–D). It consists of an old and a new city, the latter founded in 1507 by the Flemish and Walloon refugees. The old fortifications have been demolished and replaced by unusually agreeable parks and promenades. It is an important industrial center, and manufactures silks, gloves, hose, playing-cards, ornaments of various kinds, cigars, leather, and carriages. It has several metallurgical establishments and uses much platinum, and has a large trade in lumber, wood, and wine. Among the principal buildings are the ancient castle of the Counts of Hanau, the old collegiate Church of St. Mary containing their tomb, and a beautiful new Roman Catholic church. In the vicinity are the baths of Wilhelmsbad, which are much frequented by the residents of Frankfort. The number of Roman antiquities found in the vicinity of Hanau suggest a Roman origin. It became the seat of an independent count in the twelfth century, was raised to the rank of a town in 1303, became a county of the empire in 1429, and was fortified by Count Philip in 1528. It was taken by the Swedes in 1631, became independent in 1803, but soon fell into French hands, and was the place of Napoleon's victory of Oct. 30, 1813. It was annexed to Prussia in 1866. Pop. (1890) 25,027.

MARK W. HARRINGTON.

**Hancock**: village; Houghton co., Mich. (for location of county, see map of Michigan, ref. 1–E); on Portage Lake and the Mineral Range and Hanc. and Calumet Railroads; opposite Houghton. It is in the heart of the famous Lake Superior copper region, is connected with Lake Superior by

a ship-canal, and has several copper mines, smelting-works, stamp-mill, steam saw-mills, foundries, and two weekly newspapers. Pop. (1880) 1,783; (1890) 1,772; (1900) 4,059.

EDITOR OF "MICHIGAN COPPER JOURNAL."

**Hancock**: village; Delaware co., N. Y. (for location of county, see map of New York, ref. 6–H); at the junction of the two branches of the Delaware river, and on the Erie and the N. Y., Ont. and W. Railways; 50 miles E. S. E. of Binghamton, 164 miles N. W. of New York. It has four churches, union school, bluestone quarries, tanneries, flour-mills, wood alcohol factory, and extensive lumber interests. Pop. (1880) 686; (1890) 1,279; (1900) 1,283.

EDITOR OF "HERALD."

**Hancock**, CAPE: See CAPE DISAPPOINTMENT.

**Hancock**, JOHN, LL. D.: statesman; b. in that part of Braintree, Mass., now called Quincy, Jan. 12, 1737; the son of the Rev. John Hancock. He graduated at Harvard in 1754, and in 1764 inherited the business and the greater part of the large fortune of Thomas, his uncle, in whose counting-house he had been trained to business. The young Hancock was present in 1760 at the coronation of George III. In 1768 his sloop Liberty was seized for evading the laws of commerce, and a riot followed; and in 1770 he delivered a fearless and eloquent address at the funeral of those slain at the Boston massacre. In 1774 he was president of the Provincial Congress. His conduct exposed him to the ill-will of the authorities, and the arrest of Hancock and his fellow patriot, Samuel Adams, was one of the objects of the expedition to Concord which led to the conflict at Lexington. Both made their escape, but were excepted from the general pardon issued to the rebels by Gen. Gage, June 12, 1775. From 1775 to 1777 he was president of the General Congress at Philadelphia. He was the first of the signers of the Declaration of Independence. In 1778, as major-general of the Massachusetts militia, he took part in the expedition against Rhode Island under Sullivan. He was Governor of Massachusetts 1780–85; member of Congress 1785–86; again Governor 1787–93, and held at times various other offices of honor. He was a man of strong and decided character, and dignified, courtly, and pleasing manners, and made a liberal use of his large fortune for benevolent purposes. D. at Braintree, Mass., Oct. 8, 1793.

**Hancock**, WINFIELD SCOTT, LL. D.: soldier; b. in Montgomery co., Pa., Feb. 14, 1824; received his early education at Norristown (Pa.) Academy; after graduation was promoted in the army to be brevet second lieutenant of infantry July 1, 1844, receiving his full commission of second lieutenant in 1846; promoted to be first lieutenant 1853; in 1855 transferred to the quartermaster's department with the rank of captain; promoted to be major in same department 1863. After serving on the frontier he took part in the war with Mexico (1847–48), and for conspicuous gallantry was breveted first lieutenant. From 1848 to 1855 he served with his regiment in the West, as quartermaster and adjutant; served in the quartermaster's department in Florida during the Seminole hostilities, in Kansas during the disturbances of 1857, and in California, at Los Angeles, as chief quartermaster of the southern district, where, on the outbreak of the civil war in 1861, he was assigned to Kentucky as chief quartermaster of Gen. Anderson's command, but before entering on that duty he was (Sept. 23, 1861) appointed a brigadier-general of volunteers. During the fall and winter of 1861–62 he commanded a brigade at Lewinsville, Va.; in Mar., 1862, he accompanied Gen. McClellan to the Peninsula, being actively engaged at the siege of Yorktown and the subsequent pursuit which resulted in the battle of Williamsburg, where he led the brilliant charge which captured Fort Magruder and gained the day. His services at Golding's Farm, Garnett's Hill, Savage's Station, and White Oak Swamp, and during the retreat to Harrison's Landing, were conspicuous and valuable; and the brevets of major, lieutenant-colonel, and colonel were conferred upon him, and he was recommended by Gen. McClellan for promotion to major-general. He took part in the movement to Centreville, Va., Aug.–Sept., 1862; in the Maryland campaign he led his brigade at Crampton's Pass, South Mountain, and at Antietam, where he took command of the first division Second Corps on the death of Gen. Richardson; Oct. 10–11, 1862, he conducted an important reconnoissance from Harper's Ferry to Charlestown, Va. Promoted major-general of volunteers Nov. 29, 1862, he continued in command of the first division of the Second Corps, which he led at Fredericksburg, Dec., 1862, in the assault on Marye's Heights, and at Chancellorsville, May, 1863; in the following month he was placed in command of the Second Corps. At Gettysburg (July 1, 1863), after Reynolds had fallen, Hancock was sent from Taneytown by Gen. Meade to assume command; arriving on the field just as the rear of the beaten Union army was coming through Gettysburg, he at once made his presence felt, and, after staying the retreat, extended the Union lines to Culp's Hill, when the enemy's farther advance was checked. Perceiving its advantages, Gen. Hancock sent Gen. Meade such a report of the nature of the vicinity of Gettysburg as determined him to fight his battles there. On the following days (July 2–3), Hancock commanded the left center, repulsing the grand final assault of Lee's army, July 3, falling severely wounded at the moment of victory. In Mar., 1864, he returned to his command, and in the campaign of that year he bore a prominent part; in the battle of the Wilderness (May 5–7) his command amounted to more than 50,000 men; at the battle of the Po (May 10) he commanded the Second and Fifth Corps, as well as in the assault near Spottsylvania Court-house, May 12; at Spottsylvania he led his corps in its famous assault on the enemy's works, capturing upward of 4,000 prisoners, twenty pieces of artillery, and thousands of small-arms; in the subsequent operations, including Cold Harbor and the assault of the lines before Petersburg, Hancock was indefatigable until compelled (June 17) by the outbreaking of the wound received at Gettysburg to relinquish his command for ten days, when he returned to the command of his corps in front of Petersburg. On Aug. 12 he was appointed a brigadier-general in the regular army. During the months of July and August the battles of Deep Bottom and Ream's Station, and of Boydton Plank-road (Oct. 27), were fought under his direction and command. From Nov., 1864, till Feb., 1865, he was in Washington organizing; from February till July commanded the First Army-corps of veterans, remaining in Washington on that duty until Feb., 1865, when he was assigned to the command of the middle military division; from July till Aug., 1866, commanded the middle department, when he was transferred to the command of the department of Missouri, having in the meantime (July 26) relinquished his volunteer commission and been promoted to be major-general in the regular army. While commanding this department he conducted an expedition against hostile Indians on the plains. From Sept., 1867, to Mar., 1868, he commanded the department of the Gulf; the military division of the Atlantic, Mar., 1868, to Mar., 1869; the department of Dakota 1869–72, when he was assigned the command of the division of the Atlantic, which he held till his death. In 1869 he declined the Democratic nomination for Governor of Pennsylvania. He was nominated June 24, 1880, by the Democratic convention at Cincinnati, O., for President of the U. S., but was defeated at the following election by Gen. Garfield, who received a popular majority of 7,018 and an electoral majority of 59. Gen. Hancock died on Governor's island, New York harbor, Feb. 9, 1886.

**Hand** [< O. Eng. *hand*: O. H. Germ. *hant* (> Mod. Germ. *hand*): Goth. *handus* < Teuton. *handus*]: in mammals, the foremost extremity, always present, though often very much modified. When contrasted with the foot in size, there is much variety. The kangaroo has a small hand and a large foot. In the mole there is a broad shovel-shaped hand and a delicate foot. The sloth has an exceedingly long hand. The foot of the beaver and the seal is much larger than the hand. The differences between the hand and foot usually consist in greater delicacy and slenderness of the fingers, with corresponding refinement of function, since the hand has the more to do in protection, defense, nourishment, and delicate operations than has the foot, which is mainly of use in propelling and maintaining the attitudes of the body.

The hand presents for study the carpus, metacarpus, and phalanges, corresponding in general plan of structure to the tarsus, metatarsus, and phalanges of the foot. The relative dimensions of these parts vary exceedingly. The hoofed animals, the elephant, and those animals which use the fore legs mainly for support, have short and robust bones. On the other hand, the bat and pterodactyl have enormously developed fingers to support the web which gives them the wing. Climbing animals have the whole hand developed into slender and delicate manipulating organs. And in general, animals which do not enjoy *free lateral movements* of the fore legs have small and diminu-

tively modified hands. The typieal idea of the hand is so nearly the same with the foot that referenee is made for information to the article on Foot.

*The Human Hand.*—The human hand is probably the most remarkable organ, not vital, in the whole animal kingdom. Its mechanism is somewhat complicated, and quite unlike human machinery, and its sensitiveness, suppleness, delicacy of movement, and beauty of form are marvelous in the range of animal organisms. "The consummation of all perfection as an instrument," says Sir Charles Bell. The hand bears a very elose relation in its plan of structure to the foot, or is the analogue of the foot. Thus the foot has a tarsus of seven bones, a metatarsus of five, and phalanges numbering fourteen. The hand has its carpus of eight bones, its metacarpus of five bones, and fourteen phalanges. And each of these members is joined to the two bones of the limb above it. The ideal structure of the hand is well shown by the diagram devised by Dr. G. M. Humphry, of Cambridge, England, and the exact framework of the hand is seen in the cut from Holden's *Osteology*. The carpus is united to the radius and ulna by its peculiar articulations, which permit the motions of the hand as a whole in all direetions, and almost as perfectly as the ball-and-soeket joint. The eight bones of the carpus are arranged in two more or less complete rows running aeross the hand. The peculiar arrangement of the two rows, and four segments in eaeh row as represented in the eight bones, is designed to give flexibility, suppleness, and the peeuliar strength to resist violent blows whieh the hand must so often reeeive. The long metacarpals, five in number, give the back and palm of the hand, whieh furnish a broad and firm surfaee for the apposition of the fingers in grasping anything and delieately manipulating minute and multiform objeets. The slenderness and delicacy of the fingers are what give the elegant and beautiful proportions to the hand. The supination and pronation, or the turning of it on its longitudinal axis, is a prominent eharaeteristie of the human hand. No animal equals or nearly approaehes man in this respeet. And the museles whieh enable him to *point with the index-finger* are supplied to man alone, thus indieating a superior grade of being in him, as this movement could only be required for higher purposes than mere sense-gratifieation or means of gaining a subsistenee or self-proteetion.

Fig. 1. — Diagram of the human hand.

Fig. 2. — Bones of the hand.

Why are the fingers of different lengths? Regarding it in a typieal sense, Prof. Owen says it is in obedience to the law of "simplifieation of the digits," or that the longest digit is the most permanent one, and the shortest the first to disappear. Thus the thumb (*pollex*), or first digit, is the shortest, the fourth finger, or fifth digit, the seeond in length, the seeond digit the next, the fourth next, and the third digit, or seeond finger, the longest of all. Another reason of the unequal lengths of the fingers is shown by placing a small rod—say, a lead-pencil—across the palm of the hand, and bending the fingers' ends down upon it. In this experiment all the tips of the fingers reach the peneil at the same instant and press upon it with nearly equal foree. This shows that the lengths of the digits and the museles controlling them are so arranged as to make the hand most effeetive in grasping even small objects.

Eaeh hand, with its fingers, is moved direetly by thirty-one pairs of museles, whieh are located between the elbow-joint and the tips of the fingers. They vary in length from about 18 ineches to 1 inch in length, and many of them are provided with very long tendons. Those of peeuliar interest are the two used in flexing the fingers. These have their origin near to the elbow-joint, their fleshy portions lie one above the other in the fore arm, and their tendons are attaehed to the inner surfaee of the base of a part of the phalanges. The most superfieial one sends its tendons to the second phalanx of the first, second, third, and fourth digits, and the other (deepest one) sends corresponding tendons to the last phalanx of the same digits. But in order to seeure slenderness and delieaey to the fingers, with strength also, a peculiar mechanical arrangement is devised. The tendon supplying the second phalanx is split just above its point of attachment, so as to allow the tendon sent to the third phalanx not only perfect facility of motion, but also to supply the plaee of ligaments to keep it in place as it passes by the joint. Thus both of these sets of tendons can aet singly or conjointly; and not only does eaeh set act by itself, but each division of the muscle may act on its own finger if the will only so direets. The relative lengths of the fingers of man and the gorilla are shown in Fig. 3. Another interesting point in the muscles of the hand is that

Fig. 3.—The human hand.

Hand of the gorilla.

the thumb and little finger are the most abundantly supplied with muscles, and hence muscular power. This is so arranged in order that the hand may more firmly grasp any object, and be especially efficient in the aets of pronation and supination; and peculiar care is always exercised by the surgeon in treating a mutilated hand to save, if possible, one or both of the extreme digits, as they are of much more relative importance in manipulation than are the other digits.

The sensitiveness of the skin of the hand to external impressions is one of the most important eharaeteristics of this organ. This property resides in minute elevations of the skin called *papillæ*. These measure from the $\frac{1}{100}$th to the $\frac{1}{200}$th of an inch in height, and eontain always a lymphatie, blood-vessels, and nerves. They are the most numerous on the palm of the hand and at the tips of the fingers, rather than at the other joints. Thus on a square line of the palmar surfaee of the tip of the last joint of the forefinger are 108 papillæ; on the seeond joint, same space, 40; and on the first phalanx, 15. It has been assumed that eaeh nerve-fiber ends in a pencil of delieate filaments whieh gives sensibility over a eircular or oval area of the hand eovering $\frac{1}{400}$th of a square ineh; and on many of the terminal nerve-fibers of the hand and foot, in addition to the simple filaments, there are minute oval bodies found somewhat sparsely, and very small, ealled "Paeinian bodies," whieh doubtless aid the sense of toueh. The theory of touch is that pressure gives the sensation. But if this be the ease, why does tiekling with a feather or a speek in the eye produee so marked an impression? The sense of touch is more improvable by edueation than any other of the senses. This is well seen in blind people, who use their fingers as eyes with great delieaey of pereeption. The Bengalese throwsters are able to detect by toueh twenty degrees of fineness in the fibers of the coeoon.

Edward Hitchcock.

**Handel** (in German, *Händel*, hen'del), Georg Friedrich: eomposer; b. in Halle, Saxony, Feb. 23, 1685. His father, who intended to edueate him as a doetor, kept him from the public schools and forbade him to use any instrument, but young Handel learned to play on an old spinnet hidden in the garret. At eight years of age he was so profieient that when on a visit at the court of Saxe-Weissenfels, the duke, who overheard him playing on the ehapel organ, exacted from the surprised father a promise that the boy should be educated as a musician. He began his studies at onee under Zachau, organist of Halle. During the five years spent there he analyzed all the most important German and Italian eompositions of that epoeh, passed the severe ordeal of fugue and counterpoint, and finally eomposed every week a motet or a eantata for the ehureh of Halle. At thirteen (1699) he was sent to study the operatie sehool in Berlin, where he remained but a short time, and then entered as a violinist the orchestra of the opera-house at Hamburg. His playing was poor, but at the age of nineteen (1704) he one day assumed the direetion of the orchestra during the ab-

sence of the leader, and displayed such ability that he was at once advanced to that position. At twenty-one (1706) he went to Florence. At this age he was eminent as an organist and learned in the severe, scientific style of composition. But his early works are somewhat dull, lacking melody and sentiment. During two years he lived in Florence, Vienna, Rome, and Naples, composing operas which earned him some reputation, but little money. Failing to obtain an engagement, he returned to Germany. At twenty-five (1710) he was made chapel-master to the Elector of Hanover—afterward King George I. of England—and given a salary of £200. While there he gained in grace and melody from association with the elegant Italian composer Steffani. The elector twice gave him leave to visit London. His first visit was made in 1710 and his first opera, *Rinaldo*, was produced in London Feb. 24, 1711. On his second visit (1712) he received a pension of £200 from Queen Anne, and unceremoniously prolonged his absence to a permanent residence. In 1714 the elector ascended the throne of England, and, naturally being angry with Handel, forbade him the court. But Handel's music was popular in London, and it was not easy to ignore him. He wrote his *Water Music* (1715) for a royal festival on the Thames, and it so charmed the king that he forgave his truant chapel-master and raised his pension to £400. For a few years Handel lived under the roofs of Lord Burlington and of the Duke of Chandos, enjoying the patronage of the nobles, the society of wits and poets, and a quiet, studious life. At thirty-five (1720) he was appointed director of the Royal Academy of Music at the Haymarket theater. Then began a period of twenty years in which he passed through the severest trials of party warfare. His haughty, irritable manner soon created enemies among his patrons and his singers, who formed a rival opera troupe, in which Bononcini and other composers led the most eminent artists of the day. He poured from his fertile brain scores of mediocre Italian operas, generally lacking the charming qualities of the Italian school, which just then were the demand of the times. Some of these works had a short run on the stage. He gradually lost his noble patrons, social position, health, fortune, passed twice through bankruptcy, and finally sank into neglect, almost oblivion. Not till he was fifty-five years old (1741) did Handel give himself entirely to oratorio, his true work. He had written up to this time about 100 large works, and he wrote afterward but a few, each of which is now a familiar masterpiece. The people of Dublin, for whom he wrote his greatest work, *The Messiah* (produced 1742), were the first really to appreciate his genius. By this and other oratorios he suddenly rose to the pinnacle of fame, and before his death became the idol of the British. He was stricken blind in 1751, but notwithstanding this calamity his closing years were prosperous and happy. He died in London, Apr. 14, 1759, and was buried in the Poets' Corner in Westminster Abbey.

Handel's industry was extraordinary. He wrote *Rinaldo* in fourteen days and *Israel in Egypt* in twenty-seven days. He associated with only three friends—Smith, his copyist, Goupy, a painter, and Hurter, a dyer. It is believed that he never loved a woman, and was a strict celibate. He was economical in his personal expenses, but not parsimonious. The concerts given in his aid during the last years of his life enabled him to pay his debts, leave £1,000 to the Foundling Hospital of London, and £20,000 to his poor relatives in Germany. He was very fond of pictures, which were his only interest besides music. He was uncommonly isolated in his profession, having no companionship with musicians, and but little interest in their productions. Excepting a smattering of Latin, he knew almost nothing but music and the Italian language. Although he had a violent temper he was not habitually ill-natured or unkind, and in his prosperous days he was even a genial companion.

The prominent characteristics of Handel's music are sublimity and strength. Around these, grouped in secondary importance, are other qualities equally precious. He excelled all other composers in writing choruses, in which vigor of thought and clearness of form unite to carry the interest in crescendo through the most colossal effects. His most remarkable works are the oratorios *The Messiah*, *Judas Maccabæus* (1746); *Israel in Egypt* (1739); and *Samson* (1742). He wrote no fewer than 52 operas, 23 oratorios, 22 compositions for the church, 13 for chamber-music, and 3 collections for organ and piano—in all 113. Even when it is remembered that he borrowed freely from other composers, this amount must be considered enormous, for most of the works are colossal in conception and proportion. See the *Life* by Rockstro (1883), and that in German by Chrysander (Leipzig, 1858–67, unfinished). The best edition of his works is the one by Chrysander (98 vols., 1856, *et seq.*).

**Hand-tree** [transl. of Span. *manï'ta*, deriv. of *mano*, hand]: the *Cheirostemon platanoïdes*, a tree of Central America; rarely found in Mexico, where it was anciently worshiped. It is one of the family *Malvaceæ*. Its flower has no corolla, but its large calyx has five curved anthers, bearing some resemblance to a hand, whence the name.

**Handwriting**: See the Appendix.

**Handy**, Moses Purnell: See the Appendix.

**Hangchow-foo**: a large and populous city of China; capital of the province of Cheh-kiang; long noted for its magnificence, wealth, and luxury, sharing with the neighboring city of Suchow the reputation of equaling paradise. It is situated at the southern end of the Grand Canal (*q. v.*), about 2 miles from the banks of the Tsien-tang river, and about 50 miles from its mouth (see map of China, ref. 6–K). Its walls are now about 12 miles in circuit; but Marco Polo, who visited the city several times near the close of the thirteenth century as an officer of the Mongols, and who gives a very elaborate and enthusiastic account of it, says they measured 100 miles, and inclosed the beautiful Si-hu or "Western Lake," which now washes the city walls on the W. To Marco it was known as *Kinsay* (a corruption of Chinese King-sze, metropolis), Hangchow having been the capital of the Sung dynasty rulers after the Kin Tartars had gained possession of Northern China.

The chief industry of Hangchow is its silk manufactures, which give employment to 60,000 persons. Population 800,000, including a Tartar garrison of 7,000. Hangchow was captured by the Taipings Dec. 29, 1861, after a protracted siege. Opened to foreign residence and trade Sept. 26, 1896. R. L.

**Hanging Garden of Babylon**: one of the Seven Wonders of the ancient world; built probably by Nebuchadnezzar (604–561 B. C.) to please his wife, the Median princess Amyitis, who pined for the bolder scenery of her native country. The garden consisted of several acres of made land lifted, some say, 150, others say 300 feet, above the plain, and supported by several tiers of arches; Oppert thinks as many as nine. But the data are too scanty for a satisfactory reconstruction of the garden. Our information comes mainly from Diodorus Siculus (ii., 1) and Strabo (xvi., 1, 5). There is a good description in the novel *The Master of the Magicians*, by Elizabeth Phelps Ward. See Rawlinson's *Ancient Monarchies*, ii., 553; iii., 59.

**Hankel**, Wilhelm Gottlieb: See the Appendix.

**Han-kiang**: a river of China; the most important of the affluents of the Yang-tse. It rises in the Ta-Pa range, in the province of Shensi, about 50 miles W. of the important city of Hanchung-foo, and flows E. and S. for 1,300 miles through Shensi and Hupeh, emptying its waters into the Yang-tse at Hankow. It is navigable almost from its source, though rapids are both frequent and dangerous almost as far down as Lao-ho-k'ow, 1,390 *li* (about 460 miles) above Hankow. The upper valley of the Han is regarded as an earthly paradise, and is often called the "Garden of China." It contains many populous towns and villages, produces wheat, cotton, tobacco, silk, etc., and is noted for the manufacture of glue (especially at Si-hiang) and of steel (especially at Tie-lu-chwang, near the source of the river). The chief towns on the upper and middle courses of the Han are Sin-pu-wan (at the limit of navigation), Hanchung-foo, Tsz'-yang-hien, Hing-ngan-foo, Lao-ho-k'ow, and Fan-ching (noted, like Siang-yang-foo on the opposite bank, for successfully withstanding the besieging armies of Kublai Khan from 1268 to 1273, when Marco Polo's father and uncle came to the assistance of the Mongols with mangonels which they had constructed). Below Fan-ching the banks are low, and the surrounding country is frequently flooded. The chief towns are Nei-ho-k'ow, An-luh-foo, Sha-yang, Wu-kia-k'ow, Tien-mŭn-hien, Mien-yang, Han-chwan-hien, etc. The traffic on the river is very great. Steam navigation is possible as far as Lao-ho-k'ow. R. Lilley.

**Hankow** (literally, mouth of the Han): a river-port of China; in the province of Hupeh, on the left bank of the Yang-tse, at the point where it receives the waters of the Han (hence the name), and 582 geographical miles W. of Shanghai; lat. 30° 32′ 51″ N., lon. 114° 19′ 55″ E. (see map of China, ref. 6–J). It is one of the five chin or chief commercial emporia of the empire, and is splendidly situated in the very heart of the country in the center of a network

of rivers and lakes unsurpassed elsewhere. The native town lies on the east bank of the Han, along which it extends for 2½ miles, in the angle formed by the Han and the Yang-tse, along which it stretches for a mile. It is poorly built, dirty, and foul-smelling. To the E. of the native town is the foreign settlement, with a frontage on the Yang-tse of 800 yards. Here the streets are wide and regular, and kept in fine order. The custom-house lies to the E. of the settlement. Hankow was designated as a treaty-port in the treaty of 1858, but was not thrown open to foreign trade until Mar. 11, 1861. The Yang-tse is here a mile wide, and presents a scene of great commercial activity. The largest ocean steamers come to Hankow to load tea, and there is regular steam communication with Shanghai and the other river-ports both above and below Hankow. The trade of Hankow is chiefly distributive. Exclusive of the junk and overland trade the total value of imports and exports, as shown by the reports of the Imperial Maritime Customs, amounted in 1892 to 48,574,509 haikwan or custom-house taels (or to about $51,000,000 U. S. gold), of which taels 17,010,216 were foreign imports, taels 12,000,353 native products from other Chinese ports, and taels 19,563,940 exports. The direct shipments to foreign countries amounted to taels 3,224,582, a decrease of about taels 5,000,000 as compared with 1891, due in part to a falling off in the quantity of tea shipped to Russia on account of the famine, but chiefly to a great fall in the price of tea itself. The direct trade with foreign countries was carried in fourteen steamers, ten of which were tea-steamers. The chief imports are cotton and woolen goods, opium, metals, aniline dyes, ginseng, machinery, kerosene oil, seaweed, and sugar; and the exports tea, rice, silk, tobacco, beans, bean-cake, coal, hemp, hides, vegetable tallow, medicines, and wood-oil.

The population of Hankow is estimated at 800,000; but with Hanyang-foo (to which it is subordinate), also on the left bank of the Yang-tse, but to the W. of the Han, and Wu-chang-foo (directly opposite Hanyang), the capital of the province of Hupeh, it may be put at 1,500,000. Toward the end of summer, when both rivers are swollen with the melted snows of the mountains of the west, the river rises at this point 50 feet or more, flooding the town. R. Lilley.

**Han'ley**: town of England; in Staffordshire; 18 miles N. of Stafford (see map of England, ref. 9–G); in the district called The Potteries; forms with Shelton one town. The inhabitants are mostly engaged in the manufacture of earthenware and china. It is a municipal and parliamentary borough, returning one member to the House of Commons. Pop. (1891) 54,846; of parliamentary borough (including Burslem), 86,845; (1901) 61,519.

**Hanli**: a cloister of Tibet, celebrated as one of the highest inhabited places in the world; elevation, 15,117 feet above sea-level. It is in lat. 32° 50′ N., lon. 79° E., on the upper Indus river, E. of Kashmir. There are many other inhabited places in Tibet at altitudes between 14,800 and 15,000 feet. M. W. H.

**Hann**, haan, Julius Ferdinand, Ph. D., Kk. Hofrath: meteorologist and climatologist; b. in Schlosshaus, Upper Austria, Mar. 23, 1839; educated at the gymnasium of Kremsmünster and the University of Vienna. He is Professor of Physics in the University of Vienna, an editor of the *Deutsche Meteorologische Zeitschrift*, and director of the Imperial Meteorological Institute of Austria. He is a prolific writer on meteorological subjects. The most of his briefer papers have appeared in the *Zeitschrift der österr. Gesellschaft für Meteorologie* (1866–85), the *Deutsche Meteorologische Zeitschrift* (1886 to date of writing), and in the *Sitzungsberichte* and *Denkschriften der Wiener Akademie*. Among the longer memoirs and books may be mentioned *Allgemeine Erdkunde* (Prague, 4th ed. 1886); *Handbuch der Klimatologie* (Stuttgart, 1883); *Atlas der Meteorologie* (Gotha, 1887); *Die Vertheilung der Luftdruck über Mittel- und Südeuropa* (Vienna, 1887); *Die Temperaturvertheilung in den österr. Alpenländern* (Vienna, 1884–85). M. W. Harrington.

**Han'nay**, James: journalist and novelist; b. at Dumfries, Scotland, Feb. 17, 1827. He served in the navy from 1840 till 1845; in 1857 contested Dumfries, unsuccessfully, for Parliament; from 1860 to 1864 edited the Edinburgh *Courant*; and in 1868 was appointed British consul at Barcelona. His publications include *Singleton Fontenoy* (1850) a novel; *Biscuit and Grog* (1848); *Hearts are Trumps* (1848); memoirs of Thackeray and Dickens, and several volumes of nautical sketches, literary essays, and miscellanies. D. at Barcelona, Jan. 3, 1873. Henry A. Beers.

**Hannibal**: city; Marion co., Mo. (for location of county, see map of Missouri, ref. 2–H); on the Mississippi river and the Chi., Burl. and Q., the Han. and St. J., the Mo., Kan. and Tex., the St. L. and Han., the St. L., Keo. and N. W., and the Wabash Railways; 102 miles W. of Springfield, Ill., 150 miles above St. Louis by river. The river is here crossed by an iron and steel railway and wagon bridge, 1,600 feet long between abutments, built in 1872. The city is handsomely located and substantially built, with many fine residences on the hills which nearly surround it, and from which a large quantity of lime is annually taken. It contains 14 churches, 6 public-school buildings, free public library, U. S. Government building that cost $150,000, a German Lutheran and a Roman Catholic seminary, and 2 daily and 5 weekly newspapers. The city has a lumber trade with Missouri, Kansas, and Texas, with average annual sales of 150,000,000 feet, and manufactures machinery, foundry products, cigars, tobacco, stoves, and railway cars. Pop. (1880) 11,074; (1890) 12,857; (1900) 12,780.

**Hannibal** [Lat.; Gr. Ἀννίβας, from Phœnician *Channi-Ba'al*, liter., mercy of Baal]: a Carthaginian general of transcendent genius, who became celebrated for his skill in the conduct of the second Punic war. At the middle of the third century B. C. it was not yet determined whether Rome or Carthage was to be the leading power on the Mediterranean Sea. The first Punic war had resulted in the annexation to Rome of nearly all of Sicily and the islands between Sicily and Italy. But Carthage still had control not only of the African coast, but also of nearly the whole of the Spanish Peninsula. By the peace of 241 B. C. the greater part of Sicily, notwithstanding its agricultural and strategic importance, had been forced out of the control of Carthage, after it had been occupied by that power about 400 years. It is not singular that this loss, which presaged the final ascendency of Rome over all the shores of the Mediterranean, should rankle in the Carthaginian heart. Hannibal was the great leader of the desperate struggle that was practically to settle the momentous question at issue.

The son of Hamilcar Barca, the great general of the first Punic war, Hannibal was born B. C. 247, six years before the humiliating peace. At the age of nine he besought his father to allow him to accompany the army to Spain, but this was not permitted until the old general had required his son to take upon the altar an oath of eternal enmity to Rome. During the next nine years Hannibal's life was in a military camp under the eye of his father. Hamilcar was killed in 228 and was succeeded by his brother Hasdrubal, who fell at the hand of an assassin in 221. The unmistakable spirit and ability of Hannibal had so impressed themselves upon the army that the soldiers at once recognized him as their natural leader, though he was only twenty-six years old. On assuming command he entered at once upon a vigorous policy of thoroughly overawing Spain for the purpose of making it the base of operations against Rome. He crossed the Tagus, pushed into the interior for the subjugation of rebellious tribes, and in the course of two campaigns gained control of all that part of Spain which lies S. of the Ebro, excepting Saguntum. This rich old Greek city enjoyed friendly relations with Rome; but Hannibal determined to attack it, though it must have been plain that such a step would be regarded as a declaration of war. Roman ambassadors sent to Hannibal were told that they could not see him, whereupon they went to Carthage, with little better result. In the course of eight months the siege of Saguntum was successful. Hannibal secured abundant stores for the equipment of his army. As Carthage refused the demand to give up Hannibal, Rome declared war in 219 B. C.

Hannibal at once began preparations for the invasion of Italy. In the spring of 218 his army was ready, and he set out from New Carthage with 90,000 foot, 12,000 horse, and 37 elephants. The people along the route were easily conciliated, and the Roman army, sent to intercept the advance, was left in the rear. He crossed the Rhône probably not far from the modern village of Roquemaure. Marching up the left bank to the Isère, he followed that mountain stream through the hostile country of the Allobroges until he reached the narrow defiles of the Alps. Fifteen days were occupied with the passage. Modern efforts to identify the route have not been completely successful, but the best authorities favor the belief that the passage was made by the Little St. Bernard. The rocky defiles, the hostile tribes, the seemingly impassable chasms, the deep snows, and the se-

vere autumn frosts reduced his army to 20,000 foot and 6,000 horse. In October he reached the valley of the Aosta, and was welcomed by the friendly tribes of the Insubrian Gauls. After a short rest the army advanced and first met the Romans on the river Ticino. The engagement was not important, save as it demonstrated the superiority of the Carthaginian cavalry. The defeated Roman general Scipio fell back to Placentia, where he was joined by the other consul, Sempronius. The Romans now had 40,000 men, and under the lead of Sempronius advanced across the Trebia on a bitter cold day in December. The onset of Hannibal and of his brother Mago could not be resisted. The utter defeat of the Romans gave Northern Italy into the hands of the invader.

After giving his troops a winter's rest, Hannibal determined in the spring of 217 B. C. to cross the Apennines and make himself master of Central Italy. In the marshy lands of the Arno the army was obliged for several days to march through swamps covered with water. Many perished, and Hannibal himself lost an eye from ophthalmia. But at length he emerged at Fiesole. The armies of the two Roman consuls were at Arezzo and Rimini. Hannibal, instead of meeting them at once, marched past them toward Perugia, ravaging the country and drawing the enemy on in pursuit. The road passing along the northern shore of Lake Trasimene is peculiarly adapted for an ambuscade. The mountains approach the shores at both ends of the lake, while opposite the middle a broad plain extends back for a considerable distance. Hannibal concealed his army so as to attack simultaneously at the defiles and on the flank opposite the lake. The ensuing battle was little less than a slaughter of the Roman army. An immediate march on Rome was anticipated, but the invader chose to take the chance of first arousing the Italian allies. With this end in view he marched through Umbria and Picenum into Apulia. Meanwhile the Romans had placed Fabius Maximus at the head of affairs as dictator. He adopted the method to which the term "Fabian policy" was forever after to be attached. He determined on no account to bring on a general engagement on equal terms, but to harass the enemy by hanging upon his rear and so gradually to wear him out. Under this policy the fairest fields of Southern Italy were laid waste. Once, after Hannibal had ravaged the Campagna, Fabius came near entrapping him as he was about to escape into Samnium. But the Carthaginian general, by the ingenious device of tying faggots to the horns of oxen and lighting them, decoyed the Roman army away from the defile, and thus made good his escape. The general tactics of Fabius soon disgusted the Roman people as well as the army, and in the spring (216) Æmilius Paulus and Terentius Varro were placed in the field as consuls at the head of an army of 80,000 men and 6,000 horse. Hannibal's army was drawn up in a loop of the Aufidus, near Cannæ, the strong infantry on either side, the weak infantry in the center. When the attack of the Romans came the center of the Carthaginian force fell back, as had been planned, and the veterans advanced with irresistible force upon the flanks. Pressed into a dense mass the Romans were cut down without the possibility of escape. The slaughter is said to have gone on for eight hours, and the Roman army was practically annihilated.

Though this was the most important battle of the war, it did not give Hannibal the advantage that might have been anticipated. He was 200 miles from Rome, and did not yet venture to advance upon the capital. His policy still was to arouse the provinces, to attach them to himself, and in this way to accumulate strength for the final struggle, but he was unsuccessful on account of Rome's provincial policy, which insured the fidelity of her allies. In 212 she put six armies into the field, all of which pursued the Fabian method. About the same time the policy of "carrying the war into Africa" was adopted. First of all Syracuse was taken and thus the last Carthaginian stronghold in Sicily became subject to Rome. The Romans prosecuted a vigorous campaign in Spain. Meanwhile Hannibal received very inconsiderable support from Carthage. In the year 208 Rome had twenty-three legions, or about 200,000 men in the field, while Hannibal's army could scarcely have amounted to one-tenth of that number. In 207 the battle of the Metaurus was fought, in which the Carthaginians under Hasdrubal were utterly defeated. All now seemed decided. Hannibal remained in Italy for four years longer, but was obliged during the whole of this period to act on the defensive. Still no Roman general dared bring on a battle with Hannibal himself. In 204 Scipio the Younger had been victorious in Spain, and now was permitted to cross into Africa and bring the war to an issue by attacking Carthage herself. Hannibal at once received an order of recall and reluctantly embarked. In Italy he had never lost a battle, but in Africa he confronted the Romans with an evident lack of heart. The armies met at Zama in 203, and the Carthaginian force was annihilated, though it fought with desperate valor. Hannibal, with a very small force, escaped to Adrumetum. The result of the war and of the consequent treaty of peace was to render Carthage tributary to Rome, and to deprive her of all political independence.

At the age of forty-six Hannibal was now made chief magistrate of Carthage, and he at once showed that his abilities were scarcely less conspicuous in peace than they had been in war. In the course of the next seven years he so far restored the power of Carthage that Rome began once more to look with apprehension upon the new development of her old enemy. The Romans demanded the surrender of Hannibal. Not wishing that Carthage should be disgraced the Carthaginian hero betook himself to voluntary exile. He visited Tyre, Ephesus, and Crete, and finally took refuge with Prusias, King of Bithynia. The Romans again demanded their old enemy, and Prusias decided to give him up, but Hannibal, unwilling to fall into their hands, took his own life by poison, probably in 183 B. C. All writers since his time have agreed in ascribing to him military genius of the highest order.

AUTHORITIES.—The most important sources of information are Polybius, *Bk. ii.*; Livy, *Bks. xxi., xxii.*; Arrian, *Wars of Hannibal*; Plutarch, *Fabius Maximus*, and *Marcellus*. Of modern histories of the period the best is that contained in Arnold's *History of Rome*. C. K. ADAMS.

**Han'no** [Lat.: Gr. Ἄννων, from Phœnic. *Chan'non*, liter., pitying, merciful]: the name of many historic Carthaginians, among whom the following are especially noteworthy: HANNO, a navigator, who (probably in 570 B. C.) set sail with sixty ships and a large number of intended colonists, and coasted southward along the shores of the African continent, founding several towns on the way. On his return he set up in a temple a tablet containing an account of his voyage. Of this tablet a Greek version, the *Periplus*, is still extant. —HANNO THE GREAT, in the third century B. C., was the leader of the aristocratic party and the chief opponent of Hamilcar Barca and of Hannibal his son. Hanno himself was an able general.

**Hanoi**, hăă-noi', formerly **Keicho** and **Cachao**: the capital of Tonquin; near the southern boundary of China (see map of China, ref. 9-G); in lat. 21° 2′ N., lon. 105° 48′ E.; on the Songka; 60 miles by the most direct route from its port, Haiphong, and 80 miles from the sea. The streets are fairly wide and the houses built of brick. The principal trade is in silk and rice, and is largely in the hands of the Chinese. The Dutch and Portuguese formerly had commercial establishments here, and French missionaries have long been resident in the district. The principal official French resident is stationed here. Hanoi came into the hands of the French in 1873, and is an open port. Pop. about 150,000. M. W. H.

**Hanoteau**, ăă'nō'tō', HECTOR: landscape-painter; b. at Decize, Nièvre, France, May 25, 1823. Pupil of Gigoux; medals, Salons, 1864, 1868, and 1869; first-class medal, Paris Exposition, 1889; Legion of Honor 1870. A naturalistic painter, whose work is distinguished by good color and faithful rendering of nature. His *Village Pond* (1870) and *Frogs* (1875) are in the Luxembourg Gallery, Paris; the *Paradise of Geese* (1864) is in the Marseilles Museum. D. at Briey, Nièvre, Apr. 9, 1890. W. A. C.

**Han'over** (in Germ. *Hannover*): a province of Prussia; bounded N. by the German Ocean and the Elbe, E. by Mecklenburg and Prussian Saxony, S. by Hesse-Cassel and Westphalia, and W. by the Netherlands; area, 14,853 sq. miles. Pop. (1890) 2,278,361, of which only about 10 per cent. are Roman Catholics, about 13,500 Jews, and the rest Protestants; (1895) 2,422,020.

| DISTRICTS. | Area, sq. miles. | Pop. in 1890. | CHIEF TOWNS. | Pop. in 1890. |
|---|---|---|---|---|
| Hanover | 2,481 | 528,094 | Hanover | 165,499 |
| Hildesheim | 1,708 | 476,236 | Hildesheim | 29,386 |
| Lüneburg | 4,293 | 419,937 | Lüneburg | 20,681 |
| Stade | 2,595 | 338,331 | Stade | 10,190 |
| Osnabrück | 2,388 | 299,899 | Osnabrück | 39,932 |
| Aurich | 1,144 | 218,004 | Aurich | 5,639 |

With the exception of the inhabitants of the districts bordering on the German Ocean and the Netherlands, who are of Frisian descent, the Hanoverians are Saxons. The lower classes speak Platt-Deutsch (Low German), and in the districts bordering on the Netherlands, Dutch and Frisian. The southern part of Hanover is covered with hills and low mountains, branches of the Hartz, which here seldom rise to the height of 3,000 feet. They are covered with dense forests, and are very rich in minerals—gold, silver, lead, iron, coal, and salt. The northern part of the country is a low plain. The basins of the rivers Elbe, Weser (with its affluent, the Leine), and Ems, all of which run to the German Ocean, are fertile, and the soil is well suited to agriculture. Rye and flax are grown in great quantities. Along the German Ocean are extensive marshes and peat-moors. Wherever these marshes have been well drained they afford excellent pasturage, and the trade in cattle is considerable. A large portion of Central Hanover is occupied by the Lüneburg Heath, a sandy and unproductive tract, with no other resources than the rearing of sheep and bees.

The territory which forms the province of Hanover belonged from ancient times to the family of Brunswick-Lüneburg, and at times was divided up between the different lines of the family. In 1692 it was made an electorate, and when in 1714 its elector, George Louis, came to the British throne as George I., it began to play quite a conspicuous part in the history of Europe. In 1814 it was made a kingdom by the Congress of Vienna, and in 1837, at the death of William IV., it fell to Ernest Augustus, Duke of Cumberland, as the Salic law, which excludes heirs female, prevented Queen Victoria from inheriting it. In 1866 it was conquered by Prussia, and incorporated by that kingdom as a province, but the interest on the sum of 48,000,000 marks was to be paid as indemnity to the sovereign and the heirs of the Brunswick-Lüneburg family. King George V., however, who was blind, and who had settled at Hietzing, near Vienna, issued a solemn protest against the incorporation, and even threatened warlike proceedings and supported a corps of vagabonds. Prussia accordingly recalled the grant. George died in 1878, and his son, Ernest Augustus, Duke of Cumberland, continued for many years in his father's course. But in 1892 he publicly renounced his claims, and the income of the Guelph Fund was restored to him. See BRUNSWICK and GUELPH FUND. Revised by C. H. THURBER.

**Hanover**: capital of the Prussian province of Hanover; on both sides of the Leine, which here receives the Ihme; 78 miles S. E. of Bremen (see map of German Empire, ref. 3–E).. The Ihme separates the suburb Linden from the city proper. The old city, irregular and partly old-fashioned, is surrounded to the N. and E. by new and elegant quarters which have arisen since 1840, and, steadily increasing, group themselves around the railway station. Magnificent promenades extend to the N. W. of the city, and to the N., E., and S. a large forest, the Eileriede, surrounds it in a semicircle. The new quarters, of which Georg Street, Theater Street, Schiller Street, Dépôt Street, and King Street are especially noticeable, are distinguished by the original architecture of many of their buildings. The most remarkable public places are the Bahnhofsplatz, surrounded with large hotels and containing the equestrian statue of King Ernest Augustus, cast in bronze after a model by Wolff, and raised on a pedestal of granite; the Theater Platz, in the center of which stands the theater, one of the largest and most beautiful in Germany, containing seats for 1,800 persons, and built 1845–52 by Laves; the Georgs Platz, with the statue of Schiller by Engelhardt; the Markt, in the center of the old city; and the Waterloo Platz, a parade-ground, with the lofty Waterloo column. The most remarkable buildings are the Museum, in Sophie Street, finished in the round style by Hase in 1856, and containing collections of art, history, and natural science; the Polytechnic School, in Georg Street; the Lyceum, on Georgs Platz; the former town-house, in the market-place, a Gothic structure of the middle of the fifteenth century; the royal palace, an extensive building of the eighteenth century, situated on the Leine, and containing a chapel with a celebrated altar-piece by Lucas Cranach. The palace overlooks the Waterloo Platz, containing large barracks and a fine arsenal. On going from the palace to the Waterloo Platz, the statue of Gen. Count von Alten, who commanded the Hanoverians at Waterloo, stands to the right, and behind it the library building arises, containing 170,000 volumes and 4,000 MSS., among which are the literary bequests of Leibnitz. A monument to Leibnitz, consisting of a circular temple containing his bust, stands on a hill near the library, on the Waterloo Platz. The Market church, of the fourteenth century, restored in 1855, has a quadrangular tower, and contains some beautiful glass-paintings and an altar carved in oak wood. Christ church, built of brick and finished in 1864 by Hase, also contains fine glass-paintings. In the vicinity of Hanover stands the palace, Herrenhausen, situated in an extensive park laid out in French style by Le Nôtre. Connected with the palace is an art-gallery with a collection of antique and modern sculptures. An avenue of large linden-trees stretches from Hanover to Herrenhausen, and has magnificent promenades on both sides. To the E. of the avenue the colossal Welfenschloss arises, in the round style, with five towers. Since 1866 it has been occupied by the Polytechnic High School.

Hanover is first mentioned in history in 1163. It was at that time the residence of Henry the Lion, and with a few interruptions it has remained in the possession of the Guelphs. In 1481 it entered the Hanseatic League, and soon its commerce and wealth increased considerably. It suffered, however, very much from internal disturbances, brought on by the introduction of the Reformation. In 1837 it became the residence of the King of Hanover, and from that time it has made steady progress; especially since its annexation to Prussia it has increased both in size and splendor. Pop., with suburbs (1900), 235,666.

Revised by C. H. THURBER.

**Hanover**: town; Grafton co., N. H. (for location of county, see map of New Hampshire, ref. 6–E); on the Connecticut river; 55 miles N. E. of Concord. It is connected with Norwich, Vt., by a bridge, is bisected by Moose Mountain, and is the seat of DARTMOUTH COLLEGE (*q. v.*). The principal business is farming and lumbering. Pop. (1880) 2,147; (1890) 1,817; (1900) 1,884. EDITOR OF "GAZETTE."

**Hanover**: borough (founded 1764): York co., Pa. (for location of county, see map of Pennsylvania, ref. 6–G; on the Penn. and the West. Md. Railways; 35 miles S. by E. of Harrisburg. The surrounding country abounds in iron ore, and is exceedingly fertile. The borough has 9 churches, 16 public schools, including a high school, 1 daily and 5 weekly newspapers, and manufactures of leather, cigars, carriages and wagons, and flavine. Pop. (1880) 2,317; (1890) 3,746; (1900) 5,302. EDITOR OF "HERALD."

**Hanseat'ic League**, or **Hanse Towns** [*Hanseatic* is from M. H. Germ. *hanse*, an association of merchants < O. H. Germ. *hansa*, band of men]: an association of free cities of Northern Europe formed in the thirteenth century to protect their common commercial interests.

There are traces of some joint defensive action as early as the middle of the twelfth century. In 1239 Hamburg, Ditsmarsh, and Hadeln joined in measures to keep the Elbe and the sea at its mouth clear of marauders. In 1241 Lübeck and Hamburg concluded a formal treaty to provide ships and soldiers to make trade secure between the Elbe and the Trave, and on the waters from Hamburg to the ocean, and to promote their common interests. This is usually regarded as the date of the organization of the league. Six years later Brunswick joined the compact. In 1252 deputies from the three cities met at Lübeck and took steps for establishing factories at London, Bruges, and Novgorod in Russia. Later a factory was also established at Bergen. The door was open for other towns to enter the association, and its manifest advantages inclined them rapidly to seek admission, till at its height it embraced 85 cities. Many other cities, not regular members, came into commercial relations with the league, to their own advantage, while they added also to its influence and power. In 1260 its affairs were regulated by a convention which ordained a diet of delegates to assemble triennially, and an extraordinary meeting every ten years to renew the league. Lübeck was made the capital of the Hansa and the depository of its treasury and archives. The meetings were generally held at Lübeck, but occasionally at Hamburg, Cologne, and other places. For the details of administration the cities were distributed into four circles: (1) The Vandalic or Wendish towns of the Baltic, with Lübeck as capital. (2) The Westphalian, Rhenish, and Netherland towns, capital Cologne. (3) The Saxon and Brandenburg towns, capital Brunswick. (4) The Prussian and Livonian towns, capital Dantzic. The magistrates at the head of each circle were charged with sovereign power to carry out the decrees of the league.

In the outset the league aimed simply to resist the extortions of feudal lords and sovereigns, to prevent robbery and piracy, to regulate and expand commerce, and to stimulate production. It did much to define general principles of mercantile law, and to increase the wealth of the cities themselves. In its leading ideas and policy, though crude and only partially developed, are found the germs of that law of reciprocity and freedom which is now so generally recognized as the basis of modern commerce.

Through its organized association and system, with the privileges secured, the league to a great extent monopolized the trade of Northern Europe. By concessions from Henry III. and the sovereigns who succeeded him the London factory gained command of both the import and export trade of England, and engrossed the carrying trade almost to the exclusion of British merchants. Similar advantages were gained in each of its great centers. The power of the league was thus rapidly and strongly developed. It reached its culmination in the latter half of the fourteenth century. But now its aims and policy were changed. It abused the power it had gained, for the maintenance of separate interests of its own, and exercised sovereign authority to perpetuate an oppressive monopoly. So it maintained armies and navies; by a victory over the Kings of Denmark, Sweden, and Norway gained control of the Sound; assumed to depose the King of Sweden; carried on war against Denmark; and by a declaration of war compelled Edward IV. of England to grant larger concessions. Through the fifteenth century it maintained its power with growing haughtiness and arrogance till it became intolerable and declined as rapidly as it rose.

Among the causes of its dissolution may be mentioned—(1) the general development of commercial activity. This at the same time created competition and awakened jealousy of the exclusive privileges enjoyed by the league. (2) The centralization of national life on the decay of feudalism, and the consequent desire of both sovereign and people that each nation should control its own commerce. This led to the repeal of the concessions which had been granted, and broke up the monopolies enjoyed. Thus England in 1597 revoked all special privileges of the Hanseatic merchants. (3) The new direction and the new impulse and methods given to the commerce of the world by opening the passage to India by the Cape of Good Hope and the discovery of America. In 1630 a last general assembly was summoned to meet at Lübeck, but the deputies from the remaining towns went only to notify their withdrawal. Thus, after nearly 400 years, this confederacy was dissolved. Then the cities of Hamburg, Lübeck, and Bremen formed a new association called the Free Hanse Towns. Frankfort-on-the-Main was subsequently added. The four were recognized as the free cities of Germany, each exercising independent and sovereign jurisdiction till 1810, when Napoleon I. incorporated them with the French empire. In 1813 they became free members of the German Confederation. In 1866 Frankfort-on-the-Main fell to Prussia. Bremen, Hamburg, and Lübeck are still independent members of the German empire; and it is only since 1891 that they have relinquished the right of separate tariff legislation.

Revised by A. T. Hadley.

**Hansen**, haan'sen, Hans Christian Peter: critic; b. in Copenhagen, Denmark, Apr. 27, 1840. At the age of twenty-three he won a university prize by a treatise on Greek tragedy. Since 1865 he has been engaged in journalism; 1872–80 he edited *Nær og Fjærn*, generally regarded as being the most important critical weekly ever published in Denmark; and on its merging in *Illustreret Tidende*, he became editor of the latter. In 1883 he received the title of professor. In addition to a large number of critical articles, poems, and short stories, he is the author of a novel, *Christian Kjöbenhavner* (1882); *Illustreret dansk Literatur Historie* (2 vols., 1886); and *Den danske Skueplads*, not yet completed. His most valuable contribution to Danish literature is his translation of Goethe's *Faust* (part i., 1881; part ii., 1889). D. K. Dodge.

**Hansen**, haan'sen, Peter Andreas: astronomer; b. at Tondern, in the duchy of Schleswig, Dec. 8, 1795; was apprenticed to a watchmaker in Flensborg, but his talent for mathematics and his interest in physical science brought him in connection with the astronomer Schumacher, director of the observatory of Altona. In 1823 he became Schumacher's assistant, and in 1825 he was made director of the observatory of Seeberg, near Gotha, where he spent the rest of his life. His *Tables de la Lune* were published in 1857 by the British Government, and are used in the calculations of the *Nautical Almanac*. Among his other works are *Darlegung der theoretischen Berechnung der in den Mondtafeln angewandten Störungen* (Leipzig, 1862–64); *Geodätische Untersuchungen* (1865–68), etc. D. Mar. 28, 1874.

**Hanson**, John Wesley: See the Appendix.

**Hansteen**, haan'stayn, Christopher: astronomer; b. at Christiania, Norway, Sept. 26, 1784; studied mathematics at the University of Copenhagen, and was appointed teacher at the Latin school of Frederiksborg, in Seeland. While there he began his researches concerning terrestrial magnetism, and a paper he prepared on this subject received a prize from the Academy of Science, Copenhagen. In 1814 he received a chair as Professor of Mathematics at the newly established University of Christiania, where he continued his scientific labors, the result of which he published in 1819 in Christiania. The book (*Researches Concerning the Terrestrial Magnetism*), of which, however, only the first volume, with atlas, appeared, attracted much attention. Hansteen traveled from 1828 to 1830 through Western Siberia at the expense of the Government. He published in 1863 *Magnetical, Astronomical, and Meteorological Observations on a Journey through Siberia*. Besides his strictly scientific labors, he developed a great activity in a practical direction. In 1833 an observatory was erected at Christiania under his superintendence. In 1835 he published a manual of geometry, and in 1836 one of mechanics. He also was president of a committee for the regulation of weights and measures, and had charge of the triangulation of Norway. After 1823 he edited, in connection with Mashman and Sandh, a magazine of natural science. D. in Christiania, Apr. 15, 1873.

**Hants**, England: See Hampshire.

**Hanuman**: See Entellus Monkey.

**Hanus**, Paul Henry: See the Appendix.

**Haparanda**: a town of Sweden: in lat. 65° 51′ N.; at the head of the Gulf of Bothnia; on the western shore of the Torneå, a short distance from its mouth (see map of Norway and Sweden, ref. 5–H). It has only about 1,000 inhabitants, but its meteorological station, established in 1859, is one of the most important in Europe, partly on account of its northern location, and partly on account of the great variations of temperature there.

**Haplo'mi** [Mod. Lat., nom. plur. of *haplomus*; Gr. ἁπλόος, simple + ὦμος, shoulder]: a sub-order of fishes belonging to the order *Teleocephali*, which have the brain-case confined behind the orbits; symplectic bones developed; pterotics normal; the usual opercular bones all present; lower pharyngeal bones distinct and sub-triangular; upper in three or four pairs; anterior as well as other dorsal vertebræ normal and distinct; shoulder-girdle with the meso-coracoid atrophied (whence, probably, the name); and the air-bladder communicating through a duct with the intestinal canal. The fishes embraced in this group vary in form and general appearance, and to it belong the pikes, killy-fishes or minnows, and kindred types; these have been arranged under the families *Esocidæ*, *Umbridæ*, and *Cyprinodontidæ*. The *Cyprinodontidæ* were referred, by the older naturalists, near the *Cyprinidæ*, but they have no real relations with those fishes. Theodore Gill.

**Hapsburg**, or **Habsburg**, **House of** [named from the old castle of *Habsburg* (in Aargau, Switzerland). Older name *Habichtsburg*, Hawk-castle; Germ. *habicht*, hawk + *burg*, castle]: an ancient and illustrious family, to which belongs the reigning sovereign of Austria. The castle, which was erected by Werner, Bishop of Strassburg, 1001–29, is now in ruins, only the walls of the tower remaining. The founder of the house, however, was Albert, who is mentioned as Count of Hapsburg in 1153. Under him and his son, Rudolf I., the family became one of the most powerful in Southern Germany, and gained control of a considerable part of Switzerland. In 1233 the line parted into two branches—Hapsburg-Hapsburg and Hapsburg-Lauffenburg. The latter parted again into two lines—Hapsburg-Lauffenburg proper (extinct in the male line 1408, but still represented by the Feilding family in England), and the Hapsburg-Kyburg line (of which the last count died 1415). The first German emperor of this family was Rudolf I., who founded the Austrian house, which from 1438 to 1806 held the German imperial crown, and since that time has held that of Austria. In Spain, Burgundy, Tuscany, and Modena, Hapsburg monarchs, but of the Spanish line, have also borne

sway. The Spanish line sprung from Charles V., whose father was a son of Maximilian I., and whose mother was a daughter of Ferdinand and Isabella. When he abdicated, in 1555, he left his Austrian possessions and the imperial crown of Germany to Ferdinand I.; Spain and the Netherlands to his son, Philip II. With Charles II. the Spanish line of the house of Hapsburg became extinct, 1700, and the Spanish War of Succession begun, which finally left Spain to the house of Bourbon. In 1881 it was proposed to purchase the ancient Castle of Hapsburg and present it to the Crown Prince of Austria, but the opposition of the people of Aargau was so violent that the project was abandoned.

Revised by C. K. Adams.

**Harafora**: same as Arafura (*q. v.*).

**Hara-kiri**, haa'ra-kee're, or **Seppuku**, sep'po'ko [Japanese, from *hara*, belly + *kiri*, stem of *kiru*, to cut. Seppuku has the same meaning. It is of Chinese origin, and is considered more elegant than the purely native term. It is from *setsŭ puku*, the Japanese pronunciation of two Chinese words *ts'ieh* or *tsit*, to cut, and *fuh* or *fuk*, belly, the syllable *tsu* in modern Japanese being assimilated (except when initial) to a following *k*, *p*, or *s*]: self-disembowelment; a ceremonious form of judicial suicide permitted in feudal Japan among daimios and the military class, in order to save them the degradation of submitting to the headsman's ax or the hangman's rope. In point of fact, however, and especially during the last 200 years, it has been customary for the second or assistant—usually a kinsman or intimate friend—to strike off the head of the condemned person with his sword just at the moment the suicide plunged, or appeared to plunge, his dirk into his abdomen, or reached out to seize the dirk. Self-disembowelment has long been practiced in Japan by members of the military class who were unwilling to survive some disgrace, but it was only during the Ashikaga dynasty of Shoguns (1336–1568) that it was recognized as a method of capital punishment, and began to be invested with the elaborate formalities and ceremonies which afterward characterized it. These formalities refer (1) to the *place of execution*, which should be in the palace or garden of a daimio, according to the rank of the individual. In an emergency, as when on the march, a temple might be hired for the purpose. (2) The *arrangements* made there, including the kind, number, and position of the mats to be used, the screens, curtains, lights, etc. (for night was the proper time), all of which were usually attended to with the most punctilious care. (3) The *kaishaku*, or seconds. These were three in number; one to strike off the head, usually a kinsman or intimate friend, who ought to consider himself honored to be asked to officiate in this capacity, and it was the bounden duty of every samurai to qualify himself for such a task. The assistant second had to bring forward the tray containing the dirk to be used in the disembowelment. The inferior second carried the head to the witnesses for identification. He had also to be prepared to act as a substitute of either of the others should any accident occur. (4) The *witnesses*, whose duty it was to read the sentence, instruct the seconds in their duties, and identify the head after decapitation. (5) The *suicide* himself, who, having bathed and donned his dress of ceremony, took his place on the mats in the usual Japanese squatting fashion, but facing the N. As soon as he had removed his upper garments it was time for the second to poise his sword, and to strike while the principal's head was bent forward as he stretched out his hand to draw the tray toward him. With the identification of the head the ceremony ended.

The word *hara-kiri* is frequently but erroneously spelled harri-karri. See Mitford's *Tales of Old Japan* (London, 1871; 3d ed. 1876); and B. H. Chamberlain's *Things Japanese* (London and Yokohama, 1891).

R. Lilley.

**Haran** [Heb. *Chārān*; Arab. *Charrānum*; Gr. Κάρραι, or Χάρρα; Lat. *Carræ*]: the name of a district of Northern Mesopotamia with a town situated on the Belike, 50 miles N. of its influx into the Euphrates, and 10 miles S. E. of Edessa. The fertility of the district was probably the reason why Terah and Nahor stopped there, while Abraham and Lot pushed onward to Canaan. As the city stands at the very point at which the highways from Media, Assyria, and Babylonia meet to follow the same road to the Cilician coast, it was of great strategical importance to Assyria, and became the center of a considerable trade (Ezra xxvii. 23). Later on it was the scene of the defeat of Crassus by the Parthians (53 B. C.), and of the assassination of Caracalla by the soldiers of Macrinus (217 A. D.). It also flourished under the Arabs; but Abulfeda mentions that in his time it lay in ruins, and it has never since been rebuilt.

**Harar'**, or **Adari**: a city of Northeastern Africa; situated in lat. 9° 20′ N.; S. of the Gulf of Aden, at an elevation of 5,500 feet above the level of the sea (see map of Africa, ref. 4–H); its population is estimated at 35,000. The city became in 1876 a dependency of Egypt, and later came under Italian protectorate, but it was formerly the capital of a small but independent country governed by an emir. The people are Mohammedans of the strictest description, but their ethnology is very obscure. The country is very fertile and well cultivated. Coffee and cotton are raised in great quantities and of excellent quality; also wheat, fruit, and tobacco. Besides in its own products and manufactures, the city carries on a brisk trade in gums, ivory, mules, slaves, etc. It was first visited by Richard F. Burton, who succeeded in getting admission under the guise of an Arab and spent ten days there in 1855. See his *First Footsteps in East Africa; or, An Exploration of Harar* (London, 1856). In the *Bulletin de l'état Major-Général de l'Armée égyptienne* (1876) is found a sketch of the history of the city, drawn up by the Egyptian general Mohammed Moktar from native documents which he brought with him to Cairo.

Revised by M. W. Harrington.

**Har'baugh**, Henry, D. D.: minister of the (German) Reformed Church in America; b. near Waynesborough, Pa., Oct. 24, 1817; entered Marshall College at Mercersburg, Pa., in 1840; after a partial course in academical and theological studies was ordained in 1843; held pastorates in Lewisburg, Lancaster, and Lebanon, Pa., and in 1864 became Professor of Theology at Mercersburg. He was during the last year of his life editor of the Mercersburg *Review*, and had been for sixteen years previous to this editor of *The Guardian*. He was an advocate of the "Mercersburg theology," and belonged to the High Church school of his denomination. Author of *Heaven* (Philadelphia, 1848); *The Heavenly Recognition* (1851); *Heavenly Home* (1853); *Life of Michael Schlatter* (1857); *The Fathers of the German Reformed Church* (3 vols., 1857–58); *Christological Theology* (1854); a volume of *Poems* (1860); and *Birds of the Bible* (1854). D. in Mercersburg, Pa., Dec. 28, 1867.

**Harbor Beach**: Huron co., Mich. See Sand Beach.

**Harbor Grace**: next to St. John's the most important town of Newfoundland; the capital of Harbor Grace district. Lat. 47° 41′ 28″ N., lon. 53° 12′ 33″ W. Its harbor is large, and the inner port is very secure. Harbor Grace has a courthouse, jail, and a fine cathedral. It is the seat of a Roman Catholic bishopric. Has an extensive trade, one weekly newspaper, a Government savings-bank, a fire-company, gasworks, a water-supply, a convent, schools, literary institute, and various benevolent societies. Pop. (1884) 7,054.

**Harbors** [M. Eng. *harbor*, changed (appar. by analogy of *harbor*, arbor) from *hereberge*; from Dan. *herberge* or Low Germ. *harbarge*: O. H. Germ. *heriberge*, military station; *heri*, army + *bergan*, to shelter]: re-entrants or inlets of the shore line of a sea or lake, having a depth of water sufficient for navigation and sheltered from heavy seas. Natural harbors are determined, practically in all cases, by the submergence of an uneven coast-line, or more fully they are those where the conditions requisite to safety, such as depth, area, anchorage, protection from winds and waves, facility of egress and ingress, and freedom from other destructive agencies, exist in a state of nature. The best instances of natural harbors in the track of commerce are those of Queenstown, Ireland; Rio de Janeiro, Brazil; Portland, Me.; New York, N. Y.; Norfolk, Va.; Port Royal, S. C.; Pensacola, Fla.; San Francisco, Cal.; Puget Sound, Wash.; King George's Sound and Princess Royal harbor in Southwestern Australia; Port Jackson, Port Phillip, and on the Great Lakes may be mentioned Grand Marais, Grand Island, Copper harbor, Portage, Superior, Saginaw, Presque Isle, and others.

Most of the *artificial harbors* are within the shore-line at points where the beach is pierced by a river or inlet, advantage being taken of the tidal flow to effect an entrance for ships. Where, as in some foreign ports, the tidal range is great (from 20 to 40 feet), and vessels of deep draught can pass in or out with the tides to the wet docks provided for their berths, the principal works to be provided are seawalls and docks, as at Liverpool, London, Cardiff, Boulogne, Calais, Havre, etc.; but in most instances the works are designed to effect a safe passage of the outer bar, so characteristic of alluvial coasts, by the creation of a deep-water channel across its crest.

This *outer bar* is the submerged embankment whereby the littoral drift traverses the breach in the shore-line, and its improvement beeomes a eomplieated problem involving a consideration of all the phenomena attending its formation and maintenanee. The physical elements to be considered are the fresh-water volume and veloeity, the tidal prism, wave-aetion, winds, eurrents, form of basin, evaporation, latitude, eharacter of material, and exposure. These faetors sustain to eaeh other the relation of cause and effect, leading to intrieate eombinations of many variables whieh it is hopeless to attempt to formulate mathematically. But a eareful analysis of the effeets produeed by the forces as revealed by the ehanges in the submerged topography will prove invaluable, as indieating the relative direction and intensity of the resultant forees.

Many failures have resulted from the attempt to follow precedents which were not applicable, and to determine this question it is important to distinguish the physical eonditions existing at various harbors. Thus they may be analyzed as follows:

(*a*) A elass in whieh there are large tidal fluctuations, with but small interior reservoirs and little or no fresh-water drainage.

(*b*) The tidal range may be great and the inner lagoons large, while the land-water is insignifieant.

(*c*) The mean tides may be small and the inner bays extensive, with not sufficient fresh water to cover the evaporation, as at Galveston.

(*d*) There may be feeble tides and no intervening basins, but the rivers may debouch direetly into the sea, as at the Mississippi, Brazos; or

(*e*) The river may empty into tideless seas or lakes, as the Danube, Volga, etc.

By a eareful examination of existing eonditions the engineer may seleet the plan which will give greatest promise of suceess. Thus the jetties whieh have removed the bars of the Danube and Mississippi would not be applieable to the conditions prevailing at Galveston. In most eases two jetties have been proposed for the purpose of eoneentrating the ebb tides upon a eertain seetion of the bar, with the hope of produeing sufficient seour between them, but experienee has shown that the tidal prism is reduced by these obstructions to the ingress of the flood tide and henee the volume of the ebb movement is diminished, thus rendering the problem indeterminate. Moreover, it has been observed that there is in general a prevailing or resultant direction of drift to the sand of the foreshore as impelled by the flood tide and by waves breaking at an angle to the shore-line. This movement, where it exists, furnishes a key to the proper solution of the problem of effeeting an entranee; for the primary conditions to be fulfilled are to prevent the filling of the ebb channel by the external forces, or, 1, to arrest the littoral drift; 2, to eoneentrate the ebb energy upon a well-defined path by developing a *reaction* by means of a eoneave breakwater extending aeross the bar and located on the "windward" side of the ehannel; 3, to admit the full tidal prism for effeetive seour. These fundamental eonditions are believed to be best fulfilled by a peeuliar form of breakwater (deseribed later on), designed by the writer in 1887.*

Many instanees have been eited of the sueeessful use of jetties to maintain entrances by ebb seour, but a eareful analysis of these eases reveals the fact that the funetion of the jetties is mainly to protect the channel from littoral drift, while the depth is maintained by dredging. The jetties also have been advanced from time to time, as the groins between them and the shore have filled with sand, and the bar has been pushed bodily seaward without increase of depth. On the contrary, where the plan approximates to a single rectilinear or eoncave structure, the improvement in channel depth has been marked, and the eost of construction and maintenanee a minimum, as in the case of the single jetty at Bilbao, Spain, or at the mouth of the Columbia river, Oregon, or at Swinemünde, on the Baltic, or at Greytown, Central America. The suceess of the work at Karaehi, India, may be attributed entirely to the deflection of the drift which formerly passed around Manora Point and was dropped in the lee thereof in the channel.

The well-known instance of beneficial results obtained from the convergent jetties at Dublin harbor, where the mean tide is 13 feet, may be explained by reference to the peculiar physieal conditions existing at that site, whereby an exeess of ebb movement is obtained by an opening of 600 feet near the shore end of the north wall, which admits a large amount of the flood tide whieh has passed over the North Bull sands and ean escape only through the harbor. This channel has, however, been aided by dredging also. Thus it will be seen that the cases belonging to classes *d* and *e* give much greater promise of success by jetties than any others. But there are many harbors which are wholly or in part artifieial, ereated by the construction of moles or landing-piers from some projeeting cape or headland, whereby an area is embayed sufficiently large for refuge. These differ much in plan and method of construction from the riprap mound to the eoncrete in block or in mass. So rapidly has improved maehinery been introduced for this elass of construetion that masses weighing from 50 to 100 tons can be readily put in plaee at one time by larger hopper barges. The eonerete in bags is used for foundation on sand, surmounted by bloeks or monoliths. (For the inelined bloek-work at Kustendjie, Colombo, etc., see BREAKWATER.) Large eounterpoised cranes have also been successfully used by Dr. B. Bindon Stoney at Dublin; by Mr. Philip J. Messent at Tynemouth, and by Messrs. M. T. Endieott and R. E. Peary, U. S. eivil engineers at the League island works. These cranes have a eapaeity of over 50 tons, and are extremely useful in building out piers and jetties. At the month of the Brazos river, Texas, the jetties were made of mattress-work suspended from a trestle, and lowered in plaee by means of ropes as rapidly as the mattresses were completed and loaded with sand and stone. This method, as praetieed by Mr. George Y. Wisner, eonstrueting engineer, was found to be very rapid, eheap, and effeetive, and the jetties eonstrueted at that point, 600 feet apart, have resulted in producing 18½ feet of water. Equally good results have been attained by riprap jetties at Tampieo, Mexieo, under the supervision of Mr. E. L. Corthell, C. E. The physieal eonditions of these sites are about the same, and bring them under elass *d*. They have resulted in giving some relief to the eommeree of the Gulf of Mexieo by providing the western section with comparatively deep-water ports. Other efforts are also being made to obtain deep water by a single reaction jetty (Fig. 1), intended to be built of eaissons lined with conerete walls and divided by traverses into wells, whieh will be floated into position, filled with sand, and eovered with riprap and large bloeks; by this method masses weighing 1,000 tons or more may be put in plaee in a few hours' time. Wherever there is a littoral drift this strueture will arrest and defleet it, while it will also produce a reaetion on the ebb currents as they eross the bar and freely admit the flood tide, as well as afford ample faeility for navigation.

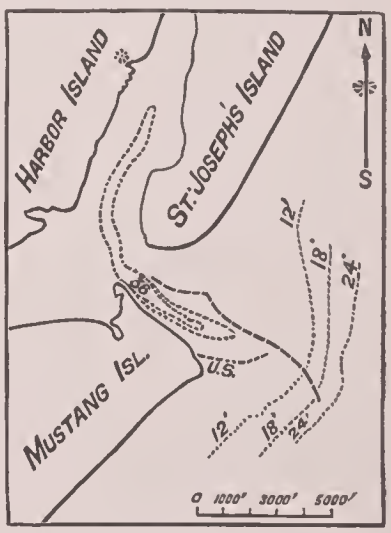


FIG. 1.—Plan for deepening Aransas Pass, Texas.

The most important harbor on the west Gulf coast is Galveston, where the normal depth over the outer bar is 12½ feet. Here the plan of improvement as now adopted by the Government consists of two convergent jetties of riprap on mattress foundation, extending across the outer bar and requiring a length of over 10 miles, while their outer ends are to be 7,000 feet apart. The estimated eost is between $8,000,000 and $9,000,000, of which about $2,500,000 have been expended, with an increase of a possible 9 inches in depth near the end of the south jetty, which is the only portion built. The bar has advanced as rapidly as the jetty, and in the writer's opinion the plan and order of construction are incapable of producing the results predicted or desired for a deep-draught harbor entrance.

The entranee to the harbor of Charleston, S. C., was to have been improved by two eonverging submerged jetties extending from Sullivan island on the N. and Morris island on the S. to the outer bar. This work was to cost $3,000,000 and to give 21 feet of water in the channel. It was begun in 1878, and during the ten years following 265,749 cubic yards of stone and 481,740 sq. yards of mattress-work were put in place at a cost, including auxiliaries, of $1,464,032.99,

* See *Proceedings American Philosophical Society*, Philadelphia, and *Transactions American Society of Civil Engineers.*

with the result that even with the assistance of dredging there was no navigable channel between the jetties, the vessels still using the old south channel with its 12 feet depth. In 1889 the project was modified, and it was proposed to abandon the submerged feature and to raise the jetties to low water at a cost of $2,548,000 more, or, if necessary, to 3 feet above this level, for $3,502,000, making the total estimate $5,334,500. Up to June, 1891, the foundations were completed to the crest of the bar. They consisted of log mattresses loaded with stone. On June 30, 1892, the expenditures aggregated $2,185,814.36, with the result of a tortuous 12-foot channel between jetties not considered permanent, and a general advance of the outer curves of the bar. These results are stated in illustration of the general principles laid down in the early part of this article. Here there is a well-defined littoral drift to the southward, and an ample tidal prism to produce early and marked results by reaction.

At Sabine Pass, Texas, two parallel jetties increased the depth to 10 feet through soft mud at a cost of $1,319,848.48 up to June 30, 1892, with $1,728,856.50 more to complete. These jetties are about half a mile apart, too far to coact effectively, but the eastern one is now (1894) being extended most rapidly on a curve to the west, thus applying to some extent the reaction principle with beneficial results. The earlier design of 1883 provided for two parallel straight jetties over 4 miles long and 1,500 feet apart.

It sometimes happens that the creation of a harbor is needed where no natural element of one is found in the configuration of the shore. The most important examples are the harbor of Port Saïd at the north end of the Suez Canal and that where the North Sea Canal of Holland opens into the ocean. In both cases the coast and sea-bottom are of sand, and the shore lines rectilinear and wholly destitute of harbor qualities.

"Port Saïd, though affording sufficiently good anchorage for small vessels, can not be considered a harbor for vessels of large tonnage and great draught of water. It is formed by two breakwaters, inclosing an area of some 450 acres, with an average depth of only 13 or 14 feet of water, except in the ship-channel leading to the inner basins, where the depth is from 25 to 28 feet. The western breakwater, which extends for 6,940 feet at right angles to the shore, was begun in 1860, and finished in 1868. For a quarter of a mile from the mainland the breakwater is formed, on its inner side, of a bank of rubblestone, surmounted by a promenade, over which the spray breaks with a very moderate N. W. wind, and on the outer or sea-front, of concrete blocks; but beyond this point to its termination it is entirely constructed of large blocks of artificial stone, composed of one part of French hydraulic lime with two parts of sand, some of which were transferred to it from the eastern breakwater. This latter, also constructed of large masses of concrete, is of more recent construction; it extends about 6,020 feet, and

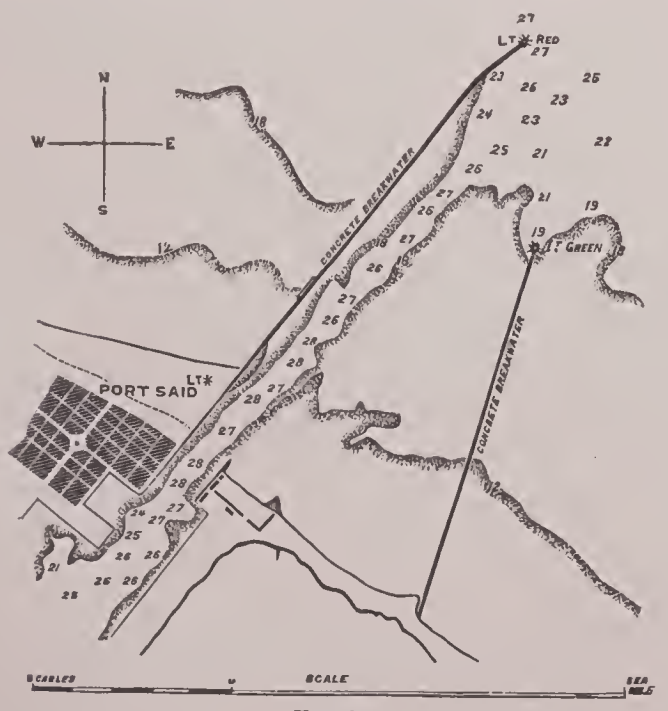



FIG. 2.

converges toward the western breakwater. These concrete blocks are made from sand and lime from Theil; two months of exposure to the air suffices to harden them, and their subsequent immersion in water adds to their hardness. Each block weighs 25 tons. Steam-cranes took them up and put them in their places. The joints between the artificial blocks are filled in with small pebbles, which, assisted by the action of the sea, form a compact and solid mass. Both structures are deficient in width, and from the rough way in which the blocks are deposited some amount of silt finds its way through the interstices, while from their slight elevation the sea, during fresh N. W. winds, washes over them, bringing with it a certain quantity of sand."

The canal furnishing to the port of Amsterdam direct communication with the North Sea has its sea-entrance and artificial harbor on a coast of sand-dunes, the trend of which is about N. by E. The axis of the harbor projected from the coast into the North Sea is nearly normal to the coast-line. The width of this entrance is 260 meters. The two piers are now extended to the depth of 8 meters below the level of low water, corresponding with about 9·50 meters below daily high water, and 8·50 meters below A. P. (i. e. the established Amsterdam level). The roots of these piers, at the foot of the downs on the beach, are 1,200 meters distant one from another. Their directions converge, so as to make an angle of about 77° with their base-line. At 1,200 meters from their origin the piers, distant 660 meters from one another, commence to converge more rapidly; so that, with an increment of length of 345 meters (1,545 in all), they terminate 260 meters apart at the harbor-mouth. To obtain the requisite depth the area between these piers has been dredged to an elliptic form for a width of 650 meters, and to a depth of 8·50 meters below A. P. at the entrance, 7·50 meters on the land side, the harbor area being 55 hectares (135 acres); while the total area inclosed by the piers is fully 100 hectares.

The method of construction adopted was to place on the sand a riprap foundation of small stone, and to lay regularly, from a huge derrick working from the built-up end of the pier itself, a wall of concrete blocks, as represented in the

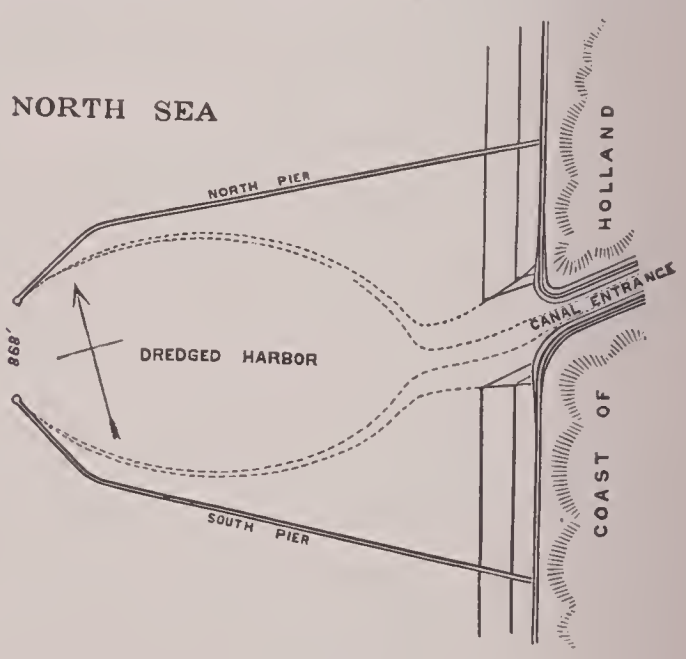



FIG. 3.

section (Fig. 4). For a more detailed account, see *Prof. Papers, Corps of Engineers*, No. 22.

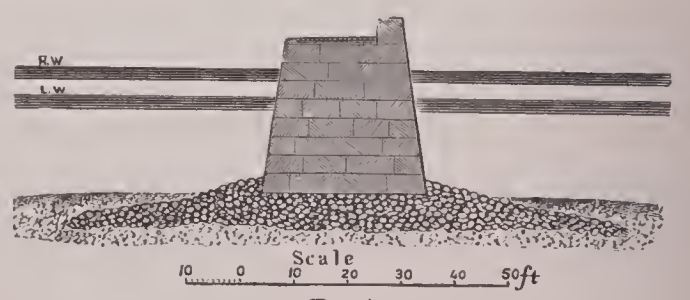



FIG. 4.

*Outer Harbors.*—In a few instances where it is necessary to effect a landing without lightering through the surf and there is no natural inlet, landing-piers have been built across the strand and through the breakers to deep water, thus affording both a quay for transportation of cars and a comparatively safe retreat for vessels. Probably the most typical instance of this kind to be found is that recently built at Ceará, on the northern coast of Brazil (Fig. 5), where an

open iron viaduct extends across the breakers for a distance of 750 meters, curving to the N. and connecting with a breakwater of concrete-in-mass 2,193 feet long, 26 ft. 3 in. wide on top, and about 30 feet high. The viaduct is composed of iron trestles built of four screw piles with the usual iron braces. There are twenty-five bays of 30 feet span. Thus the littoral currents are enabled to pass along the strand uninterruptedly, and the cove formed by the outer arm of monolithic work does not silt up. This same method was employed at Rosslare, in Ballygeary Bay, Ireland, where a pier designed by Mr. Rendel was built. The approach to the pier was formed by an embankment across the beach to low water, and no sooner had this work been executed than the sand began to accumulate on the southeastern side (or that of the flood tide). The railway was then carried straight out from the shore on an open viaduct of iron girders resting on concrete piers. Twelve of these were built of concrete deposited *in situ* within frames, each pier forming a single mass. A solid breakwater, composed of two concrete block walls, with rubble filling between, was carried out from the end of the viaduct. It was intended to curve the breakwater around until its outer arm was at right angles to the viaduct, and to continue to a depth of 19 feet below low water. Want of funds stopped the work after only 300 feet of the curved part of the breakwater was completed, and the harbor is not sufficiently sheltered. Had the viaduct been made solid a considerable advance of the foreshore would have occurred; as it was, however, the work has been perfectly successful as far as the accumulation of sand is concerned.

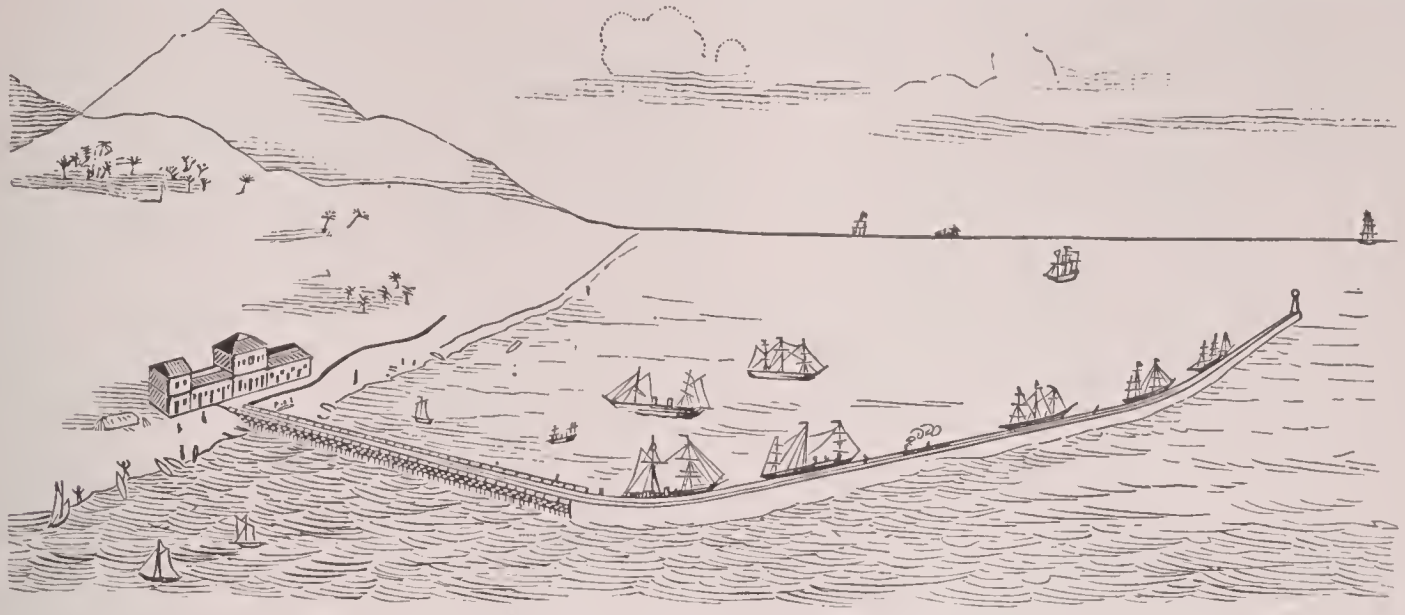


FIG 5.—The pier and harbor at Ceará, Brazil.

*Landing-piers* of iron are of frequent occurrence. One of the most extensive works of this kind is to be found at Lewes, Del., within the shelter of the breakwater, but it has never been used by the railways for which it was intended. The piers at Coney Island, N. Y., Long Branch, N. J., Atlantic City, etc., are well-known examples of such structures jutting into the breakers. From lack of sufficient protection the heads of some of these have been injured by wrecks beating against them and from storms. One of the most extensive outer harbor projects for the west Gulf coast is that known as Willett's harbor, the general plans of which are shown in Fig. 6. The viaduct is designed to extend out 4,500 feet from the shore to a depth of 27 feet, where the concrete and riprap breakwater will commence by a curve to the S., extending parallel to the shore in 30 feet depth for 3,000 feet or more, with landing-slips on the inside for the largest vessels. One of the most interesting works to evade the bar at the mouth of a river was executed in Holland for the navigable communication of Rotterdam with the sea. Naught but a map can exhibit the relations of that city to the remarkable reticulation of fluvial channels by which the waters of the Rhine, the Meuse, and the Scheldt mutually communicate and discharge themselves into the North Sea. The shortest and most natural route is to follow the Nieuwe Maas to its outlet between the Hook of Holland and the island of Voorne; and this channel, formerly much used, becoming deteriorated, ships of modern large dimensions have been compelled since 1874 to reach the Brouwershaven inlet by circuitous channels 60 or more miles in length. The direct communication, just alluded to, 15 miles in length, the Nieuwe Maas,* is deflected, near its mouth, from its course by the Hook of Holland, and discharges itself over extensive shoals, whereas the Brouwershaven inlet has ample depth of water. In former years the Voorne canal had been made in order to reach the Goeree inlet; but through various causes † had ceased to subserve fully its object.

The project finally adopted by the commission, and successfully executed, was to cut a new outlet to the Nieuwe Maas through the Hook of Holland, and to prolong it into deep-sea water by divergent piers (jetties). These two jet-

FIG. 6.—Proposed Willett's harbor on west coast of Gulf of Mexico.

ties in the North Sea constitute the proper river-mouth, consist of fascine-work with stone, and have a total length

* The main body of the Rhine river flows by Rotterdam, bearing this name, the ancient arm which, through the Netherlands, alone bears the name of "Rhine" having long since ceased to be an outlet.

† The locks were 294 by 46½ feet: the draught could be made 23 feet, and was considered adequate; but the Goeree inlet had a deficiency of depth on its bar and shoals.

of 2,800 meters, the northern pier reaching to 6·50 meters below mean low (8·20 meters below mean high) water, and the southern one so much shorter that a tide-catching form is given to the entrance. This latter arrangement, however, was found unsatisfactory, and the southern pier was lengthened by 1,200 meters in 1875 and 1876.

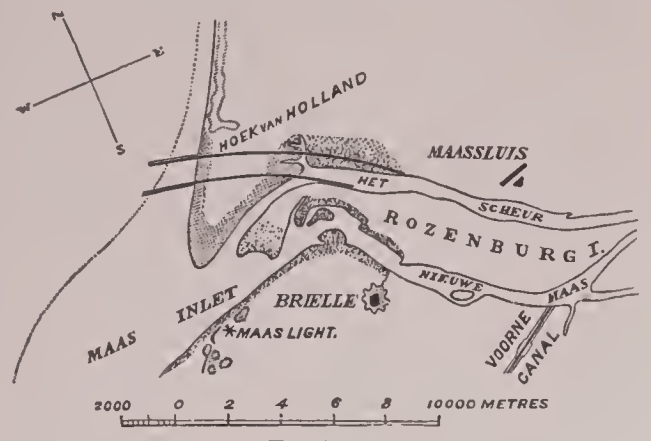



FIG. 7.

The engineer, Mr. P. Caland, was promoted to be inspector of the Waterstaat in recognition of his success. For an account of the work see *Prof. Papers, Corps of Engineers*, No. 22, where a description of its peculiar construction will be found.

These jetties were originally built 3,000 feet apart at the outer end and about 2,500 feet at the shore, but they were unable to maintain the requisite depth, so that another jetty was placed inside of the south jetty and about 700 feet therefrom, reducing the mean width to 2,300. The result was a channel with a minimum low-water depth of 63 decimeters, (21 feet) and having an average width between the 60-decimeter curve (19⅔ feet) of 400 feet. This channel, however, has to be maintained by constant dredging, and on the occasion of the writer's visit in 1889 there were a number of large ladder dredgers employed on different parts of the channel. The chart of 1886, issued by the Minister of Marine, shows that the groins have filled up with littoral drift, and the 25-decimeter contour extends to the heads of the jetties. The plan of the channel is curved in accordance with the practice of the North German and Holland engineers, the radius being about 22,000 feet, causing the channel to flex toward the concave or right bank.

A more celebrated instance of the improvement of a river-mouth by the use of parallel piers or jetties is that of the Sulina mouth of the Danube. The piers as designed were of riprap thrown in from a staging of piles, subsequently re-enforced and made permanent by covering with large blocks of concrete. As designed, the piers were 5,850 and

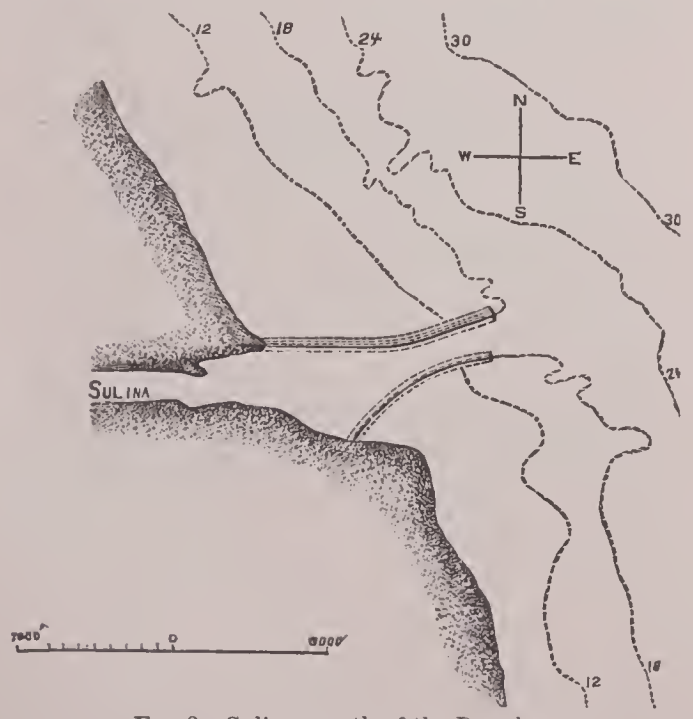



FIG. 8.—Sulina mouth of the Danube.

4,310 feet long, starting at points on shore 2,500 feet apart, and converging to parallelism about 600 feet apart. The results are thus stated by Sir Charles Hartley (*Minutes of Proceedings of Institution of Civil Engineers*, vol. xxxvi., pp. 208, 209): 1. That when the European commission of the Danube began its labors in 1856, the entrance to the Sulina branch was a wild, open seaboard stream, with wrecks, the hulls and masts of which, sticking out of submerged sand-banks, gave to mariners the only guide where the deepest channel was to be found. 2. That the depth of channel varied from 7 feet to 11 feet, and was rarely more than 9 feet. . . . 5. That on the completion of the provisional piers (in 1861) the depth on the bar increased to 17 feet, and Sulina, instead of being the worst harbor, at once took the highest rank among the best commercial harbors in the Black Sea. Finally, by prolonging the south pier, consolidating and rendering permanent the work at an expense equal to the first cost of the temporary structure, and by other improvements, an effective depth of 20 feet was attained in 1872, and has since been maintained.

The Danube bears a proportion by volume of sediment of $\frac{1}{1728}$, nearly the same as for the Mississippi. The case was cited (*Ex. Docs.* 113, H. R., p. 98, and No. 220, p. 112, 43d Congress, 1st Sess.), not as a proof, but as an example, that to the great river of the West, the Mississippi, instead of abandoning the mouths and resorting to canal—inadequate at best, and of doubtful success—a navigable open mouth might be given.

The harbor of Libau, Russia, opening on the Baltic, with no tide, has been cited as a case of successful jetty scour. Here two parallel jetties were constructed from 1856 to 1868. The north one was 2,723 feet long; the south, 3,346 feet, while they were but 350 feet apart, thus utilizing the full amount of reaction from currents. The channel was dredged to a depth of 20 feet, and the total cost of these improvements was $1,000,000. Two years later the depth at the mouth was but 14 feet. It was again dredged to 17,

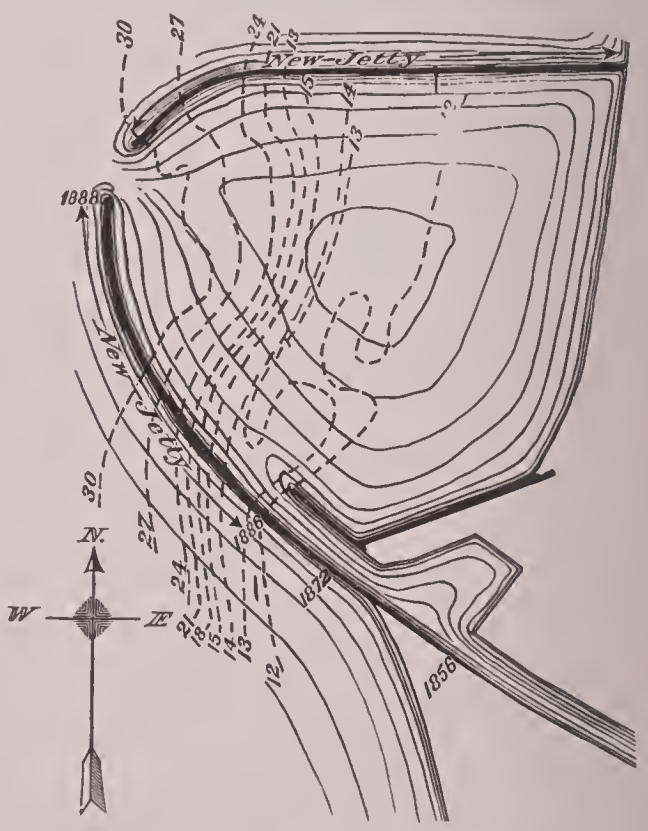



FIG. 9.—Harbor of Libau, Russia.

and by 1872 it had shoaled to only 13 feet. The jetties were extended in 1877, the south one 956 feet to intercept the littoral drift, the north one 81 feet, and the channel was again dredged to 21 feet depth. The cost to this date was $2,500,000, but the result was unsatisfactory, and in 1886 it was decided to construct an outer harbor, as at Boulogne, Madras, Kingstown, Tynemouth, and many other places, by inclosing a sufficient area between two curved moles or breakwaters each over a mile long and estimated to cost over $4,000,000. The work was begun Apr. 14, 1887, and is still progressing.

Many artificial harbors exist where a bight in the coast is utilized by building an arm across the exposed seaway, as at Dover, Newhaven, Colombo, Alexandria, Portland, Holyhead, Algiers, and many other places frequently described, but one of the latest and most important of the harbors of this class, because of its extent and position, is to be found at the Ponta Delgada, on the south side of the island of St. Michael, one of the Azores, where the spring tides rise

7½ feet. The Portuguese Government authorized the construction of a breakwater at this port in 1860 upon the design of Mr. J. S. Tucker, C. E., as revised by Sir John Rennie. Work was begun in 1861, but afterward enlarged by Portuguese engineers until now it covers a length of 1,255 yards. By Nov., 1886, it had advanced to a distance of 1,054 yards from shore to a depth of 12 fathoms. The wall along its summit was then 805 yards long, and sheltered a spacious quay for storage and cranes. At that date 3,407,037 tons of stone (basaltic rock in sizes up to 18 tons) had been deposited in the work, and it was estimated that 1,450,000 more tons would be required to finish it. This is nearly double the quantity in the Plymouth breakwater. The cost was $3,000,000 for the stone in place and $1,100,000 estimated to complete. It was under the supervision of Capt. David X. Cohen, director. The recent cost per ton of stone was only 44 cents.

*Insular breakwaters* may be used to form harbors. They may be either natural, as an isolated rock or island of sufficient extent to provide a lee, or they may be artificial mounds of riprap, of which many instances have already been cited. It should be observed, however, that where the exposure is such as to cause waves and currents to travel around the salients of the structure and meet in its rear, in course of a short time a bar will be formed which will extend ultimately to the shore, producing the numerous formations known as *presque isles*, so common on the Great Lakes and in Massachusetts Bay, as at Nahant, Marblehead, Nantasket, Lynn, etc., or at Richmond island, Maine. A similar result will be found in the shoal which has been caused by the Delaware breakwater, where a submerged embankment extends from shore to the northern end of the breakwater, having about 14 feet depth in the middle of the harbor and only 10 feet at the outer end. This has been produced by the defective location of both branches of the structure with reference to the currents, and a similar defect is repeated in the proposed design for the harbor of Lynn Haven inside of Cape Henry, Chesapeake Bay.* Here it is (1894) proposed to construct a riprap and concrete-in-mass structure rising only to extreme high water, 4,500 feet in length, at an estimated cost of $1,555,538, and extending in large part across the path of the currents. The effects produced by this plan doubtless will be similar to those of the Delaware breakwater, where fifty vessels were wrecked in eighteen months. Of projects, the most important is that for an additional structure on the shoal known as the Shears in Delaware Bay, northwest from the present harbor, where it is proposed that a national harbor of refuge for deep-draught vessels be established. To this end a survey has been requested, but no recent data as to physical conditions are available. The number of vessels anchored in the Delaware breakwater harbor has diminished over 50 per cent. in four years. In 1890 it was 2,250, exclusive of tugs and small coasting craft.

Space will not allow more ample description than has been given of artificial harbor construction. Of interesting works not described, reference may be made to the following: that of Oamaru, New Zealand, *Engineering*, Apr. 25, 1873; of Karachi, India, *Engineering*, June 6, 1873 (the Manora breakwater is described under BREAKWATER); Holyhead, *Engineering*, Sept. 26, 1873; Alexandria (new harbor), *Van Nostrands Eng. Mag.*, Feb., 1873. In *Engineering*, Mar., 1873, will be found a novel project for an "island harbor" at Boulogne, by Col. A. Clarke, Royal Engineers. See also Sir John Rennie on *Harbors*; Stevenson on *Harbors*; Vernon Harcourt on *Harbors and Docks*; *Transactions Institution of Civil Engineers*, etc. (London), and other references under BREAKWATER.

L. M. HAUPT.

**Harbor Springs**: village; capital of Emmet co., Mich. (for location of county, see map of Michigan, ref. 3–I); on Lake Michigan and the Gr. Rapids and Ind. Railroad; about 30 miles S. W. of Cheboygan. It has one of the finest harbors on the Great Lakes, is a popular summer resort, and contains 5 churches, 5 graded public schools, Roman Catholic convent and school, several summer hotels, and 2 weekly newspapers. Pop. (1890) 1,052; (1900) 1,643.

EDITOR OF "REPUBLICAN."

**Harburg**, haar'boorch [O. H. G. *hari*, army > Mod. Germ. *heer* + *burg*, fortified place]: a town of the Prussian province of Hanover; on the left bank of the southern branch of the Elbe, opposite Hamburg, which stands on the right bank of the northern branch at a distance of 4½ miles (see map of German Empire, ref. 2–E). The two points are connected with each other by a railway across both rivers. It has large tanneries and extensive manufactures of woolens and linens, and its transit trade with Hamburg is of importance. Pop. (1890) 35,090.

**Har'court**, Sir WILLIAM GEORGE GRANVILLE VENABLES VERNON, LL. D., Q. C., M. P., P. C.: politician; b. Oct. 14, 1827; graduated M. A. at Trinity College, Cambridge, with high distinction; admitted to the bar 1854; became Q. C. 1866; Professor of International Law at Cambridge 1869; knight bachelor 1873; Solicitor-General 1873–74; entered Parliament for Oxford 1868, Derby 1885 and 1892. Author of pamphlets and papers in *The Saturday Review* and London *Times*, signed "Historicus," etc. Upon Gladstone's return to power in 1880, Harcourt was appointed Secretary of State for the Home Department. He was Chancellor of the Exchequer in 1886, and again 1892–95. He was leader of his party in 1896, and was prominent in connection with the proceedings of the British South Africa Committee in 1897.

**Har'dee**, WILLIAM J.: Confederate soldier; b. in Savannah, Ga., in 1819; graduated at West Point 1838, and was appointed a second lieutenant of dragoons; first lieutenant 1839; captain 1844. He served with distinction in the Mexican war, and commandant of cadets at West Point 1856–61, when he resigned to become a brigadier-general in the Confederate army. For bravery at the battle of Shiloh he was promoted to be major-general, and placed in command of a division in Gen. Bragg's army. He was in the battles of Chaplin's Hills, Murfreesboro, and Chattanooga; promoted to lieutenant-general; engaged in siege and fall of Atlanta; commanded at Savannah, which place he evacuated Dec. 20, 1864, as he did Charleston Feb. 17, 1865, finally surrendering with Johnston's army at Durham Station, N. C., Apr. 26, 1865. Author of *Hardee's Tactics*, adopted for use in the U. S. army and for the militia. D. at Wytheville, Va., Nov. 6, 1873.

**Hardenberg**, FRIEDRICH, von: See NOVALIS.

**Hardenberg**, haar'den-bārch, KARL AUGUST, Prince von: b. at Essenroda, Hanover, May 31, 1750; studied law at Leipzig and Göttingen, and held various positions in the service of the King of Hanover, the Duke of Brunswick, and the Margrave of Anspach, until he became Prussian Minister of State in 1791. In this office his chief work was the negotiation of peace between Prussia and France in 1795. When war broke out between France and England he strove to maintain the neutrality of Prussia, but French aggressions in Anspach in 1805 drove him into an alliance with Russia against France. The victory of the latter power at Austerlitz discouraged Prussia from entering upon the war; Napoleon's policy triumphed; Prussia signed a convention with France, and Hardenberg was compelled to resign, but when war nevertheless broke out between Prussia and France, he was recalled to power, and was Minister of Foreign Affairs till 1807. He lived for some time in exile in Russia, but was recalled to Berlin, made chancellor in 1810, and carried out the plans of Stein for the reorganization of the Prussian state. Among his important measures of reform were the improvement of the military system, the opening of the civil service to all classes, the removal of feudal burdens, the abolition of serfdom, and the promotion of public education. At the same time he sought to foster the national feeling and rouse the patriots of Prussia to free her from her humiliating subjection. Few did more than he to promote the national movement which resulted in the War of Liberation and the downfall of Napoleon. He signed the Treaty of Paris and was made a prince. After this his policy lacked its former vigor and boldness. He betrayed reactionary tendencies and became displeasing to his former friends without winning the confidence of the reactionists. D. at Genoa, Nov. 26, 1822. See *Denkwürdigkeiten des Staats Kanzlers Fürsten von Hardenberg* (4 vols., 1877), containing his memoirs, and a biography by Leopold von Ranke.

F. M. COLBY.

**Har'derwyk**, or **Harderwijk** [Dutch, liter., Mulletville; *harder*, mullet + *-wijk*: Eng. *-wick*, from Lat. *vicus*, village: οἶκος, house]: town of the Netherlands: in the province of Geldern, on the Zuyder Zee; 31 miles N. E. of Utrecht (see map of Holland and Belgium, ref. 5–G). It is much engaged in herring-fishing, but it was formerly a place of vastly greater importance than at present. In the thirteenth and fourteenth centuries it was a free city, surrounded with strong walls, maintaining close commercial relations with

* See *Ex. Doc.* No. 27, 52d Congress, H. R.

England, Denmark, Sweden, etc.; but, having been bereft of its privileges by Charles V., it gradually fell into decay. It was the seat of a university from 1648 till 1811. Pop. (1890) 7,333.

**Hardicanute'** (*Harthacanut*): King of England; a son of Canute by Emma, widow of Ethelred II.; chosen King of the West Saxons in 1035, while Harold, his reputed half-brother, ruled the rest of England. In 1036 he became King of Denmark, where he was already viceroy; was deposed as King of Wessex 1037, "because he was too long in Denmark"; made preparations for invading England, when he heard of Harold's death (1040); was unanimously chosen King of England at the Witenagemote. Hardicanute's reign was short, but stained with dreadful crimes. He had the dead body of Harold dug up and thrown into the Thames; he exacted a heavy *danegeld*, and burned Worcester to the ground because it refused to pay it. D. June 8, 1042.

**Hardie**, James Allen: soldier; b. in the city of New York, May 5, 1823; graduated from the U. S. Military Academy July 1, 1843, entering the army in the artillery service; served as assistant professor at West Point, and as company officer in garrison, frontier, and Indian service until 1861, being, during a portion of the time, aide-de-camp to Gen. Wool. Served during the civil war as aide-de-camp to Maj.-Gen. McClellan during his campaigns with the Army of the Potomac, before Richmond, in the Maryland campaign, etc.; on the staff of Maj.-Gen. Burnside in the Rappahannock campaign; judge-advocate-general of the Army of the Potomac, staff of Maj.-Gen. Hooker; brigadier-general of volunteers Nov. 29, 1862; appointed assistant adjutant-general (rank of major) Feb. 19. 1863: assigned to special duty in the War Department till 1866; assistant to Mr. Secretary Stanton until he vacated office; thereafter with Gens. Grant, Schofield, and Rawlins as acting Secretary of War; appointed inspector-general (rank of colonel) Mar. 24, 1864; brevet brigadier-general and brevet major-general U. S. army Mar. 13, 1865; in 1866 senior member of commission to inspect the ordnance and ordnance stores in forts and arsenals of the U. S., with reference to the disposition of munitions, the accumulation of the war; commissioner to audit the military claims of Kansas, Montana, Dakota, California, and Oregon. Author of various contributions to the press, and of numerous military reports. D. at Washington, D. C., Dec. 14, 1876.

**Harding**, Chester: portrait-painter; b. at Conway, Mass., Sept. 1, 1792; self-taught; was at first a turner; soldier in the war of 1812 and after his service a sign-painter in Pittsburg, Pa. Went to London in 1832 and had considerable success painting portraits and was patronized by the royal family. His memoirs, published in 1891, give interesting accounts of his adventures and his intercourse with public men. A *Portrait of Daniel Webster* belongs to the Bar Association, New York, and one of *John Randolph* is in the Corcoran Gallery, Washington. D. in Boston, Apr. 1, 1866. W. A. Coffin.

**Harding**, James Duffield: landscape-painter, teacher, and writer on art; b. at Deptford, England, in 1798. He received his first instruction in the latter from his father and from Prout; studied engraving for a time, but soon engaged in teaching landscape-painting. He practiced lithography with great success, and published a number of series of his lithographic sketches—*Lessons on Trees*, *Sketches at Home and Abroad*, *The Park and the Forest*—showing in the drawing of trees a remarkable power of distinguishing the character of one kind of foliage from another, but also a disposition to reduce all tree-drawing to a set of conventional symbols. He published also *Elementary Art* and *The Principles and Practice of Art*. He was a member of the Water-color Society, and painted mostly in water-colors, but produced many oil-paintings. D. at Barnes, England, Dec. 4, 1863.

Revised by Russell Sturgis.

**Harding**, or **Hardyng**, John: English chronicler; b. 1378; was originally an inmate of the house of Henry Percy ("Harry Hotspur"), but enlisted, after the death of Percy, under the banner of Sir Robert Umfraville, whom he accompanied in the battle of Agincourt 1415, and in the naval battle which the Duke of Bedford delivered the next year at the mouth of the Seine. In 1424 he went to Rome to seek for documents which should prove that the Kings of Scotland owed allegiance to the Kings of England. When he wrote his chronicle is doubtful. According to one manuscript, it seems originally to have ended with the death of Sir Robert in 1436; according to another, he seems later on to have recomposed the work. His *Chronicle of England unto the Reign of King Edward IV.* (in verse, and continued by Grafton to 1543) was edited by Sir Henry Ellis (1812). D. after 1465. Revised by H. A. Beers.

**Harding**, Stephen: b. at Sherborne, Dorsetshire, England, in the latter part of the eleventh century; made a pilgrimage to Rome; entered the monastery of St. Claude de Joux, at Moleme, near Dijon, France; afterward, with others, established the monastery of Citeaux, and succeeded Alberic in 1110 as abbot. The severity of the discipline he enforced was not far from ruining the whole institution, when, in 1113, St. Bernard, with thirty other young men, entered the monastery and gave the abbot their heartiest support in carrying out his reforms. In 1119 he drew up, in conjunction with St. Bernard, the so-called *Carta Caritatis*, the constitution of the Cistercian order, which was confirmed by Calixtus II. and Eugenius III. D. at Citeaux, Mar. 28, 1134.

**Hardinge**, Henry, Viscount: b. at Wrotham, Kent, England, Mar. 30, 1785; entered the army 1798; made lieutenant 1802, captain 1804; served in the Peninsula 1808–14; deputy quartermaster-general 1809–13; wounded at Vimeira, Vittoria, and Ligny, where he lost an arm while commanding a German brigade; entered Parliament for Durham 1820; Secretary of War 1828; Chief Secretary for Ireland 1830, 1834–35, and 1841–44; Governor-General of India 1844–48, and performed the duties of that office with ability; commander-in-chief 1852; field-marshal 1855. D. at Southport, Sept. 24, 1856. See the *Life* by his son (1891).

**Hardness**: (in minerals): See Mineralogy.

**Hardouin**, ăar'doo'ăn', Jean: learned Jesuit and classical scholar; b. at Quimper, Bretagne, France, in 1646; librarian and Professor of Dogmatic Theology at Paris. D. Sept. 3, 1729. His numerous works, though all distinguished by vast erudition and originality, are too often marred by an inordinate love of paradox. The most famous of these, which he defended with a great deal of ingenuity, was his contention that all the Latin classics, with the exception of Cicero's works, Pliny's *Natural History*, the *Georgics* of Vergil, and the *Satires* and *Epistles* of Horace, were the skillful forgeries of certain thirteenth-century monks, perpetrated under the general supervision of one Severus Archontius. See his *Prolegomena ad censuram veterum scriptorum* (1693). In his great theological work, *Conciliorum collectio regia maxima*, he endeavored to prove that none of the great Church councils before the Tridentinum were historical. He also edited *Themistius* (1684), thirteen speeches being here printed for the first time, and Pliny's *Natural History* (5 vols., 1685). Alfred Gudeman.

**Hardwar'**, or (older spelling) **Hurdwar**: ancient town in the Northwestern Provinces, British India; situated in lat. 29° 57′ N. and lon. 78° 14′ E., at an elevation of 1,024 feet above the sea, on the spot where the Ganges bursts from the hill-country into the plain of Hindustan. During the latter part of March and the beginning of April this place is yearly visited by more than 100,000 pilgrims, who come to make their ablutions in the holy water and pay reverence to the foot-mark of Vishnu; every twelfth year is especially sacred, and at this time the number of pilgrims swells to 300,000. A large fair is also held here, to which the products of the neighboring countries are brought. Pop. 5,000.

Mark W. Harrington.

**Hardwick**, Charles: ecclesiastic; b. at Slingsby, Yorkshire, England, Sept. 22, 1821. Apparently of humble parentage, he made his way at the University of Cambridge by his talents and industry. In 1853 he was appointed Professor of Divinity in Queen's College, Birmingham, and in 1855 Lecturer on Divinity in King's College, Cambridge. He had been ordained deacon in 1846 and priest in 1847, and only a few months before his untimely death was made Archdeacon of Ely. His scholarship was both broad and accurate, and he was a versatile and rapid worker. He published other books, but his fame rests on these four: *History of the Articles of Religion* (Cambridge, 1851; 3d ed. 1876); *History of the Middle Age of the Church* (1853; 6th ed., by Stubbs, 1888); *History of the Reformation* (1856; 9th ed., by Stubbs, 1888); *Christ and Other Masters* (in 4 parts, 1855–58; 3d ed., by Francis Procter, 1874). He lost his life by a fall in climbing the Pyrenees, Aug. 19, 1859.

Revised by S. M. Jackson.

**Hardwicke**, Earls of: (1) Philip Yorke, b. at Dover, England, Dec. 1, 1690; was the son of a retail dealer, and after his elevation to the peerage he was often taunted with his low extraction. He studied law, obtained the patronage of Lord Chief Justice Macclesfield, and was admitted to the bar at the Middle Temple in 1715. In 1719 he was elected a member of the House of Commons for Lewes, Lord Macclesfield paying the expenses of the election, and, as his great patron in the same year became Lord High Chancellor, he was in the following year, 1720, made Solicitor-General. In 1724 he was appointed Attorney-General, and the very first case which occurred was the prosecution of Lord Macclesfield for corruption. In 1733 he was made lord chief justice and a peer of the realm, and in 1737 Lord High Chancellor. As a judge he enjoyed the highest authority; only three times appeals were taken, and each time his verdict was confirmed by the House of Lords. His judicial decisions show great acumen and great circumspection, and both of those qualities were much needed in a period when English law was in an almost chaotic condition. A collection of his verdicts is found in the *Reports* by Atkyns and Vesey, and in an independent volume published by West. D. in London, Mar. 6, 1764. (2) Philip, second earl, b. Dec. 9, 1720; was educated at Cambridge, where he took the doctorate of law, and in 1762 was made chancellor. He entered the House of Commons in 1741 as member for Ryegate, and for a short time in 1765 he held office in the administration of Lord Rockingham. But his feeble health made it difficult for him to take an active part in politics; he devoted most of his time to literature. He was one of the principal contributors to the *Athenian Letters; or, The Epistolary Correspondence of an Agent of the King of Persia residing at Athens during the Peloponnesian War.* Among his other works are *Walpoleana; or, A Few Anecdotes of Sir Robert Walpole* (1781); and *Miscellaneous State Papers from 1501 to 1726.* D. May 16, 1790. (3) Charles Philip, fifth earl, b. Apr. 23, 1836; suceeeded to the peerage Sept. 17, 1873.

**Hardy**, ăär'dēē', Alexandre: dramatist; b. about 1570. Of his life little is known. By 1596 he was dramatic writer for wandering companies of actors, whom he followed about. After 1599 he was especially connected with the actors who made Paris and the Hôtel de Bourgogne more and more the chief scene of their representations, and who remained there after 1628, founding the first fixed and permanent French theater. He wrote and adapted for the stage a vast number of plays, according to his own claim over 600. Of these forty-one have been preserved in print, and the titles of thirteen others are known. These plays are often upon subjects taken from classical antiquity, but they show a great variety and confusion of forms, tragedy, tragi-comedy, pastoral and dramatic poem, and are marked by coarseness and violence or by an affected grace and sentiment. They were the main repertory of his day, but were abandoned and forgotten soon after his death (about 1631 or 1632). Hardy did not observe the rules that were beginning to produce the unity and elegance of the French classical drama, but he rendered a great service by endowing his plays with action, and producing pieces that were intended to be played rather than read, and by attracting to the theater the educated public that had abandoned the old popular drama as rude and barbarous. His works have been edited by Stengel—*Le Théâtre d'Alexandre Hardy* (5 vols., Marburg, 1883–84). A. G. Canfield.

**Hardy**, Arthur Sherburne, A. M., Ph. D.: author and mathematician; b. at Andover, Mass., Aug. 13, 1847. Educated at Phillips Academy, Andover, and Amherst College. Graduated at West Point June 15, 1869, and promoted second lieutenant of Third Artillery; served at Military Academy as Assistant Instructor of Artillery Tactics July to Aug., 1869; in garrison in Florida and on leave of absence to Nov. 12, 1870, when he was discharged at his own request; Professor of Mathematics and Civil Engineering, Iowa College, 1870–73; Professor of Civil Engineering, Chandler Scientific School, Dartmouth College, 1874–78; Professor of Mathematics, Dartmouth College, 1878; U. S. Minister to Persia, 1897–99; Greece, Roumania and Servia, 1899–1900; and Switzerland, 1900. Author of *Elements of Quaternions* (Boston, 1881); *Geometrical Interpretation of Imaginary Quantities* (translated from French; New York, 1881); *New Methods in Surveying* (1884); *Elements of Analytic Geometry*; *Elements of Calculus*; a poem, *Francesca of Rimini* (Philadelphia, 1878); the novels *But Yet a Woman* (Boston, 1883); *The Wind of Destiny* (1886); *Passe Rose* (1889); and *Life and Letters of Joseph H. Neesima.* He received the degree of A. M. from Iowa and Dartmouth Colleges, and that of Ph. D. from Amherst College. James Mercur.

**Hardy**, Arthur Sturgis, LL. D.: politician; b. in Mt. Pleasant, Ontario, Canada, Dec. 14, 1837, and educated at Rockwood Academy; admitted to the bar in 1865; elected to the Ontario Legislature in 1873 and in 1875. He was appointed provincial secretary and registrar Mar., 1877; was re-eleeted in 1877, 1879, 1883, 1886, and 1890. In Jan., 1889, he was appointed Commissioner of the Crown Lands; in May, 1895, became acting Premier and Attorney-General of Ontario, and in July, 1896, succeeded Sir O. Mowat in both these offiees. He received the degree of LL. D. from Toronto University in 1897.

**Hardy**, George E.: See the Appendix.

**Hardy**, Robert Spence: author; b. in Preston, Lancashire, England, July 1, 1803; joined the Wesleyan Conference in 1825, and went as missionary to Ceylon, laboring there for twenty-three years, and then returning to England. *The British Government and the Idolatry of Ceylon* (London, 1841); *Eastern Monachism* (1850); *A Manual of Bûddhism in its Modern Developments, translated from Singhalese MSS.* (1853); *Legends and Theories of the Bûddhists compared with History and Science* (1867), were published by him. D. in Headingly, Yorkshire, Apr. 16, 1868.

**Hardy**, Thomas: novelist; b. in Dorsetshire, England, June 2, 1840. He was educated partly at King's College, London, and became an architect by profession, studying under Arthur Blomfield; subsequently he took up his residence near Dorchester in his native county. His novels, which are largely tales of rustic life in the West of England, are remarkable for ingenious plot, piquant situations, a knowledge of feminine charaeter, and occasional tragic power of an unusual kind. Among them are *Under the Greenwood Tree* (1872); *Far from the Madding Crowd* (1874); *The Hand of Ethelberta* (1876); *The Return of the Native* (1878); *Tess of the d'Urbervilles* (1890); *Life's Little Ironies* (1894); *Jude the Obscure* (1895); and *The Well-Beloved* (1897). In June, 1893, he published a drama, *The Three Wayfarers.*

**Hardy's Colorado**: See Colorado River.

**Hare**, George Emlen, D. D., LL. D.: clergyman; b. in Philadelphia, Sept. 4, 1808; graduated at Union College 1825; entered the Protestant Episcopal ministry; rector of St. John's, Carlisle, Pa., 1830–34; of Trinity church, Princeton, N. J., 1834–43; of St. Matthew's, Philadelphia, 1845–52. After serving as assistant Professor of Latin and Greek in the University of Pennsylvania for a time he became Professor of Biblical Learning in the Divinity School, Philadelphia, 1852–81; received the degree of D. D. from Columbia College 1843, and of LL. D. from the University of Pennsylvania 1873; Professor New Testament Literature 1881, and on his retirement from this chair professor emeritus until his death in Philadelphia, Feb. 15, 1892. Author of *Christ to Return* (Philadelphia, 1840); *Visions and Narratives of the Old Testament* (sermons, New York, 1889).
Revised by W. S. Perry.

**Hare**, John Innes Clark, LL. D.: jurist; b in Philadelphia, Oct. 17, 1817; graduated at the University of Pennsylvania in 1834, and was admitted to the bar in 1841; became associate judge of the district eourt of Philadelphia 1851; presiding judge 1867; presiding judge of the court of common pleas of Philadelphia 1875. He is the author of *American Leading Cases* (2 vols., 1847), in conjunction with Horace B. Wallis; *The Law of Contracts* (8vo, Boston, 1887); *American Constitutional Law* (2 vols., 1889); and has ably edited and annotated several important reprints of English law-treatises. Revised by F. Sturges Allen.

**Hare**, Julius Charles, M. A.: author; b. at Valdagno, near Vicenza, Italy, Sept. 13, 1795; became a fellow at Trinity College, Cambridge, 1818; vicar of Hurstmonceux 1832; Archdeacon of Lewes 1840; a prebendary of Chichester 1851; chaplain to the Queen 1853. D. at Herstmonceux, Jan. 23, 1855. With his brother, A. W. Hare, he wrote *Guesses at Truth* (London, 1827–48); with Thirlwall translated Niebuhr's *History of Rome* (1828); author of *Mission of the Comforter* (1846); *Memoir of John Sterling* (1848); *Vindication of Luther* (1854), and other works.—His brother, Augustus William (b. at Rome, Nov. 17, 1792), became a fellow of New College, Oxford; rector of Alton-Barnes 1829. D. at Rome, Feb. 18, 1834. Joint author of *Guesses at Truth* (see above); author of *Sermons to a Country Congregation* (2 vols., 1837).—Their nephew, Augustus

John Cuthbert Hare, son of their eldest brother, Francis George (b. at Vicenza, Italy, Jan. 6, 1786), was born at Rome, Mar. 13, 1834. He was educated at Harrow and at University College, Oxford. He has published many works, among which may be named *Epitaphs for Country Churchyards* (1856); Murray's *Handbook for Berks, Bucks, and Oxfordshire* (1860); *A Winter at Mentone* (1861); Murray's *Handbook for Durham and Northumberland* (1863); *Walks in Rome* (1870). *Wanderings in Spain* (1872); *Memorials of a Quiet Life* (1872); *Days near Rome* (1874); *Cities of Northern and Central Italy* (1875); *Walks in London* (1877); *Life and Letters of Baroness Bunsen* (1879); *Cities of Southern Italy and Sicily* (1882); *Sketches of Holland and Scandinavia* (1882); *Venice* (1884); *Florence* (1884); *Studies in Russia* (1885); *Paris* and *Days near Paris* (1887); *Northeastern France*, *Southeastern France*, and *Southwestern France* (1890). Revised by W. S. Perry.

**Hare**, Robert, A. M., M. D.: chemist; b. in Philadelphia, Pa., Jan. 17, 1781; was the son of an English brewer, and early turned his attention to scientific experiments. In 1802 he invented the oxyhydrogen blow-pipe, which won for him the Rumford medal of the American Academy. In 1806 he received the degree of M. D. from Yale, *honoris causâ*, and from Harvard also in 1816, in which year he brought forward the calorimotor, a form of galvanic battery by which intense heat may be generated. In 1831 he made successful experiments in subaqueous blasting by means of the galvanic current. Among his other inventions are the gallows-screw and several improved processes in chemistry, toxicology, and pharmacy. In 1818 he was called to the chair of chemistry in William and Mary College, and he held the chemical professorship in the University of Pennsylvania from 1818 to 1847. Late in life he became a believer in Spiritualism. He published *Brief Views of the Policy and Resources of the United States* (1811); *Chemical Apparatus and Manipulations* (1836); *Spiritual Manifestations Scientifically Demonstrated* (1855), and other works, besides an immense number of scientific papers. He was a member of various learned societies. His excellent and ingenious apparatus he gave to the Smithsonian Institution, in which he felt a deep interest. Dr. Hare excelled as an instructor in his favorite sciences. D. in Philadelphia, May 15, 1858.

**Harebell**: See Bluebell.

**Hare-lip**: a congenital deformity of the human upper lip, characterized by a fissure (rarely median, like that normal in the hare or the cat), usually a little to one side, and more frequently on the left, but sometimes occurring on both sides at once. When simple and uncomplicated with cleft palate (a frequent accompaniment), a simple surgical operation will commonly cure it perfectly, and infancy is the proper time for operation; but the operation for cleft palate (staphyloraphy) usually should be deferred to a maturer age. The fissure itself normally exists in the fœtal state; by arrest of development it remains open after birth. When two fissures exist, it is not unusual to find the incisor segment (intermaxillary bone) of the upper jaw detached from, or rather ununited to, the jaw, and the deformity may amount to a double cleft palate.

The name is also applied to a catostomid fish, the *Quassilabia lacèra*, the peculiar conformation of whose mouth suggests a hare-lip.

**Harem** [from Turk. *harem*, from Arab. *harām*, the forbidden, the shut off, hence the sacred; deriv. of *harama*, prohibit, forbid]: the female members and children of a Mussulman family; also, and more commonly, their apartment in the house. This is entirely distinct from the men's apartment, which is called selamlik (place of salutation). Into the harem no man can enter save the master, nor he till after giving warning of his approach, that any lady not of his household may have time to withdraw. There no one can pursue him. The entrance of a stranger, whether private individual or officer of the law, would be an extreme outrage and indignity. There the wife is absolute mistress. Whatever of comfort and elegance the house possesses is there, no matter how bare and unfurnished be the apartment of the men. When the master has more than one wife (something comparatively rare, though four wives are allowed each Mussulman) he must provide for each an apartment entirely distinct and complete. Edwin A. Grosvenor.

**Hares** [O. Eng. *hara* : O. H. Germ. *haso* > Mod. Germ. *hase* < Teuton. *hasan-* : Sanskr. *çaça* (for *çasa-*)]: properly those rodent mammals of the family *Leporidæ* which are in the main solitary in their habits, and which construct forms or nests upon the surface of the ground, but do not have burrows; for the social and burrowing *Leporidæ* are rabbits. According to this distinction, it is probable that there are no true rabbits in North America, except the descendants of those brought from Europe. With the exception of the calling hares (*Lagomys*, of which genus the U. S. have one species, the little chief hare, *L. princeps* of the Rocky Mountains), the hares and rabbits are all of the genus *Lepus*. Of more than forty known species, nearly half are North American. The more important are the common gray rabbit (*L. sylvaticus*), so extensively taken as food by traps, snares, and firearms; the great white hare (*L. americanus*); the jackass rabbits (*L. callotis* and *texanus*) of the far West; and the water-hares of the South (*L. palustris* and *aquaticus*), both good swimmers and inhabitants of swamps. The most common of the European hares is the *L. timidus*, so extensively coursed by greyhounds and pursued by harriers and beagles. This species is widely distributed, being found not only throughout the greater part of Europe, but in the northern portions of Asia and North America. At one time it was divided into several species, owing to the greater or less extent to which its pelage changed with the season. The Arctic hare, which in winter is snowy white, except the tips of the ears, which are black, is merely a variety of this animal, as is also the varying hare of Europe and Asia, which turns more or less white in winter.

Hares progress by a series of leaps, and are mostly very swift, flight being their chief means of eluding enemies, although their color, which harmonizes to a great extent with the dead leaves and branches of their "forms" or nests, is also protective. The hare is very skillful in throwing the hounds pursuing it off the scent. Sometimes, after running forward a considerable distance, it will return for a few hundred yards on the same track, and after making a great leap at right angles to its former course, will lie quietly hidden while the hounds run by. See also Leporidæ and Rabbit. Revised by F. A. Lucas.

**Hargraves**, Edmund Hammond: explorer; b. at Gosport, England, about 1815; went to sea at an early age, and for a time was settled in Australia; subsequently embarked for California (1849), and upon his arrival at the gold-fields was so impressed with the similarity of the country to that he had just left that on his return he entered upon explorations which resulted in the discovery of the valuable gold-fields of Australia. Disclosing his discovery to the Colonial Secretary at Sydney, he was subsequently appointed commissioner of crown lands, receiving also many valuable testimonials, among which was a grant of £10,000 by the authorities of New South Wales; in 1854 he returned to England, and published the following year an account of his discoveries, entitled *Australia and its Gold-fields*. D. Oct. 1, 1891.

**Hargreaves**, James: inventor of a carding-machine (1760) and of the spinning-jenny (1764, 1767); b. at Stanhill, near Blackburn, England; was an unlettered hand-spinner and weaver. He had tried in vain to spin several cotton threads at one and the same time, but failed. One day his little child overturned his spinning-wheel, and as he saw the spindle revolving vertically, he resolved to construct a machine with several vertical spindles. This proved a success, and was kept a secret; but his neighbors, seeing how much yarn he and his family produced, broke into the house and destroyed the machine. In 1778 he went to Nottingham and set up as a machine-spinner, but never had much success. He obtained a patent on his invention, but it was set aside by the courts, and he died a poor man, Apr., 1778.

**Hargrove**, Robert Kennon, D. D.: bishop of the Methodist Episcopal Church South; b. in Pickens co., Ala., Sept. 17, 1829; graduated at the University of Alabama 1852; was Adjunct Professor of Mathematics in the same institution 1853–57; member of Alabama conference 1857–67; of Kentucky conference 1867–68; of Tennessee conference 1868–82; elected bishop May, 1882; president of the board of trust, Vanderbilt University, since 1889. He is author of *Laws of the Methodist Episcopal Church South, as Interpreted by the College of Bishops*. Albert Osborn.

**Haricot**: See Bean.

**Häring**, Wilhelm: novelist; known under the pseudonym Wilibald Alexis; b. in Breslau, Prussia, June 29,

1798; studied at the Werder Gymnasium in Berlin; was a volunteer in the campaign of 1815; studied law at the Universities of Berlin and of Breslau; became *Kammergerichts-referendar* in Berlin, and engaged in several mercantile undertakings with little success. He soon gave up the practice of law and devoted himself to literature. His first works, *Die Treibjagd* (1820), *Die Schlacht bei Torgau* (1822), and *Der Schatz der Tempelherren* (1822), were unnoticed, but the three-volume romance *Walladmor* (1823–24), published as the work of Walter Scott, achieved popularity, and was translated into several languages. This was followed by an immense number of short stories and novels, of which only the historical romances have a permanent value. Among these are *Cabanis* (1832; 6th ed. 1880); *Der Roland von Berlin* (1840; 4th ed. 1881); *Der falsche Waldemar* (1842; 4th ed. 1880); *Die Hosen des Herrn von Bredow* (1846; 9th ed. 1881); *Ruhe ist die erste Bürgerpflicht* (1854; 4th ed. 1881); *Isegrimm* (1854; 4th ed. 1881); *Dorothe* (1856; 3d ed. 1879). In 1856 he received a blow on the head, causing partial paralysis, from which he never recovered. D. in Arnstadt, Dec. 16, 1871.

**Harington**, or **Harrington**, Sir JOHN: b. at Kelston, near Bath, England, 1561; son of John Harington (author of the excellent *Verses made on Isabella Markhame*) by an illegitimate daughter of Henry VIII. Queen Elizabeth stood sponsor at his christening, and he studied at Eton and Cambridge. He went in command of some horse to Ireland with Essex, who as Lord-Lieutenant knighted him on the field, to the great dissatisfaction of Elizabeth, who in 1596 excluded Harington from court on account of the publication of his *Metamorphosis of Ajax*, a poem. The queen had, however, a great liking for her godson, and soon recalled him. James I. made him a Knight of the Bath 1603. His other chief works are a translation of *Orlando Furioso* (in heroic verse. 1591); *Epigrams* (1615); *The Englishman's Doctor* (1609); *History of Polindor, etc.* (1651); *Briefe View of the State of the Church of England* (1653); *Nugæ Antiquæ* (with memoir, compiled by Henry Harington, 3 vols., 1769–79). D. 1612.

**Harîri**, AL, ăăl-haă-ree′rĕe [Arab., the silk-mercer]: a name of Abu Mohammed al Kâsim: b. at Bussora in 1054. Author of *Makamat* (The Assemblies), an Arabian classic of the first importance, written in prose and verse; also of *Molhat-al-Irab*, a grammar, and *Durrat-al-Ghawwâs* (The Diver's Pearl), a treatise on the Arabic language, and other works. D. 1121. The best and completest version in English is that of Prof. Thomas Chenery, of Oxford (1867). Theodore Preston, of Cambridge (1850), translated twenty of the pieces. There is a spirited free translation into German by F. Rückert (1826).

**Harivan'sa** [Sanskr. *Harivaṅça*, the family of Hari or Krishna (Vishṇu); *hari-* + *vaṅça*, family, race]: a kind of epic written in Sanskrit, regarded as a supplement to the *Mahâbhârata*. Its critical character is not high. It treats of Vishnu in his avatar as Krishna, of cosmogony, and of ancient history.

**Harkness**, ALBERT, Ph. D., LL. D.: educator; b. at Mendon, Mass., Oct. 6, 1822; graduated at Brown University at the age of twenty; taught in the Providence High School 1843–53; studied in Germany 1853–55, and in the latter year became Professor of the Greek Language at Brown University. He is the author of many well-known text-books in Latin and Greek, including a Latin grammar, Greek and Latin readers, and school editions of various classic authors.

**Harkness**, WILLIAM, A. M., LL. D.: astronomer; b. at Ecclefechan, Dumfriesshire, Scotland, Dec. 17, 1837: graduated at Rochester University, New York, in 1858, and became Professor of Mathematics U. S. navy, Aug. 24, 1863, and was attached to the U. S. Naval Observatory. In 1866 he made a voyage round Cape Horn in the U. S. monitor Monadnoc to study the phenomena of magnetism on shipboard in the southern hemisphere. The results of this work were published in the *Smithsonian Contributions to Knowledge*. In 1871 he was made a member of the commission on the transit of Venus, and was in charge of U. S. expedition to observe the transit of 1874, at Hobart Town, Tasmania.

S. NEWCOMB.

**Harlan**, JOHN MARSHALL: jurist; b. in Boyle Co., Ky., June 1, 1833. He graduated at Centre College in 1850, and in the law department of Transylvania University in 1853; was an unsuccessful Whig candidate for Congress in 1859; raised the Tenth Kentucky Infantry for the Union army, and was commissioned its colonel in 1861; attorney-general of Kentucky in 1863–67; defeated for Governor in 1871 and 1875; member of the Louisiana investigating commission in 1877; appointed associate justice of the U. S. Supreme Court Nov. 29, 1877, and one of the arbitrators on the part of the U. S. before the Bering Sea tribunal May 31, 1892.

**Harlan**: town; capital of Shelby co., Ia. (for location of county, see map of Iowa, ref. 5–D); on the Nishuabatona river and the Chi., R. I. and Pacific Railway; 40 miles N. E. of Council Bluffs. It is in an agricultural region, and has a large flour-mill, plow-factory, iron-foundry, 2 steam brick-factories, creamery, and 3 weekly newspapers. Pop. (1880) 1,304; (1890) 1,765; (1900) 2,422.

EDITORS OF "REPUBLICAN."

**Harland**, MARION: pseudonym of Mrs. Mary Virginia Hawes Terhune. See TERHUNE.

**Harlay**, ăăr′lā′, ACHILLE, de: statesman; b. in Paris, Mar. 7, 1536. Appointed first president of the Parliament. the highest judicial court in France, by Henry III. in 1582, he remained faithful to him during the civil war of the League, though he did not hesitate to remonstrate with the king on his prodigality, and to oppose the adoption of cruel measures against the Huguenots. His fidelity and courage are illustrated by his famous defiance to the Duke of Guise, who upon the expulsion of the court from Paris demanded that he should assemble the Parliament. "When the majesty of the prince is violated," said Harlay, "the magistrate no longer has authority." He was left untouched for some time, but afterward was thrown into the Bastile. After the death of Henry III. he was released on the payment of a ransom, and was maintained by Henry IV. at the head of the Parliament. He used his powers to counteract the manœuvers of the Ultramontanes, and caused the condemnation of the books of Bellarmin and Mariana. Author of *La Coutume d'Orléans*, 1583. D. in Paris, Oct. 21, 1616.

**Harlay de Sancy**, ăăr′lā′de-saăn′see′, NICOLAS: b. in 1546; is principally known as having been the owner of the celebrated diamond, named after him the Saney diamond, the largest in Europe, which belonged afterward to the crown of France. Harlay de Sancy was ambassador and superintendent of finances under Henry III. and Henry IV. He was a kind of freethinker, and he changed his creed so often that the famous Protestant writer d'Aubigné published a bitter satire under the name of *Catholic Confession of Sancy*. D. in 1629.

**Har'leian Collection**: a mass of MSS. collected by Robert Harley, Earl of Oxford (1661–1724), and by Edward, his son. In 1723 it was purchased by the British Government for £10,000, and the documents are now in the British Museum. There are some 8,000 MSS., many of them of very great value, and there were originally above 400,000 pamphlets. Volumes of *Harleian Miscellanies* have been from time to time published, being compilations from the collected documents. Harley's printed books were sold to a private person.

**Harlem**: a part of New York city above 106th Street, and between the East river and Eighth Avenue. It was once a distinct corporation. See NEW YORK.

**Harlem River**: the name given to the tidal channel or strait which with Spuyten Duyvil creek separates Manhattan Island from the mainland, and connects the Hudson river with the channel called East river, which separates Manhattan from Long Island. It begins at Kingsbridge, where Tibbits brook flows into Spuyten Duyvil creek, and extends in a generally S. E. direction for 7 miles to Randall's island, near HELL GATE (*q. v.*). In June, 1895, this whole channel was opened as a ship-canal. Its depth at high water is 15 feet, and at low water 9 feet.

**Harlequin** [from O. Fr. *harlequin*, probably corruption of *helequin*, prob. of Teuton. origin, meaning troop of hell, i. e. hell's kin]: in mediæval and modern pantomime, the buffoon lover of Columbine, and her protector from the machinations of Pantaloon and the Clown. He wears tight-fitting, particolored garments covered with spangles, and often has the assistance of good fairies. The origin of the character may be traced back to the ancient *Atellanæ*. The buffoon Sannio, described by Cicero in his *De Oratore*, is the direct ancestor of "the two Zanni," Arlechino and Scapino, who flourished in the Italian *comedia del' arte*, the former being the servant of Pantalone, the old citizen of Venice; the latter, of *il dottore* from Bologna. When the

*comedia del' arte* was transplanted to France, one of the Zanni (Scapino) was gradually dropped, while the other assumed the principal part of the play, remodeled in various shapes—the lover, the villain, the *deus ex machinâ*, but always witty, graceful, entertaining, and in possession of the sympathy of the audience. The traditional features in the costumes and in the business of the charaeter are not easy to explain, though some of them are evidently very old. The mask some refer back to the Greek comedy. The dress, made up of patches, was the old dress of the Roman buffoon, *centunculus*. For further details, see PANTOMIME.

**Harlequin Duck**: a handsome somewhat rare wild duck (*Histrionicus histrionicus*), occurring in the northern parts

The harlequin duck.

of Europe, Asia, and North America, principally on the seacoast. Its general color is deep, leaden blue, but when adult the male bears a conspicuous white collar and various marks of white and reddish, the general pied appearance suggesting the popular name. F. A. LUCAS.

**Harles**, GOTTLIEB CHRISTOPH: a learned bibliographer and classical editor; b. at Culmbach, June 21, 1738; studied philology in the University of Erlangen; was made Professor of Greek and Hebrew in the gymnasium at Coburg 1765; Professor of Poetry and Eloquence 1770 in the University of Erlangen; in 1776 university librarian; and in 1777 founded the Philological Seminary. Edited with notes the *Plutus* of Aristophanes, Aristotle's *Poetics*, Cicero's *De Oratore* and *Verrine Orations*, Cornelius Nepos, Theocritus, Bion, and Moschus, and other classie authors. Wrote numerous works on Greek and Latin literary history and bibliography. His chief work was the new and enlarged edition of *Fabricii Bibliotheca Græca* (12 vols. 4to, Hamburg, 1790–1809). With the exception of the last mentioned his editions, which were mere compilations and devoid of originality of treatment, are now deservedly forgotten. D. Nov. 2, 1815. Revised by ALFRED GUDEMAN.

**Har'less**, GOTTLOB CHRISTOPH ADOLF, von, D. D.: author; b. at Nuremberg, Bavaria, Nov. 21, 1806; studied at Erlangen and Halle; held (1829–45) a theological professorship at Erlangen, and afterward one at Leipzig; and in 1852 became an eeclesiastical councilor to the Bavarian Government and president of the superior consistory of Munich. Author of a commentary on *Ephesians* (Erlangen, 1834; 2d ed. 1858); *Theological Encyclopædia* (Nuremberg, 1837); *Christian Ethics* (Stuttgart, 1842; 7th ed. 1875; Eng. trans. Edinburgh, 1868); *Jacob Böhme and the Alchemists* (Berlin, 1870); and other valuable works. D. in Munich, Sept. 5, 1879. Revised by S. M. JACKSON.

**Harley**, ROBERT: See OXFORD, EARL OF.

**Harman**, HENRY MARTYN, D. D., LL. D.: professor of languages; b. in Anne Arundel co., Md., Mar. 22, 1822; graduated at Dickinson College, Carlisle, Pa., 1848; Professor in Female College, Baltimore, 1853–55; one of the principals of the Classical Institute in Baltimore, 1858–68; Professor of Languages, West Virginia, 1868–69; Professor Aneient Languages in Dickinson College, 1870–79; in 1879 became Professor of Greek and Hebrew in samc institution. Published *A Journey to Egypt and the Holy Land in 1869–70* (1872); *Introduction to the Study of the Holy Scriptures* (1878); contributor to *Methodist Review* and *Journal of the Society of Biblical Literature and Exegesis*. D. July 2, 1897.

**Har'mar**, JOSIAH: general in Revolutionary war; b. in Philadelphia in 1753; educated in the same city; in 1776 he was made eaptain First Pennsylvania Regiment, and lieutenant-colonel in 1777, whieh command he retained until the close of the Revolution, serving with Gen. Washington in his campaigns 1778–80; in the South with Gen. Greene 1781–82; brevet colonel First U. S. Regiment 1783; in 1784 was selected to bear the ratification of the definitive treaty to France, and in the following year was present as Indian agent at the treaty at Fort Mackintosh; appointed (Aug., 1784) lieutenant-colonel of infantry under the Confederation; brevet brigadier-general by resolution of Congress 1787, and general-in-chief of the army Sept. 29, 1789, which post he held until 1792, when he resigned. Adjutant-general of Pennsylvania 1793–99. D. in Philadelphia, Aug. 20, 1813.

**Harmat'tan**: a dry, parching east wind which prevails on the Guinea coast of Africa in the winter months. It usually brings a reddish dust with it. Its times of greatest frequency at Christiansborg, on the Gold Coast, are Nov. 1, Dec. 5, Jan. 10, Feb. 2, Mar. 1, and the direction shows a diurnal swing from N. E. to S. E. The temperature during the prevalence of the wind is cooler in the morning and evening, hotter at midday. The atmospheric pressure is slightly increased, while the humidity is decreased on the average by 25 or 30 per cent. M. W. H.

**Harmo'dius**: a beautiful youth of Athens, who was warmly attached to a citizen named Aristogiton, his remote kinsman, both belonging to the Gephyræi. It appears that Hipparchus, brother of the tyrant Hippias, desired to sever the relationship which existed between the friends, and to attach Harmodius to himself, and, failing, put repeated insults upon the two friends in the person of the sister of Harmodius. Accordingly, they determined to put to death not only Hipparchus, but his brother the tyrant. On the feast of the great Panathenæa (514 B. C.) Hipparchus was assaulted and slain, but Harmodius was at once killed by the guards. Aristogiton, put to the torture, in a spirit of revenge named the chief friends of Hippias as his accomplices, and they were accordingly put to death. After the expulsion of Hippias (510 B. C.), Harmodius and Aristogiton came to be highly honored as martyrs for the cause of liberty. The statues from the chisel of Antenor which were erected in their honor were carried away to Susa by Xerxes, but were afterward restored to Athens by Alexander. In the meantime, however, a new group of the tyrant-slayers had been exeeuted by Critios and Nesiotes. The original was imitated on coins and by their help two statues in the Naples Museum have been recognized as copies of the Harmodius and Aristogiton of Critios and Nesiotes. Harmodius and Aristogiton were praised in drinking songs, one of which by Callistratus has been preserved in the works of Athenæus, and speaks of them as the men who "slew the tyrant and gave to Athens equal laws." The families of the tyrant-slayers were exempted from taxation and all public burdens, and it was forbidden by law to give to slaves the names of Harmodius and Aristogiton. See Grote, *History of Greece* (New York, 1865), and others; Collignon, *Histoire de la sculpture grecque* (Paris, 1892); Overbeck, *Geschichte der griechischen Plastik* (Leipzig, 1893); Mitchell, *History of Ancient Sculpture* (New York, 1888). Revised by J. R. S. STERRETT.

**Harmo'nia** (in Gr. Ἁρμονία): a nymph of the spot on which Thebes was founded, a daughter of Ares and Aphrodite, and sister of the dragon which Cadmus slew. She herself was the prize that awaited Cadmus in case he should prove suceessful in his eontest with the dragon. (See CADMUS.) Their marriage took place on the spot which afterward beeame the Cadmea of Thebes. All the gods came to the marriage, each bringing a gift, while Apollo, the Muses, and the Graces made the marriage music. Chief among the gifts were a mantle presented by Athene, and a necklace made by Hephæstus, the gift of Aphrodite. Some maintained that the neeklace had been given by Zeus to Europa on their wedding night in Crete, and that Cadmus, having received it from Europa, gave it to his bride, a story which was self-contradictory, since Cadmus never saw Europa after her rape by Zeus. Both the necklace and the mantle proved á curse to all who owned them. (See POLYNICES). According to another story Cadmus met and married Harmonia in Samothrace, where she was called a daughter of Zeus and Electra, one of the daughters of Atlas. After the celebration of their marriage in Samothraee, they went to Bœotia and founded Thebes. Aecording to another story, Harmonia was a native of Areadia, and was kidnapped by Cadmus while she was visiting Samothrace. Still another story has it that Cadmus, a cook of the King of Phœnicia, ran off with Harmonia, the king's fluteplayer. Originally Harmonia was a goddess whose functions were similar to those of Aphrodite Pandemos in her better and nobler side.

Hence, as her name indicates, she was the goddess who presided over civic unity and fraternity, and corresponded to the Roman Concordia. J. R. S. Sterrett.

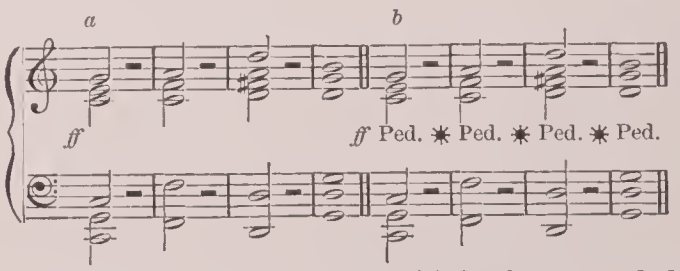
**Harmon'ica** [liter., femin. of Lat. *harmo'nicus*, musical, harmonical = Gr. ἁρμονικός, deriv. of ἁρμονία, harmony. See Harmony]: a musical instrument improved by Franklin (but known long before his time), consisting of a series of revolving glass cups, which upon being pressed by the tip of the finger or a suitable bow give forth musical tones of a peculiarly fine quality, and consequently also called a *glasschord*. Though much admired, the instrument soon passed out of notice. Various harmonicas have been since brought forward. The "chemical harmonica" is a long, straight, open tube of glass, one end of which is held over a flaming jet of hydrogen. A musical sound is given out, varying in pitch and other qualities with the proportions of the tube. The phenomenon is caused by a series of minute explosions produced by the burning gas, which communicate a vibration to the tube.

**Harmonic Motion** [so called because expressible as a simple harmonic function of the time. See Harmonic Ratio]: in mechanics, the projection on any diameter of a point moving uniformly in a circle. If a planet or satellite, moving uniformly in a circular orbit about its primary, be viewed from a very distant position in the plane of its orbit, it will appear to move backward and forward in a straight line with a simple harmonic motion—e. g. the satellites of Jupiter seen from the earth. Such motion as that described is approximately that of the simplest species of *vibrations* of a sounding body, a tuning-fork or piano wire; it is also that of the various media in which waves of sound, light, heat, etc., are propagated, and it enters extensively into the theories of these phenomena, as well as into those of astronomy and mechanics. The *amplitude* is the range on one side or the other of the middle point of the course. The *argument* is the circular arc described by the projected point, and measured from any arbitrary fixed point. It is proportional of course to the time measured from period of passage through that arbitrary point. The distance of a point moving with simple harmonic motion from the middle of its course is a *simple harmonic function of the time*, the *argument* of which has just been defined. The *period* of such motion is the time of a complete course to and fro. The *phase* at any instant is the fraction of the whole period elapsed since the moving point passed through its middle position in a positive direction. The *epoch* is the time from the era of reckoning to the reaching of greatest elongation, in the direction reckoned as positive, from its mean position or middle of the course. For *Harmonic Analysis* ("spherical"), see Laplace's *Coefficients*.

**Harmonic Ratio** [*harmonic*, liter., pertaining to music or harmony, hence applied to the ratio, series, or proportion subsisting between lengths of stretched strings which vibrate in unison]: in mathematics, an anharmonic ratio equal to minus unity. If a pencil of four right lines meeting in a point, $O$, be intersected by a fifth right line in the four points $A$, $P$, $P'$, $B$, then the ratio $\frac{A\ P.\ P'\ B}{A\ P'.\ P.\ B}$ is constant, no matter how the intersecting line be drawn. This ratio is called the *anharmonic ratio* of the pencil; and if it be *minus unity*, it is a *harmonic ratio* and the pencil is a *harmonic pencil*. In this case the angle $A\ O\ B$ will be divided internally and externally into parts of which the sines are in the same ratio: and the line $P'\ P$ will be harmonically divided by the points $A$ and $B$—one *on* it and the other on its prolongation, and $A\ B$ is a harmonic mean between $P'\ B$ and $P\ B$. If $B$ is at an infinite distance—that is, if the intersecting line be parallel to $A\ B$ (and the pencil *harmonic*)—$P\ P'$ is bisected at the point $A$. The division of a musical string into lengths denoted by the reciprocals of the numerical series 1, 2, 3, 4, 5, 6, etc., produces a great many of the essential sounds of our musical system. Hence such a progression, or more generally that of reciprocals of any series in arithmetical progression, is called *harmonic*. If from four points taken on a conic section a pencil be drawn to any variable fifth point of the curve, the anharmonic ratio of the pencil thus formed will be constant.

Revised by S. Newcomb.

**Harmonics** [from Gr. τὰ ἁρμονικά, neut. plur. of ἁρμονικός, harmonic, pertaining to harmony; deriv. of ἁρμονία, harmony. See Harmony]: in music, certain secondary or accessory sounds which are given out by sonorous bodies, besides the principal sound, and different from it, but bearing also to such sound a determinate harmonic relation. It is probable that no musical sound is absolutely pure and simple, but that every well-defined sound is the generator or root of several other sounds, which are more or less audible to our ears. A single string, or monochord, produces not only its own proper sound, but also its octave, twelfth, fifteenth, seventeenth, nineteenth, etc., or the sounds belonging to one-half, one-third, one-fourth, one-fifth, one-sixth, etc., of its length. These secondary sounds, in combination with the principal one, are found to be the elements of the perfect *major triad*—i. e. the root or fundamental tone—with its third and fifth, or their octaves and double octaves. A musical ear readily detects several of these in the sound of a large church-bell (the larger the better), and these harmonies are more or less perfect in proportion as the bell is regularly formed, well cast, free from cracks or flaws, and of uniform density. Sounding bodies not only give out primary tones and accompanying harmonies from their own substance, but also, under certain conditions, induce similar sounds in other bodies within reach of their vibrations. A string vibrating at a certain rate—e. g. 120 times in a second—will by "sympathy" cause equivalent vibrations in another contiguous string of the same length, thickness, and tension, and will also excite the more rapid vibrations of strings tuned to sound its octaves, thirds, and fifths; the vibrations or undulations on which sound depends meeting, coalescing, or touching each other at certain regular distances, longer or shorter, and thus producing the harmonic intervals just named. A long-continued note on an open string of a violin will thus cause vibrations in the corresponding string of another violin hanging against the wall. A tuning-fork forcibly struck, and set on the sounding-board of a piano, will occasion all the strings in harmonic relation with it to vibrate in sympathy. The jarring of window-sashes, the jingling of glass vessels, and the rattling of loose articles of furniture, when musical notes *of a certain pitch* (and not otherwise) are sounded, are facts easily explainable on the same principle. Telegraph wires also, during a brisk wind, often give out harmonic tones, though the proper sound of the wire is inaudible. These derived or sympathetic vibrations are, in very large strings, sensible to the touch, and may even be visible to the eye (especially when aided by a magnifying-glass), though the sounds produced are too faint to be appreciated by the ear when the experiment is confined to a single string. But when *several* strings are struck simultaneously, the sympathetic vibrations of a large number of other strings contiguous to them become distinctly audible to any ear by the manifest access of power thus given to the original sound. When a full chord, for example, is forcibly struck on a piano, with *the dampers raised* by using the loud pedal, the quantity of sound produced is much greater than otherwise, because, the strings being now all free, every octave, fifth, and major third, with their octaves and double octaves, throughout the whole instrument, respond by sympathy to the notes actually struck, and the general effect is quite sensible to the ear. Composers of piano music often avail themselves of this fact when they wish to give to certain chords the highest degree of force, richness, and brilliance. In the following example the chords at *a* and *b* are precisely the same, but the latter will far exceed the former in power, because the use of the pedal on each note sets the strings free to contribute their harmonics, and thus to intensify the notes under the fingers:




In the large pipes of an organ (chiefly the stopped diapason and bourdon) the harmonic or accessory sounds are often disagreeably perceptible, sometimes causing an indistinctness or uncertainty as to the real tonal pitch of the pipe. In such cases the organist hears distinctly the harmonic fifth or twelfth, while the proper sound of the pipe is barely appreciable. A pipe may also, by an over-pressure of wind, be made to sound one or other of its harmonies *instead* of, or in union with, its own proper tone, as in the quintaton stop of German organs, where the pipes

are so "overblown" as to yield a piereing quality of tone many degrees higher than that proper to their length or capacity.

*Under* harmonies, or those below the natural sound, are frequently heard from large bells, making a booming or deep humming sound. It has also been found that two pipes of moderate size, under certain relations of length and diameter, if sounded simultaneously, will generate a third sound far deeper than their own, and this foreign sound will so predominate as to substitute itself for the proper sounds of the two pipes. Advantage of this curious fact has been taken by modern organ-builders in obtaining from two pipes—e. g. one of them 8 feet long, and the other only about 5—a derived or harmonie tone equivalent to that of a pipe 16 feet in length, thereby eeonomizing both space and expense. It is obvious that an organ of moderate size may thus be made to produee tones similar in depth to those for whieh pipes of the largest class are commonly required. See Grove's *Dictionary of Music and Musicians.* Revised by DUDLEY BUCK.

**Harmonic Stops**: in a large organ, certain stops eonsisting of two, three, four, or more ranks of pipes, tuned in oetaves, double oetaves, and double or triple thirds and fifths above the natural piteh of the keys. Among these are the eornet, sesquialtera, mixture, and furniture; but, comprehensively, the term may also include those stops having only a single rank of pipes, which are tuned in thirds, fifths, and their oetaves above the piteh represented on the keyboard. These latter are known as "mutation stops," among whieh are the quint, twelfth, tieree, larigot, and several others. The use of these stops is not only to add power to the "foundation stops" of the instrument—i. e. those whieh give the primary or *true* sound and its oetaves—but also to produee elearness, variety, and greater or less degrees of brillianee, aeeording to the eharaeter and requirements of the musie under performanee. Henee these stops are found in largest number on the keyboard or "manual" designated as the "great organ," though several of them have plaee also on the "ehoir organ," the "swell," and the "pedal organ."

Mueh of the sound produced by sueh stops must, in the nature of things, be utterly diseordant and eontradietory to the harmony under performanee by the organist. Taking the diapasons as the standard (beeause tuned to the true and natural piteh), it is easy to understand that no ill effeets of this kind would ensue by connecting with them another stop (e. g. the principal), sounding simply an octave higher, or still another (the fifteenth), sounding a *double* octave above each note on the keyboard. The effect would be only an increase of force and brilliancy, as in the addition of female to male voices; but when we add to the diapason sueh a stop as the twelfth, whieh makes a *perfect fifth* (in the octave above) to *every note* under the organist's fingers, we perceive that contradictory elements are introdueed, and more or less discord must inevitably be the result. To a person not familiar with the organ it seems ineredible that a stop whose pipes are tuned a fifth or double fifth above the proper pitch should be admissible, inasmuch as sueh a stop must neeessarily deliver in the key of the *dominant* that which the organist plays in the *tonic* or proper key.

The natural eonelusion from this would be that an organ provided with mutation and compound stops must be the most discordant of all instruments; and yet it is a known fact that these very stops eontribute largely to the richness, majesty, and roundness of pure organ-tones. Experienee proves that in their absence the diapasons, with mere duplieates in unison, octaves, and double octaves (as the principal, fifteenth, twenty-second, etc.), yield but a thin, meager, and disagreeably harsh quality of tone—a tone unsatisfactory to the ear for want of an infusion of some other element to give it substance and body. The explanation of the enriching effeet of the twelfth, tierce, sesquialtera, and similar stops, though seemingly difficult, is not so in reality, as it is nothing more than the carrying out of the laws of *harmonics*, by applying them to each individual note on the keyboard of the organ. (See HARMONICS.) As a sounding body naturally gives forth not only its own proper tone, but also several aeeessory sounds (as the 8th, 12th, 15th, 17th, etc.), so the organ-builder seeks to strengthen the diapasons and other foundation stops by adding to them certain other stops or ranks of pipes, which are tuned (not as duplicates, but) in *imitation of the harmonic or secondary sounds* which are already faintly produeed by the standard or fundamental stops. Each note of a complete organ therefore carries and exhibits all these harmonic elements in their perfection, and the ordinary ear reeognizes *not the several constituents* of the sound, but *the whole blended together* in unity, as if produced by a single pipe. Hence it is that in playing a scale movement on the full organ the eonsecutive fifths and major thirds of the mutation and eompound stops are not offensively apparent; and even in full chords the elashing of contradietory harmonics with their primaries is overborne and neutralized by the greater power of the stops sounding the root-tones, with octaves and double oetaves superadded, and eoming in *the same region with* the harmonies. Bad effeets ean ensue only when harmonie stops are drawn *without* those stops whieh are their foundation or correetives, as when we use the sesquialtera or cornet *without* the diapasons, prineipal, and fifteenth, at the least, as the basis from whieh they spring and the source of their meaning. See Grove's *Dictionary of Music*, etc. Revised by DUDLEY BUCK.

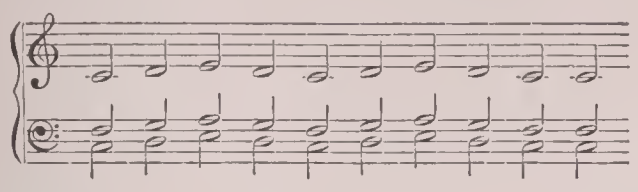
**Harmonists**: the followers of George Rapp (1770–1847), a German, of Würtemberg, who, believing that he was divinely called to restore Christianity to its primitive purity, organized a eommunity in whieh goods were held in eommon. Disturbed by the authorities, they removed in 1803 to the U. S.; settled in 1805 at Harmony, Butler eo., Pa., and removed in 1815 to New Harmony, Ind., whieh in 1824 they sold to Robert Owen. They then removed to Economy, Pa., 17 miles N. W. of Pittsburg. They own 3,500 aeres of land, and have important manufaetures. They do not marry. They interpret the Seriptures literally, believe that the millennium is near at hand, and that all mankind will ultimately be saved. They observe Christmas, Good Friday, Easter, and Penteeost. They are deereasing in numbers, having, aecording to the census of 1890, about 250 members.

**Harmony** [M. Eng. *harmonie*, from O. Fr. *harmonie* < Lat. *harmonia* = Gr. ἁρμονία, harmony; liter., a ehording or joining together; deriv. of ἁρμόζειν, to join or fit together]: in musie the union of two or more sueh melodies, or the eombination of several tones in one *simultaneous* utteranee in aeeordanee with eertain regulating prineiples, in distinetion from melody whieh eonsists of a varied *succession* of single or simple tones. Harmony, as now understood and praetieed, is a seienee of eomparatively modern times, having risen from its rudest form to its present perfeetion within the last three or four eenturies. There is no evidenee that the ancients had any aequaintance with the laws indicating the relations of combined musieal sounds, or any conception of the rieh and beautiful effeets resulting from those combinations under scientific and æsthetic treatment. The speculations of Greek writers concerning the origin, relations, and proportions of intervals, and their theory of the diatonic, chromatie, and enharmonic genera, contributed nothing of consequence to the development of harmony, and possibly as little to the improvement of melody. It is capable of proof that this science made little advance till the invention of the more perfeet classes of instruments, such as the keyed organ and the precursors of the harpsichord and piano. When these instruments eame into existenee it beeame possible, for the first time, to reduee to experiment and proof all kinds of musical combinations, and to deduce from aetual test some fundamental rules on which ehords might be classified, and their progressions determined in an orderly and scientific manner.

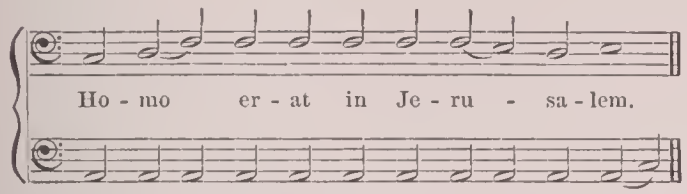
Even as late as the eleventh century the music of the Church—chiefly Gregorian plain-song—was but a simple melody, more or less inflected, without any accompanying harmony, except sueh as might be supplied by a rude and arbitrary use of occasional octaves, fifths, and fourths. It is questionable, indeed, whether even the term "melody," as now understood, can with justiee be applied to those successions of notes which seem so bald and unmeaning, but which, nevertheless, constituted what our forefathers regarded as "music," and extolled as consonant with their own ideas of perfection. Of the music of that age Dr. Burney gives some curious relics. "Guido," he remarks, "speaks of *diaphonia*, whieh means *discant*, or, as he calls it, '*organum*.' This consisted in singing a part *under* the plain-song or chant. Some used only *fourths* for this purpose, but it was allowable to double either the plain-song or the 'organum' by octaves *ad libitum*." The following examples are quoted from Guido by Dr. Burney. For greater convenienee they are given in modern notation; and the reader will be able to judge of the condition of musieal sei-

ence and sensibility at a time when so hideous a succession of fourths, fifths, and octaves could be tolerated in divine service or anywhere else:

Ex. 1.



Ex. 2.




In all the examples extant of that age the same wretched poverty of thought appears. The writers of music were groping in the dark, without rule, and without any apparent inward feeling to indicate the direction which such rule should take. Some ideas they had about simple intervals, but none concerning their use and relations. Fourths, fifths, and sixths succeed each other without order or reason; and it is remarkable that the fourth seems to have been a rather favorite interval. What further advances the musicians of that period made it is not easy to determine, but it is inconceivable that either Guido or his fellow laborers ever produced anything harmonious.

The first attempts at harmony seem to have been in the line of *extemporizing* a secondary part to any well-known melody, by running under it a parallel train of notes in fourths, fifths, or octaves (as is often done by ignorant people at the present day). For the sake of variety, as in the last example, the accompanying part would sometimes form a kind of ground-bass, *not* following the movement of the melody, and ending with a clumsily formed cadence. This two-part or "double singing," as it was called, was common in the twelfth century, and even earlier. The constant hearing of the ecclesiastical chant rendered that chant familiar to the people, and its scales and inflections had a general influence over the style even of the secular songs. By a kind of natural instinct, some diversity would be sought by those who were weary of a dry uniformity of song either in the church or the field, and with very little effort one singer might invent a free and artless undersstrain to enliven or improve upon the song of his companion and neighbor. This part-singing was also much favored and promoted in and after the twelfth century by the facility which the organs then coming into use afforded for sounding two or more notes at once. The ear was thus in some degree trained to perceive the effect of perfect and imperfect intervals, and very gradually some rules were arrived at to regulate their succession. Some evidences of such improvement are discernible at this era, as will appear from the following harmonies of Marchetto da Padova:

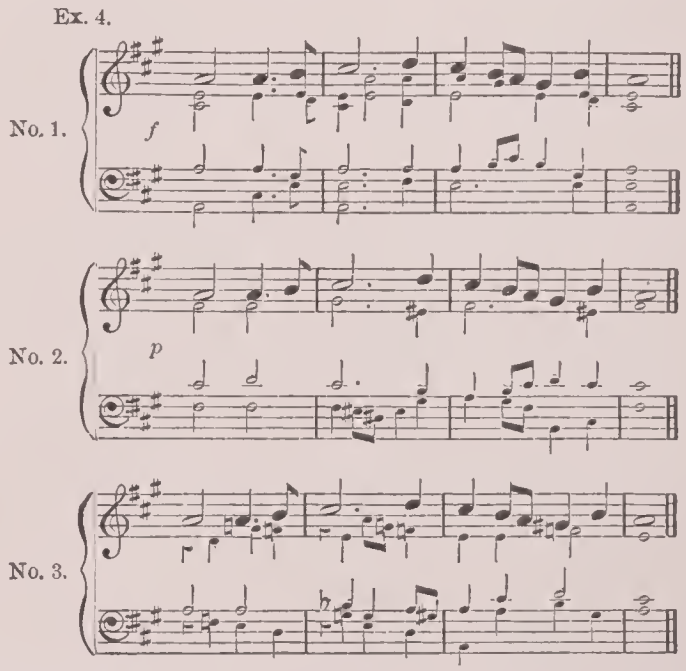
Ex. 3.

The organs of that age, however, though important as *suggestive* of harmony, were of small dimensions and of clumsy construction, containing but an octave or two of pipes, sufficiently harsh and noisy to be heard at a great distance, and played by keys requiring the force of the hand rather than the mere pressure of the fingers. But by the end of the fourteenth century these instruments had reached a far higher degree of perfection, having regular keyboards, numerous stops, and a compass of several octaves with the semitones. In consequence of this a new stimulus was given to the study of harmonious combinations and progressions, but still the advance in this direction continued to be slow and uncertain. Even as late as the middle of the fourteenth century, according to the statement of Dr. Burney, "the rules in use were of the rudest kind, and the ordinary ear in church service was not offended, probably, by any number of fifths and octaves in succession." From this to the time when Palestrina flourished (b. 1529; d. 1594) was a period when counterpoint was first successfully developed, its true principles discovered, carefully applied, and cast into a scientific form. The works of that renowned writer, though deficient in melody and the elegance and refined sentiment of modern music, abound with proofs of a profound acquaintance with counterpoint, even in its most subtle and intricate departments, and of wonderful skill in the most elaborate kinds of composition. Of the steps by which this great advance was reached, through a period of two centuries before Palestrina—an advance comparatively sudden, after more than 4,000 years of almost total darkness on the subject of musical science—there is no full and accurate account. But it is certain that within that time the leading principles of harmony had been discovered and applied with singular unanimity; compositions showing an exact knowledge of counterpoint had been produced; and already the nature and structure of *fugue* and *canon* had become familiar to musical writers.

The masters of the sixteenth and seventeenth centuries appear to little advantage as originators or students of *melody*, but their devotion to *harmony*, even in the most abstruse forms of canon, fugue, imitation, musical enigmas, etc., was all-absorbing and almost marvelous in its results. Their successors, however, with less pedantry and more regard for the beautiful and imaginative, advanced the art by adding to their studies the cultivation of this further department of melody.

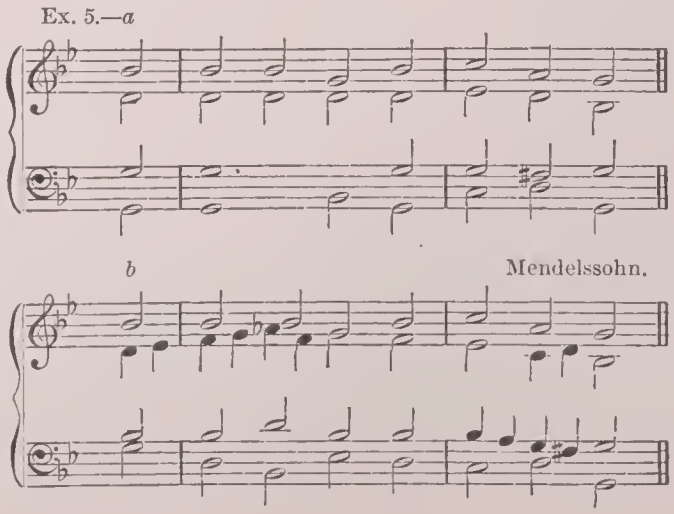
Harmony has a certain controlling power over melody—i. e. the sentiment or mental effect of a given melody is largely dependent on the harmony affixed to it. A change of the harmony, either within the same key or by digression into another key or mode, may alter and even reverse the whole drift and spirit of a melody. Thus, without the variation of a single note the character of a given melody may be alternately joyful, sad, or otherwise, according to the relations impressed upon it by diversified and skillful harmony. The following example will be sufficient to show how an air may be affected in sentiment by changes in the quality of its accompaniment:

Ex. 4.




Very plain and even unmeaning melodies may also be impressed with a new beauty by the sole effect of a pleasing accompaniment. In the following example this is illustrated, the refined harmony at *b* giving the melody a far higher interest than it could have under the common treatment, as shown at *a*:

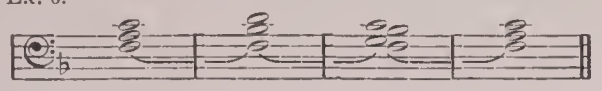
Ex. 5.—*a*



Hence it is that, as a general rule, the mind of a composer naturally associates some definite harmony with his conception of a new melody. Whether conscious of it or not, certain harmonious forms and progressions, key-relations, modulations, and even particularities of counterpoint are in the background of his thoughts, and quietly determine the spirit and significance of the melodic strain. And for this reason it becomes impossible to have a just conception of the sentiment intended to be expressed by a given melody till the very harmony with which it was invested by the composer is seen or heard.

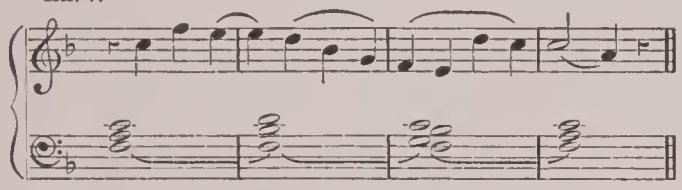
There is one aspect also in which *melody* may be viewed as holding a similar directive influence over *harmony*, or at least the power of conferring beauty on masses of chords which would otherwise be void of color and expression. A series of chords, quite regular in progression, may easily be written in which the ear detects nothing attractive or descriptive of any peculiar line of thought and feeling—such, for instance, as the following:

Ex. 6.



But let a distinctly marked and flowing melody be added, and these naked chords will acquire a meaning and connection which the ear recognizes at once, though due entirely to the suggestions of the melody. See this illustrated in Ex. 7:

Ex. 7.



This office of melody, as an element capable of throwing an air of ideal beauty over a train of dull and apparently aimless harmonies, is often lost sight of by young composers. The charm of chromatic and involved masses of chords obscures their sense of design, outline, rhythm, and breadth and symmetry of structure. And for this reason their early compositions are often overlaid and deformed with crude attempts at what they regard as scientific harmony, a superfluity of dissonant combinations and extravagant transitions into remote keys. Harmony may thus be abused till it becomes unmeaning and tiresome, like color thrown at random on canvas, with an absence of all distinctly marked objects and graceful forms.

The systematic treatment of harmony as a science has not been attempted in the present article, as the sole design has been to give such a general and historical view of the subject as might prepare the way for a full discussion of the subject under the head of Music (*q. v.*).

Revised by Dudley Buck.

**Harmony**, David B.: rear-admiral; b. at Easton, Pa., Sept. 3, 1832; entered the U. S. navy as a midshipman Apr. 7, 1847; served on board the Iroquois at the passage of Forts Jackson and St. Philip and capture of New Orleans, and in many severe engagements with the batteries at Vicksburg and Grand Gulf; was executive officer of the ironclad Nahant in the first attack upon Fort Sumter Apr. 7, 1863, and in the engagement with the ram Atlanta June 17, 1863; in command of the Asiatic station June, 1891; retired June, 1893.

**Harmony of the Gospels**: an arrangement of the four separate narratives of the life of our Lord which presents at one view all their facts and teachings. The earliest efforts to accomplish this appear to have been of the nature of a *diatessaron*, or a continuous narrative embracing all that is contained in the four Gospels, rather than of a "harmony," strictly so called. Tatian (about A. D. 170) prepared such a work, and after being long lost the commentary by Ephraem Syrus upon it was published by Georgius Moesinger in Venice, 1876, and in 1888, in Rome, Augustinus Ciasca published the Arabic translation of this harmony. In the earlier part of the third century Ammonius of Alexandria prepared a harmony, traces of which remain in the so-called *Ammonian Sections*, combined with the *Canons* of Eusebius. These are of great importance, having been placed in the margin of nearly all manuscripts of the Gospels since the middle of the fourth century. They are simply tables of reference by which may be found any passage in one Gospel either parallel or similar to a passage in one or more of the others. Each Gospel is divided into sections; the sections of St. Matthew being arranged in a column in the order of their numbers, the numbers of the sections corresponding to this in the other Gospels are placed opposite. Thus the first table, or *canon*, is formed of parallel passages in the four Gospels. There are ten such canons, containing the parallel passages in three Gospels, in two, and those found only in one. In the margins of manuscripts the number of the section is written above, and that of the canon by which the similar passages may be found, below in the form of a fraction. Since Eusebius every age has abounded in harmonies constructed on a variety of principles.

On the most cursory examination of the Gospels it is plain that the same events are not related in them all in the same order. Some of them, at least, must have arranged the details of the narrative on some other principle than that of chronological sequence. It is generally agreed that St. John, who gives minute notes of time, has carefully observed the chronological order of the history; but comparatively few facts are common to this Gospel and the others. Assuming in regard to these points the order of St. John, how shall the remaining events be grouped around them? St. Luke, in his introduction (i. 3), expresses his purpose to write "in order." Does this mean in chronological order? Some harmonists, and among them Tischendorf, have so understood it; but on examining the index of his *Synopsis Evangelica* it is plain that he has found himself obliged to disturb the order of St. Luke quite as much as is ordinarily done. It seems more probable that St. Luke's "in order" is equivalent to "systematically." He is remarkable for relating each event and discourse in careful connection with the circumstances under which it occurred; but it would be impossible to observe the order of St. Luke without violating that of all the other Evangelists and, at the same time, what would seem to be the most probable succession of events. The same things may be said with even more force of the first Gospel; indeed, it is soon evident to the student that exact chronological order was no part of the purpose of St. Matthew. St. Mark remains; and on comparing the points common to him and to St. John it will be found that they exactly agree. On further arranging events in what seemed on the whole the most probable sequence, several harmonists (notably Robinson; see his *Introduction*) have found that they had hit upon the order of St. Mark. There has come, therefore, to be a general disposition to adopt the order of St. John as more fully carried out by St. Mark. On this plan the order of two of the Gospels is preserved intact, which can not be accomplished in any other way.

Another debated question, which somewhat affects the structure of a harmony, is the length of our Lord's public ministry. Three theories have been proposed, severally known as the *Bi-paschal*, the *Tri-paschal*, and the *Quadri-paschal* schemes, according as they suppose that ministry to have included two, three, or four Passovers, and thus to have continued in addition to the first half year, one, two, or three years. Until the time of Eusebius opinions on this point were very vague and various, and do not seem to have really been definitely formed at all. He investigated the subject carefully, and decided in favor of the quadri-paschal scheme; and this view was adopted on his authority for many ages without much further investigation. In modern times much research has been devoted to the point with varying results. The bi-paschal scheme has been generally abandoned, but in Germany the tri-paschal has found great favor, having been adopted by such men as Wieseler and Tischendorf. In Great Britain also it has some eminent advocates, as well as in the U. S.; but the balance of opinion in both countries is decidedly in favor of the quadri-paschal. A weighty argument for this has been found in the reading of the *Codex Sinaiticus* in John v. 1, which renders it in the highest degree probable that the feast there mentioned must have been a Passover, and there are three other Passovers distinctly mentioned. Independently of that reading, however, and before it was known, the argument of Robinson to show that it was really the Passover has never been satisfactorily met.

When all doubtful questions have been determined, there will still remain a certain number of passages whose chronological position can not be fixed with certainty, because they contain no notes of time. These, however, are comparatively few and of secondary importance. On comparing the harmonies published in Germany, Great Britain, and the U. S. within the last fifty years, it will be found there is a gen-

eral and striking agreement in the order of all the main points of the Gospel history, even among those who differ in regard to the whole length of our Lord's ministry. There is more difference of opinion as to whether miracles of a similar character, yet narrated with certain circumstantial differences in the different Gospels, should be considered as the same or as actually different. The tendency of the earlier harmonists was to consider such events different when the circumstances were at all differently narrated, as, e. g., when the healing was of one demoniac or two, when the blind was cured as Jesus was entering into or departing from Jericho; later harmonists make more allowance for individual differences of narration, and in such cases identify the events, whether the data can be found (as they generally can) to explain these differences or not.

There is still greater difference in regard to the longer discourses of our Lord as given in the first Evangelist, such as the Sermon on the Mount and the charge to the Twelve (ch. x.), parts of which are given by the other synoptic Evangelists at other times and under different circumstances. Were these repetitions, or are the discourses as given in St. Matthew groupings together of several discourses uttered at different times? In most cases the other Evangelists give parts of the discourses in the same connection with St. Matthew, and other parts in connection with events or circumstances, especially the Perean journey of our Lord, of which St. Matthew makes no mention.

The uses of a harmony are very obvious. It enables the critical scholar to compare readily the language of the several writers in the narration of the same things; it gives to the exegetical student the fullest material for the interpretation of our Lord's acts and words; and to every Christian it affords a ready and convenient method of seeing at once all that is recorded of each scene and event and discourse.

The harmony in common use is by Edward Robinson (Boston and New York, 1845–46, both in Greek and in English; rev. ed. by M. B. Riddle, 1885 and 1886 respectively); on a somewhat new plan is that by J. A. Broadus (New York, 1893). The *Diatessarons* or attempts at interweaving the four Gospels into a continuous narrative are numerous. The most successful are by F. Gardiner (Andover, 1871); G. W. Moon (London, 1877; rep. New York); J. P. Cadman (Chicago, 1885); A. T. Pierson (New York, 1890). Tatian's *Diatessaron* has been edited in English by S. Hemphill (Dublin, 1888), and by J. H. Hill (Edinburgh, 1894).

Revised by S. M. Jackson.

**Harmony of the Spheres**: a kind of music which the ancients imagined was produced by the motions of the heavenly bodies. This sound, said they, we do not hear, because we have always heard it, and can not contrast it with absolute silence, of which we know nothing. Others thought the sound too powerful for our hearing, or that our senses are too gross to perceive it.

**Harms**, Klaus: Lutheran pastor; b. at Fahrstedt, Holstein, May 25, 1778; worked in the mill of his father till his nineteenth year. He studied theology at the University of Kiel 1799–1802; was tutor in the family of a pastor at Propsteierhagen, near Kiel, 1802–06; and was appointed assistant pastor at Lunden in 1806 and pastor in Kiel 1816. On the religious life, not only of Germany, but also of the Scandinavian countries, he exercised a powerful and most beneficial influence. Like Luther, he knew the wants of the people, and spoke their language. His preaching defied all homiletical rules, but reached the heart. In 1817, on the occasion of the third centennial of the Reformation, he published *Ninety-five Theses*, in which he attacked rationalism as sharply as Luther had attacked popery. They startled Germany like a thunderbolt, and provoked controversy on all sides between the orthodox and rationalistic. Most of them are translated in *The Lutheran Church Review* for July, 1889. His other works consist of several collections of sermons, a *Pastoraltheologie* (1830; 3d ed. 1878), an autobiography, etc. An excellent edition of his autobiography, with the theses was published as volume seven of the *Bibliothek Theologischer Klassiker* (Gotha, 1888). There are also biographies by C. Lüdemann (Kiel, 1878) and C. C. G. Behrmann (Kiel, 1878); cf. *Das Gedächtnissfeier für Claus Harms* (Kiel, 1878); H. F. Neelsen, *Claus Harms als Seelsorger und Freund* (Kiel, 1878). D. at Kiel, Feb. 1, 1855.

Revised by H. E. Jacobs.

**Harms**, Ludwig (*Georg Ludwig Dettev Theodor*): preacher; b. at Walsrode, on Lüneburg Heath, Hanover, May 5, 1808; the son of a Lutheran minister; educated at Göttingen 1827–30, and in 1844 became assistant pastor to his father at Hermannsburg, and succeeded him in 1849. His powerful evangelical preaching led to a great awakening in the parish, where rationalism had previously prevailed. The almost dead and poverty-stricken parish became from 1849 a missionary center, with a missionary college, a missionary journal, a printing establishment, and missions in Africa, New Zealand, and Australia, sustained by contributions for which he made no direct appeals. At his death at Hermannsburg, Nov. 14, 1865, the direction of the work passed into the hands of his brother Theodore (b. 1819; d. 1885), who was succeeded by his son, Rev. Egmont Harms. An excellent account of Harms's work is found in Stevenson's *Praying and Working* (London, 1862; rep. New York, 1892). A number of volumes of his sermons have been published. See *Life* by his brother Theodore (Hermannsburg, 1867; 4th ed. 1874), and a volume of his correspondence (1879).

Revised by H. E. Jacobs.

**Harnack**, Adolf: theologian; son of a distinguished Lutheran theologian and professor, Theodosius Harnack (d. 1889); b. at Dorpat, Russia, May 7, 1851; there he studied 1869–72; went to Leipzig in 1874 as tutor; became in 1876 professor extraordinary; ordinary professor at Giessen 1879; at Marburg 1886; at Berlin 1889. In critical knowledge of the sources of early Church history he has no superior. With Gebhardt and Zahn he put forth, 1876–78, an edition of the Apostolic Fathers, *Patrum apostolicorum opera* (Leipzig, 3 parts), and in 1882 began, with Gebhardt, to issue *Texte und Untersuchungen zur Geschichte der altchristlichen Literatur*, of which the ninth volume appeared in 1893, and to this series he contributed many important articles. He has separately published *Zur Quellenkritik der Geschichte des Gnostizismus* (1873); *De Apellis gnosi monarchica* (1874); *Die Zeit des Ignatius und die Chronologie der antiochenischen Bischöfe bis Tyrannus* (1878); *Das Mönchthum, seine Ideale und seine Geschichte* (Giessen, 1881; 3d ed. 1886); *Martin Luther in seiner Bedeutung für die Geschichte der Wissenschaft und der Bildung* (1883; 2d ed. 1886); *Lehrbuch der Dogmengeschichte* (Freiburg im Breisgau, 1886–90, 3 vols.; 2d ed. 1888–90); *Die Apostellehre und die jüdischen beiden Wege* (Leipzig, 1886); *Grundriss der Dogmengeschichte* (Freiburg im Breisgau, 1889; 2d ed. 1893; Eng. trans. by E. K. Mitchell; *Outlines of the History of Dogma*, New York, 1893); *Augustins Confessionen, Vortrag* (Giessen, 1888); *Rede auf August Neander gehalten zur Feier seines hundertjährigen Geburtstage am 17. Jan., 1889, in der Aula der Berliner Universität* (Berlin, 1889); *Das neue Testament um das Jahr 200. Thdr. Zahns Geschichte des neutestamentlichen Kanons [1 Bd., 1 Hälfte] geprüft* (Freiburg im Breisgau, 1889); *Das apostolische Glaubensbekenntniss, ein geschichtlicher Bericht neben ein Nachwort* (Berlin, 1892; 26th ed. 1893); *Antwort auf die Streitschrift D. Cremers zum Kampf um das Apostolicum* (Leipzig, 1892); *Geschichte der altchristlichen Literatur bis Eusebius*, 1. *Theil* (1893). Samuel Macauley Jackson.

**Harnett**, Cornelius: statesman; b. probably in North Carolina, Apr. 30, 1723; became owner of a large estate near Wilmington, and was early interested in the cause of liberty. He was (1770–71) an active member of the provincial assembly; in 1775 president of the provincial council, and afterward acting governor; in 1776 a member of the provincial Congress at Halifax, in which he used his active influence in favor of national independence, and was one of a committee to draft a State constitution and bill of rights, in which he procured the insertion of the clause declaring for religious freedom. In 1777–80 he was in Congress, and signed the Articles of Confederation. Harnett was taken prisoner when the British took possession of the Cape Fear region, and died in captivity at Wilmington, N. C., Apr. 20, 1781.

**Har'ney**, William Selby: soldier; b. in Louisiana in 1798; appointed second lieutenant of infantry U. S. army Feb., 1818; in 1833 appointed paymaster with rank of major, and in 1836 was transferred to the Second Dragoons as lieutenant-colonel, taking an active part in the Florida war against the Indians; brevet colonel Dec., 1840, for gallant conduct; appointed colonel 1846; served with distinction in the war with Mexico (brevet brigadier-general), and in 1858 was promoted to be brigadier-general. While in command on the Pacific coast he took possession of the then neutral territory of San Juan island, Puget's Sound, which was, however, soon evacuated by the U. S. In the early

days of the civil war he commanded in Missouri, but for an unauthorized truce with Gen. Price was soon relieved, and in 1863 retired from active service. In 1865 he was brevetted major-general. D. May 9, 1889.

**Ha'ro**, or **San Juan Archipelago**: a group of islands belonging to the U. S.; E. of the southern end of Vancouver island, and between Haro and Rosario Straits, N. of Puget Sound.

**Har'old I.** (surnamed HAREFOOT, from his swiftness): King of England; the reputed son of Canute by Ælgifa of Northampton, who was either wife or concubine of the king; but whether Harold was really their offspring is doubtful. In 1035 Harold was chosen as Canute's successor by the Danish party, and began to reign N. of the Thames; but Hardicanute (*Harthacanut*) the late king's recognized heir, was preferred by the English party. Before this time it is believed that Harold had ruled Denmark for Canute. Hardicanute was chosen King of Wessex, and Emma, his mother, was his regent, he being then absent in Denmark. Harold soon rid the kingdom of the Anglo-Saxon princes (Æthelings), and in 1037 he was chosen King of all England. He banished Queen Emma, and died at Oxford, Mar. 17, 1040. The history of his reign is obscure.

**Harold II.**: King of England; the last sovereign of the Anglo-Saxon race; second son of Godwin, the great earl of the West Saxons, by Gytha, a Danish lady, and consequently not of the royal line of England; assisted his father in his quarrels with Edward the Confessor, with whom he became reconciled 1052; with Tostig, his brother, conquered Wales 1063; was shipwrecked at the mouth of the Somme, Normandy, made prisoner, and compelled to swear to give support to Duke William's claim to the English crown 1065; caused himself to be proclaimed king, and was crowned Jan. 10, 1066; defeated and slew Harold Hardrada, who supported the claims of Tostig, Harold's brother, at the battle of Stamford Bridge, Sept. 25, 1066; fought William the Conqueror at the bloody battle of Hastings, and was killed there Oct. 14, 1066.

**Har'old** (or **Har'ald**) **I. Haar'fager** [Haarfager is O. Norse; fair-haired; *hār*: Germ. *haar*: Eng. *hair* + *fagr*: O. H. G. *fagar*: Eng. *fair*]: first King of Norway in the historic period. According to the story he loved Gyda, a jarl's daughter, who refused to marry him until he had conquered all Norway; and accordingly in 865 he took a vow never to comb or cut his hair till all the jarls submitted to his sway. His great sea-fight at Hafursfiord (885) released him from his vow. He died at Trondjem in 933, and was succeeded by Eric I.

**Har'old** (or **Har'ald**) **III. Hardra'da** [*Hardrada* is from O. Norse *harđ*: O. H. G. *hart*: Eng. *hard* + *rāđ*: O. H. G. *rāt*: O. Eng. *rēd*, counsel]: King of Norway; b. about 1016; became a kind of knight-errant in the East; served in the Byzantine armies 1038–40, and was distinguished by his exploits in Sicily and at Jerusalem; became sole King of Norway on the death of Magnus the Good, his nephew, 1047; invaded England 1066 to avenge the supposed wrongs of Tostig, brother to Harold II. of England; gained the battle of Fulford (Sept. 20), but was defeated and killed in the battle of Stamford Bridge, Sept. 25, 1066.

**Haroun' al Rasch'îd** [Arab.; Aaron the just]: Caliph of Bagdad, the fifth of the Abbasides; a son of the Caliph Mohammed Mahdi by a slave-woman; b. at Rei about 765 A. D. (148 A. H.); invaded the Greek empire 781; encamped opposite Constantinople, and compelled the Empress Irene to pay yearly 70,000 dinars in gold; succeeded Mousa al Hadi, his brother, in 786; raised the caliphate to its greatest pitch of splendor, chiefly by the aid of Zahya and Jaafer the Barmecides, whom he treacherously murdered (803); sent an embassy with presents to Charlemagne (probably in 801); was frequently and with almost uniform success engaged in fierce wars with the Byzantines; made Bagdad a center of learning, commerce, and industry. D. in Khorassan, Apr. 2, 809. See Palmer, *The Caliph Haroun Alraschid* (1881).

Revised by J. R. JEWETT.

**Harp** [M. Eng. *harpe* < O. Eng. *hearpe*: O. H. Germ. *harpha* (> Mod. Germ. *harfe*): Goth. *harpō*, whence Low Lat. *harpa* > Fr. *harpe*]: a musical instrument highly esteemed by the ancients, and used by Egyptians, Hebrews, Greeks, and in Celtic nations, particularly in Wales and Ireland, as well as among the Teutonic nations of antiquity, while the Romans preferred the lyre. The word is of Teutonic origin; Icelandic *harpa*. It occurs for the first time in the works of Fortunatus, a Latin writer of the seventh century, who speaks of the harp as a barbarous instrument. It was known to the Egyptians in the earliest times, though there is nothing which indicates that they were its inventors. The Egyptian harp had no front pillars. It was bow-formed and strung with catgut. The pedestal was often profusely decorated. The Assyrian harp resembled the Egyptian; it was bow-formed and had no front pillar. But it had the sound-body uppermost, and the lower portion was simply a bar to which the strings were tied and by means of which the tuning was effected. Of the shape of the Hebrew harp nothing is definitely known; indeed, it is probable that the Hebrew word which is generally translated "harp" really means "psaltery," a horizontal stringed instrument. The oldest specimen of the true Irish harp, with its curved front pillar and graceful sweep of neck, is that belonging to Trinity College, Dublin; it dates from the fourteenth century. A cast of this harp is in the South Kensington Museum, England, and has been accurately described in the catalogue by Engel. Another of great age, belonging to a family in Perthshire, Scotland, and called the *Clarsach Lumanach*, or "Lamont's Clarschoe," had about thirty strings tuned singly, with the scale sometimes doubled like lutes. In modern times the power and the sweetness of the harp have been much improved, especially by Sébastien Érard. Generally the harp is of a somewhat triangular outline, and has strings of wire or catgut. See Hipkins, *Musical Instruments* (1889).

**Har'palus**: treasurer of Alexander the Great. In 324 B. C. he took flight with a large amount of embezzled treasure, which the Athenians, to whom he fled for refuge, forced him to deposit in the Parthenon in trust for Alexander. The discrepancy between the sum as stated by Harpalus and the sum actually deposited led to investigation, and the name of Demosthenes headed the list of the nine who were charged with having received bribes. Harpalus meantime had escaped from the prison in which he had been confined and went with some troops to Crete, where he was murdered.

B. L. GILDERSLEEVE.

**Harpe**, JEAN FRANÇOIS, de la: See LA HARPE.

**Harper**: a town on Cape Palmas, Liberia (see map of Africa, ref. 5–B). Pop. with suburbs (1891) 8,550.

**Harper**, JAMES: publisher; b. in Newtown, Long Island, N. Y., Apr. 13, 1795. He was the son of a farmer, and removed with his brother JOHN (b. Jan. 22, 1797; d. Apr. 22, 1875) to New York city, where the brothers learned the printer's trade, founded the firm of J. & J. Harper, printed for a time for booksellers, and, establishing themselves as printers and publishers, brought out their first publication, an edition of *Locke on the Human Understanding*, in 1818. Their brothers, JOSEPH WESLEY (b. Dec. 25, 1801; d. Feb. 14, 1870) and FLETCHER (b. Jan. 31, 1806; d. May 29, 1872), learned the business with them, and were admitted to the firm, the name of which was changed to Harper & Brothers about 1833. The extensive plant of the firm on Cliff and Pearl Streets was destroyed by fire in 1853, and the present establishment occupies the site of the former one. James Harper died in New York city, Mar. 27, 1869.

**Harper**, JOHN MURDOCH: See the Appendix.

**Harper**, WILLIAM RAINEY, Ph. D., D. D.: educator and author; b. at New Concord, O., July 26, 1856; A. B., Muskingum College, 1870; Ph. D., Yale University, 1875; principal of Masonic College, Macon, Tenn., 1875–76; tutor in preparatory department, Denison University, 1876–79; principal of same 1879–80; Professor of Hebrew and the Cognate Languages, Baptist Union Theological Seminary, Morgan Park, Ill., 1879–86; principal of the Chautauqua College of Liberal Arts 1885–91; elected principal of the Chautauqua System 1891; Professor of the Semitic Languages, Yale University, 1886–91; Woolsey Professor of Biblical Literature, Yale University, 1889–91; D. D., Colby University, 1891; editor of the *Old and New Testament Student* and of *Hebraica*; first president of the University of Chicago and head Professor of the Semitic Languages and Literatures in that institution. He has been the chief exponent of the inductive system of language study, and has edited numerous text-books on that principle. His name appears as joint author of *Harper's Elements of Hebrew*; *Hebrew Method and Manual*; *Elements of Hebrew Syntax*; *Hebrew Vocabularies*; *Harper and Weidner's New Testament Greek Method*; *Inductive Latin Method*; *Inductive Greek Method*; *Inductive Latin Primer*; *Cæsar's Gallic Wars*; *Vergil's Æneid*.

C. H. THURBER.

**Harper's Ferry**: railway junction in Jefferson co., W. Va. (for location of county, see map of West Virginia, ref. 6–N); picturesquely situated at the confluence of the Potomac and Shenandoah rivers, and in the basin formed by the steep heights known as Maryland, Loudoun, and Bolivar Heights, which tower high above the village. The scenery at this point, where the combined streams break through the Blue Ridge, is grand and beautiful. An unusual historic interest also attaches to this locality. In Oct., 1859, the place was entered by John Brown and his followers, and the U. S. arsenal and national armory seized and held for upward of twenty-four hours. During the civil strife it was among the first to feel the ravages of war. In Apr., 1861, the small party of regulars guarding the public buildings evacuated the place before an approaching body of insurgents, and the town was occupied and held by the Confederates, who in turn evacuated it the following June after destroying the arsenal and armory, and the bridge across the Potomac. Again in Sept., 1862, during Lee's invasion of Maryland, the place was invested by the Confederates, and after a futile defense, the heights not having been fortified, was surrendered by Col. Miles, who was himself shot dead while bearing the white flag betokening surrender; 12,000 prisoners, 47 guns, and upward of 13,000 small-arms, besides a large quantity of stores, thus fell into the hands of the Confederates. The place was reoccupied by Gen. McClellan after the battle of Antietam. When, in the summer of 1864, Early invaded Maryland the garrison of Harper's Ferry evacuated the town and occupied Maryland Heights, holding them against the Confederate advance and covering Harper's Ferry with their guns so thoroughly that although Early entered the town with his skirmishers on July 5, capturing and destroying a large amount of property, he was not able to occupy it in force or use it for a dépôt of supplies, and therefore withdrew and crossed the river at Shepardstown. The Chesapeake and Ohio Canal passes by on the Maryland shore. Harper's Ferry is the seat of the normal school called Storer College. Pop. (1890) 958; (1900) 896. JAMES MERCUR.

**Harpies** [plur. of *harpy* < M. Eng. *harpie*, from O. Fr. *harpye* < Lat. *harpyia* = Gr. ἅρπυια, plur. ἅρπυιαι, harpies, liter., snatchers, deriv. of ἁρπάζειν, snatch]: in Greek mythology, the daughters of Thaumas (the personification of the wonders of the sea), son of Pontus (the Great Deep) and Electra, daughter of Ocean. Originally there were but two: Aello (Storm or Tornado) and Ocypete (Hurricane or Cyclone). In Homer their number is not limited to two. From being the demons of the storm they became by a natural transition the demons of Death, that comes, as it were, on the wings of the storm and snatches men away in sudden and unaccountable fashion. In this character they appear on the Harpy Monument in Lycia. Because of their swiftness they have something of the nature of the horse, and one of the Harpies, Podarge (Lightfoot, or Quickfoot), became by Zephyr, the quick west wind, the mother of Zanthus and Balius, the immortal horses of Achilles, and of Phlogeus and Harpagus, the horses of Castor and Pollux. In Hesiod and in archaic art they appear in human form with wings, indicative of swiftness. Later on they have the body, legs, and claws of a bird, but the head, arms, hands, and breasts of a woman. In vase-paintings belonging to the Argonautic cycle Zetes and Calais, sons of the North Wind, free Phineus from the tortures inflicted upon him by the Harpies, the demons of the Storm. In the nature of the case one or the other must die, and the Harpies are either killed or made to bind themselves to vex Phineus no more. According to Vergil, they dwell in the Strophades islands in the Ionian Sea, S. of Zante (now Strofadia and Strivali). Vergil makes them guardians of the door of the house of Hades. See Roscher, *Ausführliches Lexicon*, etc., under *Harpyia*; Mitchell, *History of Ancient Sculpture* (New York, 1888); Collignon, *Histoire de la Sculpture Grecque* (Paris, 1892); and Overbeck, *Geschichte der Griechischen Plastik* (Leipzig, 1893). J. R. S. STERRETT.

**Harpignies**, har'pĕĕn'yee', HENRI: landscape-painter; b. at Valenciennes, France, July 28, 1819; pupil of Achard; medals, Salons, 1866, 1868, and 1869; second-class medal, Paris Exposition, 1878; officer Legion of Honor 1883; one of the best painters of the French school; his pictures are finely composed and superbly drawn; his water-colors are excellent. Among his works are *Evenings on the Campagna* (1866); *Oaks of Châteaurenard*, and *Valley of Aumonce* (1875), in the Luxembourg Gallery, Paris; and *Moonrise*, in the Metropolitan Museum, New York. W. A. C.

**Harpoc'rates** [Gr. Ἁρποκράτης; Egyptian, *Har-pe-chruti*, Horus the child]: the Younger Horus, a divinity of the ancient Egyptians, son of Osiris and Isis; worshiped in later times in Greece and Rome as the god of silence, but not so esteemed by the Egyptians. His sculptures show him as a child placing his finger upon his lips—an infantile act which the Greeks incorrectly thought to be expressive of a command to preserve silence. The Romans honored him as the sender of prophetic dreams. He was begotten when Osiris was dying or even after he was dead; he was therefore always weak and puny. Accordingly he is interpreted as the weak winter sun, and he also seems to have symbolized originally the feeble vegetal life of the winter months. He is therefore the counterpart of Priapus.

Revised by J. R. S. STERRETT.

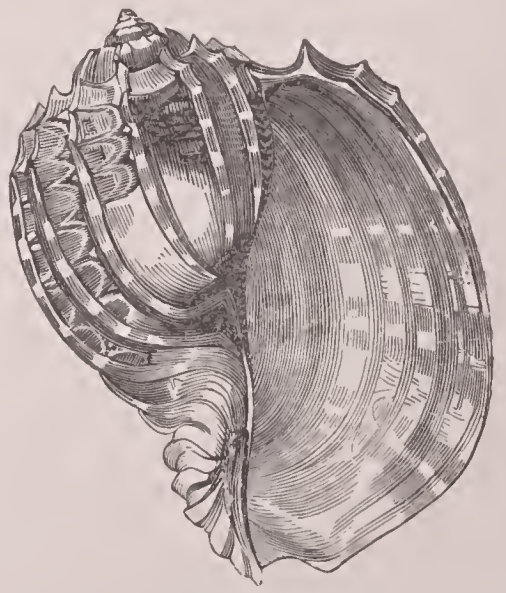
**Harpocra'tion** (in Gr. Ἁρποκρατίων), with the Roman surname VALERIUS: a Greek rhetorician and lexicographer who flourished at Alexandria, but of whose life no particulars are preserved. Even the period when he flourished is uncertain. An important work for the explanation of legal and political terms is ascribed to him, entitled λεξικὸν τῶν δέκα ῥητόρων, containing in somewhat irregular alphabetical order an explanation of expressions peculiar to Athenian courts of law and of proper names in the ten chief Attic orators. Suidas and the *Etymologicon Magnum* have borrowed much from him. The best editions are that of Bekker (Berlin, 1833) and that of G. Dindorf (Oxford, 1855).

Revised by J. R. S. STERRETT.

**Harpoot**, or **Kharpoot** (Arm. *Kharpert*): town; in Kurdistan, in the vilayet of Mamuret-ul-Aziz; near the Euphrates (see map of Turkey, ref. 5–H). It occupies a commanding situation on a plateau at the foot of mountains. A large trade is carried on in cotton, cereals, opium, silk, olive oil, wine, and cattle. It is the headquarters of Roman Catholic and Protestant missions to the Armenians, is the seat of Euphrates College, and has many churches and mosques. American mission property valued at over $60,000 was destroyed here by the mob during the Armenian troubles in 1895. The Government officials and the wealthier classes reside in the suburb of Mezereh. Pop. (1889) 35,000. E. A. G.

**Harp-seal**: popular name of a species of hair-seal (*Phoca* (*Pagophilus*) *grœnlandicus*), so called from the markings on its back. It inhabits the coasts of Greenland, Labrador, and Newfoundland; is also found in the north of Europe and of Asia, and is of great commercial importance. It is the most extensively caught of all the seals sought in the Newfoundland fisheries, many steamers as well as sailing vessels being employed in its pursuit. It yields great quantities of excellent oil, and its skin is also valuable. See SEAL-FISHERIES.

**Harp-shell**: popular name of a genus (*Harpa*) of gasteropod mollusks, of the whelk family, natives of the Atlantic, Indian, and Pacific Oceans. There are several species, of which *H. ventricosa* is best known. It is caught as food at the Mauritius, and the shells are highly valued.



The harp-shell.

**Harp'sichord** [with inserted *s*, from O. Fr. *harpechorde*; *harpe*, harp + *chorde*, chord]: the precursor of the modern piano. In form it resembles the grand piano, but is smaller, and is strung with steel and brass wires, two to each note, which are struck by *jacks* furnished with quill plectrums. Stops, swells, and double rows of keys were sometimes employed to affect the power of the wires. When skillfully played upon, the instrument gave forth a feeble but not unpleasing tone, susceptible of delicate modulations. The harpsichord was in common use in the twelfth and thirteenth centuries, and introduced into England in the seventeenth, but superseded by the piano.

**Harpy**: See HARPIES.

**Harpy-eagle**: a large and powerful eagle (*Thrasaëtus harpyia*) of tropical America, of very rare occurrence in the southern parts of the U. S. It is dark gray above, barred with black, wings dark, head and under parts, except a dark band across the breast, white. The head is crested. The harpy is over 3½ feet long, the beak is strong, feet and the talons enormous. Judged by its build, this eagle is the most powerful of the birds of prey. It is said to feed on sloths, young peccaries, and other mammals. F. A. Lucas.

Harpy-eagle.

**Harraden**, Beatrice: See the Appendix.

**Harrier** [deriv. of *harry*, ravage; cf. Germ. *verheeren*, lay waste]: a general name for the hawks of the genus *Circus*. Of some fifteen species, only one (*Circus hudsonicus*), the marsh-hawk, is a native of the U. S. Like the goshawks, the harriers fly along the ground in search of prey. In this genus feathers radiate from the eyes, giving the bird a rather owl-like appearance. Many of the species are European.

**Harrigan**, Edward: actor and playwright; b. in New York city, Oct. 26, 1845; was educated in the common schools. In 1859 he removed to San Francisco, where he worked three years in a ship-yard. He first appeared professionally as a comic singer at the Olympic theater, San Francisco, in 1867. After some years of experience as a variety actor, he formed a partnership with Tony Hart in 1871 in New York. Harrigan wrote a number of sketches, in which he himself appeared. On Aug. 7, 1876, Harrigan and Hart opened their first Theater Comique in New York, and it was at this house that they brought out (1879–1881) *The Mulligan Guard* series of plays. Between Aug., 1881, and Jan., 1885, they produced in other theaters in New York a number of plays, including *Squatter Sovereignty*, *Cordelia's Aspirations*, *Investigation*, and *McAllister Legacy*. In May, 1885, Harrigan and Hart dissolved partnership. Harrigan has written and produced on an average two new plays yearly. All his dramas are pictures of the lower life in New York, and while they are strong in character are weak in plot and construction. B. B. Vallentine.

**Harrington**, James: author; b. at Upton, North Hants, England, Jan., 1611; was educated at Trinity College, Oxford; served in the Low Countries, and became groom of the bedchamber to Charles I., to whom he was faithful, though an enthusiastic republican. His chief work, *Oceana* (1656), a description of an ideal republic, was dedicated to Cromwell, although it contained severe reflections upon him. It made a great sensation when it first appeared. While it was in press Cromwell's suspicions were roused, and the book was forbidden to appear. The author, however, succeeded in obtaining permission to publish it through the daughter of Cromwell. Several persons wrote against it, among whom was Baxter. In 1659 the author published a kind of abridgment of it under the title *The Art of Lawgiving*, and at the same time he founded the Rota Club, where he lectured in order to propagate his ideas. The club was closed, however, after a few months. Soon after Charles II.'s restoration Harrington was confined in the Tower as a traitor, and became insane during his imprisonment. His minor works are mostly upon the theory of government, but among them is a translation of four books of the *Æneid* into English verse. A collected edition of his works was published by Toland in 1700; another and more complete by Birch appeared in 1737; and there is still a third, from 1747. His political works were translated into French by Henry (3 vols., 1789). There is also a French translation of *Oceana* (Paris, 1795). D. at Westminster, Sept. 11, 1677. Revised by H. A. Beers.

**Harrington**, Mark Walrod, A. M.: astronomer and meteorologist; b. at Sycamore, Ill., Aug. 18, 1848; educated at Evanston, Ill., and University of Michigan, graduating at the latter in 1868; began teaching there the same year; 1870–71 in Alaska in the employ of the U. S. Coast and Geodetic Survey, taking part in a reconnoissance of the Shumagin islands; studied in Leipzig 1876–77; in the latter year was Professor of Astronomy in the Chinese Foreign Office Cadet School in Peking for one year; resigned on account of ill-health and returned to the U. S.; appointed Professor of Astronomy and director of the observatory at the University of Michigan 1879–91; in 1884 founded *The American Meteorological Journal*, of which he was managing editor until 1892; in 1891 he was appointed chief of the U. S. Weather Bureau at Washington on the transfer of the meteorological work from the War Department to the Department of Agriculture; in 1891 was made vice-president of the International Meteorological Conference at Munich; associate editor *Johnson's Universal Cyclopædia*, in charge of the department of geography, meteorology, and climatology; president of Washington State University 1895–97.

**Harrington**, Sir John: See Harington.

**Har'riott**, Thomas: mathematician and astronomer; b. at Oxford, England, 1560; studied at St. Mary's Hall, Oxford; graduated B. A. 1579; went with his patron, Raleigh, to Virginia 1584–85; published a *Briefe and True Report of the New Found Land of Virginia* (1588; republished in Hakluyt's 3d vol.); became a pensioner of the Earl of Northumberland; made very important algebraical improvements; greatly simplified the theory of equations, and was the first to conceive the possibility of putting all the terms of the equation into the same side. He was also an able observer of the phenomena of physics. D. in London, July 2, 1621. The posthumous *Artis analyticæ Praxis nova ad æquationes resolvendas* (1631) is his most important work.

**Harris**, David Bullock: Confederate general; b. at Frederick's Hall, Louisa co., Va., Sept. 28, 1814; graduated at the U. S. Military Academy at West Point in 1833, and entered the army as a brevet second lieutenant of the First Artillery; served a year with that regiment in the field; and was assigned to duty as Assistant Professor of Engineering at West Point; resigned from the army in 1835. For several years thereafter he was employed as a civil engineer on important works, such as the James river and Kanawha Canal; subsequently was an exporter of tobacco to Europe and of flour to South America. In Apr., 1861, he entered the Confederate army as a captain of engineers of the Virginia forces; first reconnoitered the line of Bull Run, and determined its defensive and strategic value; and when the position of Manassas Junction was occupied in force late in May, 1861, laid out and constructed the works for its defense. In the battle of Bull Run, attached specially to the staff of Gen. Philip St. George Cocke, Capt. Harris was conspicuous for courage and skill at several critical moments in the disposition of the Confederate troops, notably in their encounter with Sherman's brigade. He accompanied Beauregard early in 1862 to the West, and there planned and constructed the works at Island 10 and Fort Pillow on the Mississippi river, and subsequently the river-defenses at Vicksburg. In 1862 Capt. Harris was charged with the direction of the engineer operations of the defense of Charleston, S. C. In 1864 (meanwhile promoted to the grade of colonel of engineers and second in rank in his corps) he went back with Gen. Beauregard to Virginia, and was employed on the defenses of Petersburg. Soon after he returned to Charleston and was commissioned brigadier-general. D. of yellow fever near that city, Oct. 10, 1864.

**Harris**, George: jurist; b. in England in 1809; educated at Cambridge; entered the navy as a midshipman, but left it on account of ill-health; studied law, was admitted to the bar in 1843, and went the Midland circuit. After being the acting judge of the Birmingham county court for two years, under the direction of the Lord Chancellor, he was appointed one of the registrars of the court of bankruptcy in 1862, and held that position till 1869. He wrote *The Life of Lord Chancellor Hardwicke* (1847), having for that purpose obtained access to the manuscripts at Windsor Castle; also *Civilization considered as a Science*, *The True Theory of Representation in a State*, *The Theory of the Arts* (translated into French), and *Philosophical Treatise on the Nature and Constitution of Man* (1876). D. Nov. 15, 1890.

**Harris**, Howell: the chief founder of Calvinistic Methodism, the most prevalent form of dissent in Wales; b. at Trevecca, county of Brecon, Wales, in 1713; studied at Oxford, and on returning to Wales took the field as an evangelist and open-air preacher, founding societies and awakening the whole principality by his zealous labors. Though, like Wesley and Whitefield, a Churchman, he received little or no sympathy from the clergy, but the two great evangelists heartily recognized him. In a few years he had formed no less than 300 societies. Wesley and Whitefield frequently traversed the principality in his company, preaching daily.

Wesley describes Harris as a "powerful orator." Harris raised and commanded a regiment, mostly of his own people, during the French war, when the invasion of England was expected. For about three years he preached in his camps and in the market-places whenever his troops moved. D. at Trevecca, July 21, 1773. See his *Autobiography* (1791).

Revised by J. F. Hurst.

**Harris**, Isham Green: statesman; b. near Tullahoma, Tenn., Feb. 10, 1818; was a shop-boy in Paris, Tenn., in 1832; after mercantile success, was admitted to the bar in 1841; elected to the State Legislature in 1847; member of the U. S. Congress 1849–53. He then removed to Memphis and resumed the practice of law; was a presidential elector for the State at large in 1856; elected Governor of Tennessee in 1857, and re-elected in 1859 and 1861; served as volunteer aide on the staff of the commander of the Confederate Army of the West. After spending eighteen months in Mexico and a year in Great Britain, he returned to his profession at Memphis in 1867; U. S. Senator from 1877 till his death, in Washington, July 8, 1897; unanimously elected president *pro tem.* of the Senate in 1893.

**Harris**, Joel Chandler: journalist and author; b. at Eatonton, Ga., Dec. 9, 1848. He learned the trade of a printer, and was connected with various newspapers in his native State. Since 1876 he has held an editorial position on the Atlanta *Constitution*. To that paper he contributed his very successful studies in the folk-lore of the American Negro, published collectively in 1880 as *Uncle Remus: his Songs and his Sayings*. This was followed by *Mingo and other Sketches* (1883); *Nights with Uncle Remus* (1884); and other volumes. H. A. Beers.

**Harris**, Robert: Canadian artist; b. in Carnarvonshire, Wales, Sept. 18, 1849; educated at Prince of Wales College, Charlottetown, Prince Edward Island. He practiced land-surveying as a young man; by working from nature acquired skill enough to do some illustrating and to paint portraits of prominent men. In 1877 he went to Europe; studied art in London and Paris, and exhibited paintings in the Paris Salon, Royal Academy, London, and elsewhere in England. In 1883 he painted for the Government of Canada *Fathers of Confederation*, a large picture now in the library of the Parliament House, Ottawa. Subsequently he settled in Montreal; has painted a number of subjects dealing with life in Canada, and is chiefly occupied as a portrait-painter. Among his best-known paintings is *Meeting of School Trustees*, purchased by the Government of Canada for the Canadian National Gallery, Ottawa. He was elected president of the Royal Canadian Academy in 1893, and has since been re-elected at each annual meeting. Neil Macdonald.

**Harris**, Samuel: the "apostle of Virginia," so called; b. in Hanover co., Va., Jan. 12, 1724; became a colonel of militia in Pittsylvania County, and held important public offices. In 1769 he was ordained a Baptist minister, having for years zealously preached in the Baptist churches with great power; gave a large share of his property to charitable causes, and underwent much persecution from the then Established Church of Virginia. In 1774 he was ordained an "apostle" by the General Association of Separate Baptists. Date of death uncertain, probably 1794.

**Harris**, Samuel, D. D., LL. D.: theologian; b. in East Machias, Me., June 14, 1814; graduated at Bowdoin College in 1833, and at Andover Theological Seminary in 1838; taught at Limerick, Me., 1833–34, and at East Machias 1834–35 and 1838–41. He was pastor of the Congregational church in Conway, Mass., 1841–51, and of the South Congregational church in Conway, Mass., 1851–55. From 1855 to 1867 he was Professor of Systematic Theology in the Theological Seminary in Bangor, Me.; president of Bowdoin College 1867–71; and in 1871 took the chair of Systematic Theology in the theological department of Yale College. He has published *Zaccheus, or the Scriptural Plan of Benevolence* (Boston, 1844); *Christ's Prayer for the Death of His Redeemed* (1862); *The Kingdom of Christ on Earth* (Andover, 1874); *The Philosophical Basis of Theism* (New York, 1883); *The Self-revelation of God* (1887).

Revised by S. M. Jackson.

**Harris**, Thaddeus Mason, D. D.: a Unitarian divine; b. at Charlestown (now Boston), Mass., July 17, 1768; graduated at Harvard in 1787; was appointed private secretary to Gen. Washington, but sickness prevented his acceptance. In 1790 he delivered the Phi Beta Kappa address at Cambridge, where he studied divinity; was librarian of Harvard University 1791–93; pastor of the First church, Dorchester, 1793–1839, where he died Apr. 3, 1842. He was the author of many works, among which are *The Minor Encyclopædia* (4 vols., 1803); *Journal of a Tour into the Northwest Territory* (1803); *Natural History of the Bible* (1820); and *Memoirs of Oglethorpe* (1841).

**Harris**, Thaddeus William, M. D.: a son of Dr. T. M. Harris (1768–1842); b. at Dorchester, Mass., Nov. 12, 1795; graduated at Harvard in 1815, and studied medicine, which he practiced at Milton, Mass. He was (1831–56) librarian of Harvard College, and for a time was instructor in Botany and Natural History, and won especial distinction as an entomologist, being one of the pioneers of that science in North America. D. at Cambridge, Mass., Jan. 16, 1856. His most important works are a *Systematic Catalogue of the Insects of Massachusetts*, and a valuable treatise *On Insects Injurious to Vegetation* (1841; enlarged eds. 1842, 1852, 1862). He also published many scientific and antiquarian papers.

**Harris**, Thomas Lake: reformer; b. at Fenny Stratford, England, May 15, 1823; in 1827 was taken to the U. S. by his parents, who settled at Utica, N. Y. He early attained some distinction as a writer, and became a minister of the Universalist faith in New York city and elsewhere. From 1850 to 1855 he labored as a lecturer upon Spiritualism, in which he became an earnest believer. He preached in Great Britain 1858–61, winning many followers to his system, which combines the Swedenborgian theology and the Platonic philosophy with some of the doctrines of Fourier. His followers, the Brotherhood of the New Life, are found in Great Britain, the U. S., India, and Japan. Their chief establishment, co-operative, but not communistic, was at Wassaic, Dutchess co., N. Y., from 1861 to 1867, when it was removed to Brocton, Chautauqua co., N. Y. The Scriptures and the marriage relation are esteemed sacred by them; proselytism is repudiated; and self-renunciation is regarded as one of the supreme duties of man. Mr. Harris is the author of numerous poetical and prose works explaining his mystical philosophy, one of which is *God's Breath in Man* (1891).

**Harris**, William Logan, D. D., LL. D.: bishop; b. near Mansfield, O., Nov. 4, 1817; joined the Michigan conference in 1837, and after ten years as an itinerant preacher was for three years principal of the Baldwin Institute; he subsequently served from 1851–60, as professor in the Ohio Wesleyan University. In 1860 he was elected assistant secretary to the missionary society of the Methodist Episcopal Church. At the General Conference of his church in 1872 he was elected bishop. He was energetically devoted to his denomination in her greatest enterprises, and was especially eminent in her anti-slavery struggle. He published in 1879, with W. J. Henry, a work on *Ecclesiastical Law*. D. in New York city, Sept. 2, 1887.

**Harris**, William Torrey, A. M., LL. D., D. Sc.: educator; b. at Killingly, Conn., Sept. 10, 1835; entered Yale College in 1854; became a teacher in St. Louis, Mo., 1857, and superintendent of public schools there 1867; was in 1866 one of the founders of the Philosophical Society at St. Louis; founded *The Journal of Speculative Philosophy* 1867, which he has since edited, and in which he has published many translations and original articles upon philosophical questions. It was the first journal of the kind in the English language. His school reports were widely sought for and read both in the U. S. and Europe. Has written on philosophical and sociological subjects for *The Forum*, *The Atlantic Monthly*, *The North American Review*. In 1890 he published *The Logic of Hegel*; in 1891 *The Spiritual Sense of Dante's Divina Commedia*. He was elected president of the Boston Schoolmasters' Club in Oct., 1884, and became U. S. Commissioner of Education in 1889.

**Harrisburg**: town; capital of Saline co., Ill. (for location of county, see map of Illinois, ref. 11–F); on the Cleve., Chi., Cin. and St. L. Railway; 70 miles N. E. of Cairo. It is in an agricultural and fruit-growing region, and has valuable deposits of salt, coal, and iron in its vicinity, and 2 banks and 4 weekly newspapers. Pop. (1880) 934; (1890) 1,723; (1900) 2,202.

**Harrisburg**: city (site settled by John Harris about 1726, known as Harris's Ferry in 1755, laid out as the town of Louisbourg in 1785, incorporated as the borough of Harrisburg in 1791, made the State capital in 1812, and chartered as a city in 1860); capital of Dauphin County and of the State of Pennsylvania (for location of county, see map

of Pennsylvania, ref. 5–G); on the Susquehanna river, the Pennsylvania Canal, and the Penn., the N. Cent., the Phila. and Read., and the Cumberland Valley Railways; 106 miles W. by N. of Philadelphia, 121 miles N. of Washington, D. C. The river is here spanned by four bridges, each over a mile in length—two for railways, one for street railway, and one for carriages. The State Capitol buildings are located in the midst of a beautiful park of more than 15 acres on a gentle rise of ground. The Capitol proper, burned down Feb. 2, 1897, had large porticoes on the east and west fronts, and a spacious ro-

State Capitol, Harrisburg, Pa.

tunda surmounted by a dome. A monument erected to the memory of the soldiers who fell in the Mexican war adorns the Capitol park. Besides the Harrisburg Academy and 3 seminaries, there were in 1900 2 high schools, 28 grammar schools, 83 primary schools, and a teachers' training-school. The various religious denominations had a total of 50 churches. There were 26 building, loan, and savings institutions; 3 national banks with aggregate capital of $500,000, and 2 State banks with aggregate capital of $600,000; and 1 quarterly, 1 monthly, 11 weekly, 1 semi-weekly, and 3 daily periodicals. The charitable institutions comprised a Home for the Friendless, Children's Industrial Home, State Lunatic Asylum, and 7 hospitals. The city has a system of water-works which cost $750,000. gas and electric-light plants, and electric street railways. In 1887 the board of trade compiled statistics of the local manufactures, which showed number of establishments, 403; aggregate capital, $8,511,340; persons employed, 10,402; amount of wages paid during the year, $4,049,418; and value of products, $17,187,910. The principal industries were the manufacture of iron and steel, steam railway cars, foundry and machine-shop products, boots and shoes, clothing, malt liquors, carriages and wagons, silk goods, coffins, marbleized slate, hydraulic cement pipe, flour, brooms, nails, steel barrows, tin, worked wood, brick and tile, galvanized iron cornices, etc. The city ranks seventh in population in the State, and is the see of a Roman Catholic bishop. Pop. (1900) 50,167.

Business manager of "Star-Independent."

**Harrison**: town; capital of Boone co., Ark. (for location of county, see map of Arkansas, ref. 1–C); in Crooked Creek valley; 40 miles S. E. of Eureka Springs, 90 miles S. of Springfield, Mo. It is the center of one of the largest and richest mineral belts in the U. S.; contains a U. S. land-office and three newspapers; and is engaged in farming, milling, and manufacturing. Pop. (1880) 582; (1890) 1,438; (1900) 1,551.

Editor of "Boone Banner."

**Harrison**: village; Hamilton co., O. (for location of county, see map of Ohio, ref. 7–C); on the Cleve., Cin., Chi. and St. L. Railway; 25 miles W. N. W. of Cincinnati. It is in an agricultural region, and contains flour-mills, creameries, distilleries, canning-factory, woolen-mill, and corn-drill, furniture, and carriage factories. Pop. (1880) 1,850; (1890) 1,690; (1900) 1,456.

**Harrison**, Benjamin: a signer of the Declaration of Independence; b. about 1740 at Berkeley, Charles co., Va.; was educated at William and Mary College. He took an early and prominent part in public affairs, and in 1764 was Speaker of the House of Burgesses, and again 1777–82. He was a member of the General Congress from 1774–77, and Governor of Virginia 1782–85. He was the brother of Gen. Charles Harrison, a Revolutionary officer, and father of President William Henry Harrison. D. in Apr., 1791.

**Harrison**, Benjamin: twenty-third President of the U. S.; b. in North Bend, O., Aug. 20, 1833; son of John Scott Harrison, and grandson of William Henry Harrison, the ninth President of the U. S. His great-grandfather, Benjamin Harrison, was a signer of the Declaration of Independence. After attending school he was sent to Farmer's College, at College Hill, near Cincinnati, where he remained two years, and afterward entered Miami University, Oxford, O., where he made a good record as a student and graduated at the age of eighteen. In 1853 he married Miss Caroline L. Scott (b. Oct. 1, 1832; d. Oct. 25, 1892), daughter of the Rev. Dr. John W. Scott, principal of a seminary for young ladies at Oxford. He studied law in Cincinnati, in the office of Storer & Gwynne, and removed in 1854 to Indianapolis, Ind., where he made his home and practiced law. In Oct., 1860, he was elected by the people reporter of the decisions of the Supreme Court of the State. He was commissioned second lieutenant of Indiana Volunteers in 1862, recruited Company A, Seventieth Indiana Volunteer Infantry, and on the reorganization of the regiment was commissioned colonel. He brought his regiment to a high degree of efficiency, and with it participated in the campaign waged by Sherman in 1864 against Johnston. He served with special distinction at the battle of Peach Tree Creek; had charge of the brigade at the battle of Nashville; was breveted brigadier-general Feb., 1865. His military record was in a high degree honorable. He was re-elected reporter of the Supreme Court Oct., 1864, while in the field, and after being mustered out he served in this capacity for four years. In 1876 he was the Republican candidate for Governor of Indiana, but failed of an election. He was appointed a member of the Mississippi river commission in 1879, and the following year was chairman of the Indiana delegates to the Republican national convention at Chicago which nominated Mr. Garfield for the presidency. In the following winter he was elected to the U. S. Senate, and after his election was offered a portfolio in Mr. Garfield's cabinet, which he declined, and took his seat in the Senate Mar. 4, 1881. During six years he rendered valuable service in the Senate, and became known as the advocate of protective duties, civil service reform, and the restoration of the U. S. navy. He was a delegate to the national convention in 1884, where his name was mentioned in connection with the presidency. At the expiration of his term in the Senate he received the votes of the Republican minority in the Indiana Legislature for re-election. He was nominated for the presidency in the national convention of 1888 on the protective tariff platform, and elected after an exciting campaign in which the tariff question was the controlling issue. He received 233 electoral votes, against 168 electoral votes cast for Mr. Cleveland, while the popular vote stood 5,439,853 for Mr. Harrison and 5,540,329 for Mr. Cleveland. Among the notable events of his administration were the passage of the McKinley Bill, the suppression of the Louisiana lottery, the enforcement of the reciprocity policy, the extension of the new navy, the promotion of civil service reform, the arrangement of the international monetary conference, the organization of the Bering Sea arbitration, the difficulty with Chili, and the settlement of the Samoan question. In 1892 he was renominated by the Republican party, being again opposed by Mr. Cleveland as the Democratic candidate. In the following election the Democratic party was successful, Mr. Cleveland receiving 276 electoral votes against 145 for Mr. Harrison. The popular vote stood 5,553,142 for Mr. Cleveland and 5,186,951 for Mr. Harrison. Mr. Harrison was appointed at the close of his term lecturer in International Law in Stanford University. D. March 13, 1901. C. H. Thurber.

**Harrison**, Constance Cary: See the Appendix.

**Harrison**, Frederic: author; b. in London, Oct. 18, 1831; educated at Oxford; graduated in 1853; called to the bar in 1858; was a member of the commission upon trades-unions 1867–69; secretary to the royal commission for the digest of the law 1869–70; and from 1877 to 1889 was Professor of Jurisprudence and International Law at Lincoln's Inn Hall. In philosophy he is a follower of Comte, and was one of the founders of the Positive school in England in 1870. In politics he is a Liberal and a Home Ruler. His

chief works are *The Meaning of History* (1862); *Order and Progress* (1875): an English translation of the second volume of Comte's *Politique Positive*; *The Choice of Books, and other Literary Pieces* (1886); and *Oliver Cromwell* (1888).

**Harrison,** Gabriel: See the Appendix.

**Harrison,** James Albert: See the Appendix.

**Harrison,** John: inventor; b. in Faulby, Yorkshire, England, 1693; was bred a carpenter; produced a new escapement for clocks and watches and a compensation (gridiron) pendulum 1725; went to London 1735; invented the nautical chronometer 1736, and perfected it in 1759; received in consequence (1767) a prize of £20,000 offered in 1714 for the invention of means by which mariners could tell their longitude within 30 miles. D. in London, Mar., 1776.

**Harrison,** Susan F.: Canadian author; b. in Toronto, Ontario, Feb. 24, 1860. She was for a time literary editor of the Toronto *Week*; has been a teacher of music and literature, published various musical compositions of merit, and has been a successful contributor to periodicals. Among other works she has published are the following: *Crowded Out, and other Sketches* (Ottawa, 1889); an anthology entitled *French and English Native Writers* (Toronto, 1889); *Pine, Rose, and Fleur-de-Lis* (Toronto, 1891).

Neil Macdonald.

**Harrison,** Thomas Alexander: figure, marine, and landscape painter; b. in Philadelphia, Pa., Jan. 17, 1853; pupil of Gérôme, Paris; member Société Nationale des Beaux-Arts, Paris; Royal Institute, London; and Society of American Artists (1885); honorable mention, Paris Salon, 1885; first-class medal, Paris Exposition, 1889; Legion of Honor and Officer of Public Instruction 1889; medal, Munich Exposition, 1890; represented in the state collection, France. *Le Crépuscule*, a marine view under an effect of moonrise, attracted great attention when exhibited at the Salon, and received a prize of $2,500 at the American Art Association, New York (not a professional society), in 1887. It is now in the Museum of Fine Arts, St. Louis, Mo. *The Amateurs*, a picture of children fishing, is in the Art Institute, Chicago, Ill. *In Arcady*, a realistic study of nude figures in a landscape, is a canvas remarkable for harmony in the color scheme and truth to nature. *Castles in Spain* is in the collection of J. G. Johnson, Philadelphia. Studio in Paris.

William A. Coffin.

**Harrison,** William Henry: ninth President of the U. S.; b. Feb. 9, 1773, at Berkeley, in Charles co., Va.; studied at Hampden-Sidney College with a view to entering the profession of medicine. In 1791 he became an ensign in the army, and in 1792 a lieutenant on Wayne's staff. In 1797 he was made captain and commandant of Fort Washington, now Cincinnati, O. On the conclusion of peace with the Indians, he resigned his commission in 1798, and was immediately appointed secretary of the Northwest Territory. This position he resigned in 1799 in order to take a seat as delegate in Congress. He was (1801–13) Governor of Indiana Territory and superintendent of Indian affairs, and as such concluded thirteen important treaties and gained the battle of Tippecanoe, Nov. 7, 1811. In 1812 he was made major-general of Kentucky militia and brigadier-general in the army, with the command of the northwest frontier. In 1813 he was made major-general, and as such won much renown by the defense of Fort Meigs and the battle of the Thames, Oct. 5, 1813. In 1814 he left the army, and was employed in Indian affairs by the Government. He was a member of Congress from Ohio 1816–19; State Senator 1819–21; U. S. Senator 1825–28; presidential elector 1821 and 1825· U. S. minister to Colombia 1828–29; after which he retired to his farm at North Bend, Hamilton co., O., 16 miles below Cincinnati, where for twelve years he was clerk of the county court. In 1839 he was nominated for the presidency by the Whigs at Harrisburg, Pa., Mr. Van Buren being the Democratic candidate, and Gen. Harrison received 234 electoral votes against 60 for his opponent. Mass meetings and processions were introduced for the first time in a presidential campaign, and the watchwords "log cabin" and "hard cider" (referring to statements of his political adversaries as to the general's habitation and his favorite drink) were effectively used by the Whigs, and aroused a wonderful popular enthusiasm. President Harrison died April 4, 1841, thirty-one days after his inauguration. He published in 1838 a small work on the Indians of the Ohio valley. See his *Life* by Dawson (1824), by Hall (1836), by Hildreth (1839), by Burr (1840), by Isaac R. Jackson and others.

Revised by C. K. Adams.

**Harrison,** William Pope, D. D., LL. D.: author and minister; b. at Savannah, Ga., Sept. 3, 1830; educated at Emory College, Oxford, Ga.; after serving as a pastor, he was in 1870 elected, by the General Conference of the Methodist Episcopal Church South, editor of *The New Monthly Magazine*; in 1882 book editor; in 1886 and 1890 editor of *The Quarterly Review*; served four years as chaplain of the House of Representatives, Washington; was a member of five general conferences of his Church; secretary of the General Conference 1890; was a member of the platform committee of the Œcumenical Conference at Washington 1891, and a member of the London Œcumenical Conference in 1881. He has published *Theophilus Walton, or the Magnets of Truth*, a controversial work (1858); *Lights and Shadows of Forty Years* (1883); *The Living Christ* (1884); *The High Churchman Disarmed, a Defense of our Fathers* (1886); *Methodist Union* (1892); *The Gospel among the Slaves* (1893).

**Harrisonburg:** city; capital of Rockingham co., Va. (for location of county, see map of Virginia, ref. 5–F); on the Balt. and O. Railroad; 25 miles N. of Staunton, 125 miles N. W. of Richmond. It is in the beautiful Shenandoah valley, is engaged in farming, and has 8 churches, 1 private and 2 public schools, a tan-yard, and 4 weekly newspapers. Pop. (1880) 2,831; (1890) 2,792; (1900) 3,521.

Editor of "Spirit of the Valley."

**Harrisonville:** town; capital of Cass co., Mo. (for location of county, see map of Missouri, ref. 4–D); on the Kan. C., Ft. S. and Mem., the Kan. C., Osceola and So., and the Mo. Pac. Railways; 45 miles S. S. E. of Kansas City. It has 8 churches, 2 public schools, high school with large general library, electric-light plant, 4 weekly newspapers, machine-shops and foundry, and steam flour-mill. It is in an agricultural and coal region. Pop. (1880) 1,113; (1890) 1,645; (1900) 1,844.

Editor of "Cass County Democrat."

**Harrodsburg:** town; capital of Mercer co., Ky. (for location of county, see map of Kentucky, ref. 3–H); on the Louisville S. Railroad; 30 miles S. of Frankfort. It contains an academy, high school, 2 flour-mills, grain-elevator, distillery, 2 planing-mills, ice-factory, electric-light plant, water and sewage systems, and 2 weekly newspapers. It is in an agricultural region, and has numerous mineral springs. Pop. (1880) 2,202; (1890) 3,230; (1900) 2,876.

Editor of "Democrat."

**Har'rogate,** or **Har'rowgate:** watering-place of Yorkshire, England; 20 miles W. of York (see map of England, ref. 6–I). Its sulphurous and chalybeate springs are much frequented during summer, and have very beneficial effects in diseases of the skin, scrofula, dyspepsia, and gout. Pop. (1891) 13,917.

**Har'row,** or **Harrow-on-the-Hill:** town and parish of Middlesex, England; on the London-Birmingham Railway, 12 miles N. W. of London; chiefly famous for its school, founded in 1571 as a free school for poor boys, now one of the most exclusive of English classical schools. It has about 600 students. Pop. of parish (1891) 5,725.

**Harrowby,** Hon. Dudley Francis Stuart Ryder, Earl of: politician; b. in Brighton, England, Jan. 16, 1831; educated at Harrow School and Christ Church, Oxford; entered Parliament as Viscount Sandon in 1856; was vice-president of the council of education 1874–78; introduced Education Act 1876; president of the Board of Trade under Lord Beaconsfield 1878–80; Lord Privy Seal in Salisbury's government 1885–86; member of royal commission on education 1886–89.

**Harsha,** David Addison: See the Appendix.

**Hart:** See Stag.

**Hart,** Albert Bushnell: professor of history; b. in Clarksville, Pa., July 1, 1854; A. B., Harvard, 1880; Ph. D., Freiburg, 1883; has been fellow, instructor, and Assistant Professor of History in Harvard University. Author of *Coercive Powers of the United States Government* (1885); *Topical Outline of the Courses in Constitutional and Political History of the United States* (1884–90); *Introduction to the Study of Federal Government* (1890); *Epoch Maps Illustrating American History* (1890); *Formation of the Union* (1892).

**Hart,** Charles Henry: See the Appendix.

**Hart,** George Vaughan: See the Appendix.

**Hart,** Henry Martyn, S. T. D. (Trinity College, Dublin): clerical writer; b. in Otley, Yorkshire, England, Mar. 3, 1838; educated in England; principal of Wriothesley House School, Blackheath, Kent, 1862–79, and incumbent of St. Germain's

church, Blackheath; became dean of St. John's Cathedral, Denver, Col., in 1879. He was editor of *The World of the Sea*, and contributed mineralogical and geological articles to *The Popular Educator*; published *Elementary Chemistry* (1870); *The Children's Service-book, with Music and Sermons* (1875); *The Book of Family Prayer* (1876); *The Preacher's Legacy* (1879); *Purgatory* (1885); *Notes on the Jewish Sacrifices* (1889); *Service-book and Hymnal for Evening Service and Sunday-schools* (1891).

**Hart**, James McDougal: landscape-painter; b. at Kilmarnock, Scotland, May 10, 1828. He was taken to the U. S. when three years of age; studied painting with his brother, William Hart, and later in Düsseldorf under Schirmer. National Academician 1859; third-class medal, Paris Exposition, 1889. Among his works are *Drove at the Ford* (1874), in the Corcoran Gallery, Washington; *Adirondacks* (1859), in the collection of W. T. Walters, Baltimore. Studio in New York. W. A. C.

**Hart**, Joel T.: sculptor; b. in Clarke co., Ky., in 1810; bred a mason. While working in 1830 at Lexington, Ky., as a stone-cutter he began modeling in clay, and soon won reputation. His statue of Henry Clay, which he began in 1846, owing to a shipwreck and other causes of delay was not set up for many years; it is in Richmond, Va. The *Angelina, Woman Triumphant* (in the court-house at Louisville, Ky.), and *Il Penseroso* are among his best works. He made many portrait-busts, and invented a mechanical contrivance for modeling heads from life. D. at Florence, Italy, Mar. 2, 1877. Revised by Russell Sturgis.

**Hart**, Samuel, M. A., D. D.: scholar; b. at Saybrook, Conn., June 4, 1845; educated at Trinity College, Hartford; since 1868 tutor, adjunct tutor, and professor in that institution; registrar of diocese of Connecticut since 1874; custodian of Standard Prayer-book since 1886; secretary of American Philological Association 1873–78; president of same 1891–92; secretary of the House of Bishops 1892; elected Bishop of Vermont 1893, but declined the appointment; published editions of *Juvenal* (1873); of *Persius* (1875); and of Bishop Seabury's *Communion Office* (1874; second ed. 1876); *Historical Address at Quadri-millennial of Saybrook, Conn.* (1885); and of *Guilford, Conn.* (1889); *Historical Sermons of Bishop Seabury* (1883–86).

**Hart**, William: landscape and cattle painter; b. at Paisley, Scotland, Mar. 31, 1823; self-taught; removed to U. S. in boyhood; studied in Scotland 1849–52; National Academician 1858; member American Water-color Society, president 1870–73. D. at Mt. Vernon, N. Y., June 17, 1894.

**Hart-Dyke**, Sir William: See the Appendix.

**Harte**, Francis Bret: novelist; b. at Albany, N. Y., Aug. 25, 1839. In 1856 he went to California, dug gold, taught school, engaged in the express business, set type in the office of *The Golden Era*, became editor of *The Californian*, a literary weekly, and was appointed secretary of the U. S. branch mint in San Francisco in 1864. Some of the poems which he published in San Francisco papers during the following years—*The Society upon the Stanislaw, The Pliocene Skull, John Burns of Gettysburg*, etc.—attracted great attention, and in 1868 he started *The Overland Monthly*. The two sketches which he contributed to this paper, *The Luck of Roaring Camp* and *The Outcasts of Poker Flat*, made quite a sensation, and with the publication in 1870 of his poem, *The Heathen Chinee*, his popularity culminated. In 1871 he removed to New York city; was appointed U. S. consul at Crefeld, Germany, in 1878, and at Glasgow in 1880, where he served till 1885. He afterward resided in London. Among his books are *Condensed Novels* (1867); *Poems* (1870); *Echoes of the Foot Hills* (1874); *Tales of the Argonauts* (1875); *On the Frontier* (1884); *Maruja* and *By Shore and Sedge* (1885); *A Phyllis of the Sierras* (1887); *A Waif of the Plains* (1890); *A Protégée of Jack Hamlin's* (1894); *Clarence* (1895).

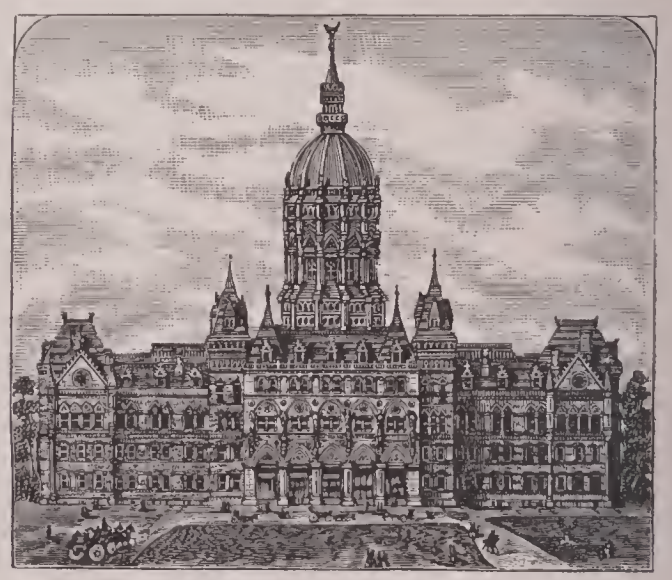
**Harte-beeste**, haart'beest, or **Caama**, kaa'ma [*harte-beeste* is South African Dutch; *harte* for European Dutch *hert*, *hart* + *beeste*, animal]: *Alcelaphus caama*, a large antelope of South Africa, which is extremely swift, and is hunted for its flesh, which resembles beef. The harte-beestes go in great herds. They are often domesticated. The bastaard harte-beeste, or sassaby (*Antilope lunata*), also lives in South Africa, toward the tropic.

**Har'tel**, Wilhelm, von: philologist; b. in Hof, Moravia, May 29, 1839; studied in Vienna; privat docent 1866; professor extraordinary 1869; ordinarius 1872; member of the Vienna Academy 1875; of the Berlin Academy 1893; raised to the peerage in 1882. His principal works are *Homerische Studien, Studien über das attische Staatsrecht, Demosthenische Studien*. Editor of Eutropius, Cyprian, and Ennodius for the *Corpus Script. Ecclesiast.* He founded the *Wiener Studien* in 1877. Alfred Gudeman.

**Har'tenstein**, Gustav: philosophical writer; b. at Plauen, Germany, Mar. 18, 1808; became in 1834 extraordinary and in 1836 regular Professor of Philosophy at Leipzig; is of Herbart's school of thought, and has done much to make his master's teachings understood. Among his works are *Probleme und Grundlehren der allgemeinen Metaphysik* (1836); *Die Grundbegriffe der ethischen Wissenschaften* (1844); *Historisch-philosophische Abhandlungen* (1870). He also edited Herbart's and Kant's complete works.
Revised by W. T. Harris.

**Hartford**: city and port of entry; an important railway and commercial center; capital of Connecticut and county-seat of Hartford County; on the west bank of the Connecticut river, 50 miles from its mouth and at the head of navigation, except for small boats; lat. 41° 45′ 59″ N., lon. 72° 40′ 45″ W. (see map of Connecticut, ref. 8–H). It is on the Hartford and the Highland Divisions of the New York, New Haven and Hartford Railroad; 111 miles from New York and 124 miles from Boston. It is the eastern terminus of the Central New England and Western Railway (Poughkeepsie bridge route), and the northern terminus of the Valley Division of the New York, New Haven and Hartford Railroad, extending to Long Island Sound at Saybrook, about 45 miles.

Hartford covers an area of about 17 sq. miles, and lies on terraces and low hills, from the highest parts of which fine views of the Connecticut river valley are obtained. It is laid out with much regularity. Main Street, the chief thoroughfare, on which are situated some of the largest stores and insurance buildings, extends N. and S., and other important streets are parallel with it or cross it at right angles. Asylum Hill, which is almost exclusively a residence section, is crossed by Asylum and Farmington Avenues, running E. and W. and uniting to form Asylum Street, the seat of an extensive and varied business. The city is intersected by Park river, a narrow stream which empties into the Connecticut and is crossed by numerous bridges, one of which, supporting a soldiers' memorial arch, forms an approach to the new State-house. Aside from the



New State Capitol, Hartford, Conn.

relics preserved in the Historical Society rooms and in the new State-house, the old State-house, now the city-hall, built in 1794–96, the graveyard in the rear of the Center or First (Congregational) church, and a few mansions antedating the Revolutionary war, comprise the most interesting antiquities of the city. Many of the banks, insurance buildings, and business blocks, and some of the churches, are large and handsome structures, as are the buildings of Trinity College. Bushnell Park, named in honor of its projector, Horace Bushnell, D. D., is a tract of land drained by Park river, is beautifully laid out, and with the adjoining grounds of the new State-house comprises 46 acres. Charter Oak Park, containing fair-grounds and a trotting-park, lies on the outskirts of the city.

The prominent business interests are insurance and manu-

factures. There are 7 fire-insurance companies (including a mutual company), having a capital of $9,750,000. Their gross assets in Jan., 1901, were $40,767,693.52; the surplus was $15,018,700.11. There is also here a steam-boiler insurance company. There are 6 life-insurance companies (including accident), two of them mutual companies, with assets amounting to $152,098,206, and a surplus of $21,217,194. Hartford has 8 national banks (aggregate capital, $5,475,000; deposits, about $15,000,000), 4 trust companies (capital, $850,000; deposits, $3,450,447.42), 4 State banks (capital, $1,150,000; deposits, $4,590,296.54), and 4 savings-banks, one of them the largest in New England, with aggregate deposits of $31,885,753.01. The manufactured articles include firearms, steam-boilers, steam-engines, machinery, nails, screws, pins, bicycles, carriages, automobiles, furniture, pumps, hosiery and knit goods, subscription-books, and envelopes. Some of its factories have a worldwide reputation. Many factories in other towns, such as those producing edge tools, carpets, underwear, and silks, are controlled by Hartford corporations. The number of manufactories in 1901 was about 550; hands employed, about 10,000; value of products, nearly $20,000,000. Hartford is a central market for Connecticut leaf tobacco. In 1887 it was made a port of entry, superseding Middletown. The city has a paid fire department and an electric fire-alarm telegraph system. Water is supplied from large storage reservoirs on the slope of Talcott Mountain, W. of the city. There is telephone connection with the leading towns of the State and with other States.

The educational institutions are Trinity College, Hartford Theological Seminary (Congregational), Hartford High School, with which is incorporated Hopkins Grammar School, endowed in 1657, Collins Street Classical School, Woodside Seminary for Young Ladies, 2 nunneries, Roman Catholic parochial schools, and a complete system of public schools. The Hartford Public (free circulating), Trinity College, the State, Theological Seminary, Watkinson Reference, and Historical Society libraries have large and important collections. There are 4 daily papers, 2 Sunday papers, and many other publications. Among public institutions are the American School for the Deaf, the oldest asylum of the kind in the U. S., a hospital, the Old People's Home, the Watkinson Juvenile Asylum, the Young Men's Christian Association, the Women's Christian Association, the City Mission Society, and the Union for Home Work. A Retreat for the Insane is situated in the south part of the city. St. Joseph's Cathedral is the seat of the Roman Catholic bishop of the diocese of Hartford.

Hartford was settled in 1635 by emigrants from Newtown (now Cambridge, Mass.), re-enforced in 1636 by a company constituting the Puritan church at Newtown, led by its pastor, Rev. Thomas Hooker. In 1637 the settlement, which had been called Newtown, was renamed after Hertford, England, the birthplace of Rev. Samuel Stone, the teacher of the church. A classical school was opened in 1638; in 1639 the planters of Hartford, Windsor, and Wethersfield adopted at Hartford a written constitution, the first framed in America. In 1654 the general court of Connecticut dispossessed some Dutch traders who since 1633 had held a fort at the mouth of Park river. In 1687 Sir Edmund Andros, Governor-General of New England, made at Hartford an unsuccessful attempt to seize the charter granted to Connecticut in 1662. (See CHARTER OAK.) Hartford was the sole capital of the colony of Connecticut until 1701. From that year until 1873 New Haven was one of the capitals. In 1873 a constitutional amendment was adopted making Hartford the sole capital again. A handsome new State-house, built at a cost of about $2,500,000 and completed in 1880, was erected on ground purchased from Trinity College. The old State-house, in which in 1814–15 the HARTFORD CONVENTION (*q. v.*) held its sessions, stands in State-house Square in the heart of the city. Pop. (1890) 53,230; (1900) 79,850. See *Memorial History of Hartford County, Connecticut* (2 vols., Boston, 1886).

Revised by WILLIAM A. GRAHAM.

**Hartford**: village; Van Buren co., Mich. (for location of county, see map of Michigan, ref. 8–H); on the Chi. and W. Mich. and the Tol. and S. Haven Railways; 17 miles N. E. of Benton Harbor; 19 miles N. E. of St. Joseph. It is in an agricultural region and the richest part of the famous Michigan fruit belt, and contains 5 churches, union school, flour and saw mills, brick and tile works, and 2 weekly newspapers. Pop. (1880) 838; (1890) 1,044; (1900) 1,077.

EDITOR OF "DAY SPRING."

**Hartford City**: town; capital of Blackford co., Ind. (for location of county, see map of Indiana, ref. 5–G); on the Ft. W., Cin. and Louisv. Railroad and the Penn. lines; 40 miles S. of Fort Wayne, 75 miles N. E. of Indianapolis. It is in the center of the natural gas belt, and manufactures window-glass, straw boards, paper, wood pulp, machinery, flour, and hubs and spokes. Pop. (1880) 1,470; (1890) 2,287; (1900) 5,912.

EDITOR OF "TELEGRAM."

**Hartford Convention**: a political convention held at Hartford, Conn., between Dec. 15, 1814, and Jan. 5, 1815, for the purpose of considering the interests of the New England States in relation to the war with Great Britain. It consisted of twelve delegates from Massachusetts, seven from Connecticut, three from Rhode Island, two from New Hampshire, and one from Vermont. The president was George Cabot, of Massachusetts, and the secretary Theodore Dwight, of Connecticut. The convention sat in secret session for three weeks, and then issued a report to the Legislatures of the States represented.

The purpose of the convention will be made clear by a brief review of the antecedent political condition. The Democratic, or, as it was then called, the Republican or Anti-Federalist party, came into power in 1800, and very soon had a strong majority not only in the South but also in the West. The course of the Government, including Congress, was directed, it was thought, very largely to the development of agricultural interests at the expense of the interest of manufactures and commerce. This policy aroused not a little hostility and bitterness on the part of New England, the stronghold of the Federalists. In 1812 the Republicans succeeded in carrying, as a strict party measure, a bill declaring war against Great Britain for the purpose of enforcing an abandonment of the right of search and the right of impressment. To this war the Federalists of New England were unanimously and strenuously opposed, for reasons which were set forth in an address to the people. They denounced the projected invasion of Canada in most vigorous terms, as "cruel, wanton, senseless, and wicked." When summoned to supply their quota of militia, the Governors of Massachusetts and Connecticut denied the power of the President to make such a draft, "except to execute the laws, suppress insurrections, or repel invasions." That this declaration was approved by the people was indicated by the fact that immediately afterward they chose an overwhelming majority of Federal members of the Legislature. In every step that was taken the New England Federalists insisted upon the strictest and most limited construction of the Federal Government's constitutional powers. In 1813 the Legislature of Massachusetts declared the war "impolitic and unjust," and refused to vote thanks for naval victories, for the reason that "in a war like the present, waged without justifiable cause, and prosecuted in a manner indicating that conquest and ambition are its real motives, it is not becoming a moral and religious people to express any approbation of military and naval exploits not immediately connected with the defense of our seacoast and soil." The Federalists of New England presented a united front of opposition to all the measures of the war. Meantime the Federal Government, urged on by the desperation of the Republican leaders, deemed itself driven to attempt to raise men by conscription and impressment. A proposition was presented in Congress to enforce a draft, and to enlist minors without the consent of their parents. While these provisions were under consideration the defense of the New England coast was neglected; the commerce and fisheries of New England were open to destruction; and New England practically had no voice in the conduct of affairs. In Feb., 1814, a committee of the Legislature of Massachusetts declared: "We believe that this war, so fertile in calamities, and so threatening in its consequences, has been waged with the worst possible views, and carried on in the worst possible manner, forming a union of wickedness and weakness which defies, for a parallel, the annals of the world." In view of such expressions it is not singular that New England had no influence in the conduct of the war. The administration believed there was evidence of a disloyal intention, and even went so far as to send agents to search for evidence of a secret plot to separate that portion of the country from the Union and place it as a grand duchy under an English prince. The condition seemed to be so threatening that the President, at the request of Congress, appointed Jan. 12, 1815, as a national day of fasting and prayer.

It was when public affairs were in this condition that the convention met Dec. 15, 1814. After three weeks of deliberation it issued its report. It denied "any present intention to dissolve the Union," but admitted that "if a dissolution should become necessary by reason of the multiplied abuses of bad administration, it should, if possible, be the work of peaceable times and deliberate consent." It proposed that Congress should pay into the State treasuries their portion of the taxes raised in the States, and that it should intrust the States with their own defense. It laid down the general principle that "it is as much the duty of the State authorities to watch over the rights *reserved* as of the U. S. to exercise the powers that are *delegated*." It recommended constitutional amendments to deprive the Southern States of the representation of three-fifths of their slaves; that two-thirds of both houses of Congress should be necessary for the admission of new States; that the votes of two-thirds of both houses should be necessary to declare an embargo or a war; that naturalized citizens should not be eligible to Congress; and that the President should not be eligible for re-election. The Legislatures of Massachusetts and Connecticut adopted these recommendations, and sent delegates to Washington to urge them upon the administration and Congress; but before the delegates arrived the defeat of the British by Gen. Jackson at New Orleans had aroused a public enthusiasm which would listen to no complaints or memorials. No attention whatever was paid to the recommendations, but they are of great historic interest and importance, as showing that the disruption of the Union under certain possible contingencies was contemplated in New England as well as in other parts of the country. It was the taunt of Senator Hayne, of South Carolina, in regard to the Hartford convention and the part of Nathan Dane in it, that called forth one of the most eloquent and famous passages of Daniel Webster's celebrated reply.

Authorities.—Dwight's *History of the Hartford Convention*; Ingersoll, *History of the Second War with Great Britain*; Adams, *Documents Relating to New England Federalism*; Holmes, *Annals*; Goodrich, *Recollections*; Quincy, *Life of Quincy*; Benton, *Debates of Congress*.

C. K. Adams.

**Hartig**, haar'tich, Georg Ludwig: writer on forestry; b. at Gladenbach, near Marburg, in Hesse, Germany, Sept. 2, 1764; studied in the University of Giessen, and became successively inspector of forests to the Prince of Solms-Braunfels in 1786, to the Prince of Orange-Nassau in 1797, to the King of Würtemberg in 1806, and to the King of Prussia in 1811. As early as 1787 he founded a school for instruction in forestry at Hungen in the Wetterau, and he afterward carried his school along with him from place to place, until he finally succeeded in 1812 in having the institution connected with the University of Berlin. Among his numerous books on forestry, the principal are *Lehrbuch für Jäger*, *Lehrbuch für Förster*, *Kubiktabellen für geschnittene, beschlagene, und runde Hölzer*, *Lexikon für Jäger und Jägdfreunde*, etc., which have often been republished. D. in Berlin, Feb. 2, 1836.

**Hartington**: village (founded 1883); capital of Cedar co., Neb. (for location of county, see map of Nebraska, ref. 8–G); on the Chi., St. P., Minn. and Omaha Railway; 22 miles S. by E. of Yankton, S. D. It is in an agricultural and stock-raising region, is engaged in milling and brick-making, and has 2 banks and 2 weekly newspapers. Pop. (1890) 834; (1900) 971.

Editor of "Herald."

**Hartington**, Marquis of, Spencer Compton Cavendish, LL. D., P. C., now Duke of Devonshire: statesman; b. July 23, 1833; graduated at Trinity College, Cambridge, in 1854; was connected with the special mission of Earl Granville to Russia in 1856; in 1857 became a member for North Lancashire in the House of Commons; was appointed a lord of the admiralty in Mar., 1863, and in April of same year became Under Secretary of State for War; in Feb., 1866, became Secretary of State for War; retired in July of same year; lost his seat for North Lancashire in Dec., 1868; in 1869 was returned for New Radnor, having first become Postmaster-General in Mr. Gladstone's cabinet; held that office till Jan., 1871, and then became Chief Secretary for Ireland; retired in Feb., 1874, with his party; succeeded Mr. Gladstone as the leader of the Liberal party in the House of Commons; received the freedom of the city of Glasgow, Nov. 5, 1877, and became lord rector of the University of Edinburgh, Jan. 31, 1879; in Apr., 1880, he became M. P. for Northeast Lancashire; Secretary of State for India from May, 1880, to Dec. 16, 1882, when he became Secretary of State for War; resigned June, 1885. He refused to join Gladstone's Home Rule cabinet in 1886, and became a leader of the Liberal Unionists, giving Lord Salisbury's government his support, though refusing to become a member of the cabinet. On the death of his father, the Duke of Devonshire, Dec. 21, 1891, he succeeded to his title and estates. He married the Dowager Duchess of Manchester Aug. 16, 1892.

**Hartlaub**, haart'lowp, Carl Johann Gustav, M. D.: ornithologist; b. at Bremen, Germany, Nov. 8, 1815; educated at the universities of Bonn, Berlin, and Göttingen. Dr. Hartlaub is a member of various scientific societies and is one of the few honorary members of the American Ornithologists' Union. He has devoted much attention to the question of the geographical distribution of birds. His most important publications have treated of the birds of Africa, Madagascar, and Polynesia. Among them are *System der Ornithologie Westafrikas* (Bremen, 1857); *Beitrag zur Fauna Zentral-Polynesiens*; *Die Vögel Ostafrikas* (Leipzig, 1870; this in conjunction with Dr. Friedrich H. Finsch; *Die Vögel Madagascars und der benachbarten Inselgruppen*; *Ein Beitrag zur Zoologie der Æthiopischen Region* (Halle, 1877.)

F. A. Lucas.

**Hartlepool**: a municipal borough of England, constituting with the municipal borough of West Hartlepool a parliamentary borough; in the county of Durham; 18 miles E. S. E. of Durham. It is situated on a peninsula projecting into the North Sea, and has a good harbor (see map of England, ref. 4–I), which communicates with the port of West Hartlepool. It was for years a well-frequented bathing-place, but is now chiefly engaged in the coal-trade. Pop. (1891) 21,521. Fishing, the building of iron ships, the manufacture of cement and of marine engines, are important industries. Hartlepool contains a hospital and an ancient parish church. West Hartlepool, which adjoins Hartlepool, was founded in 1847, and became a municipal borough in 1889. It contains extensive docks and ship-building yards, and manufactures cement, marine engines, and wood-pulp. It has a large trade with Germany, Holland, and Russia, and exports coal, grain, timber, agricultural products and other articles of commerce. It has a school of art, a mechanics' institute, an athenæum, custom-house, market-house, and other public buildings. Pop. (1891) 42,492.

**Hartley**, Sir Charles Augustus, F. R. S. E., K. C. M. G.: civil engineer; constructor of improvement of the Sulina mouth of the Danube; b. at Heworth, Durham, England, in 1825. In 1845, after a practical course of instruction in mining and railway engineering at Bishop Auckland and Leeds, he was district engineer on the Scottish Central Railway until 1848; next resident engineer at Sutton harbor, Plymouth. On the completion of the harbor in 1855, he accepted a commission as captain of Turkish engineers, and served through the Crimean war, receiving the Turkish war medal. In 1856 Mr. Hartley was chosen engineer to the European commission on the Danube, on the recommendation of Lieut.-Gen. Sir John Stokes and Gen. Sir John Burgoyne. He inspected the Suez Canal works and reported on them to his Government. He was knighted in 1862. In 1867 he received against twenty competitors the Russian competition prize for plans for enlarging the harbor of Odessa. In 1874 he recommended the improvement of the south pass of the Mississippi; was a member of Mr. Ead's advisory board, and was consulted by him up to the completion and success of the jetties. He was consulted as to the Cattewater breakwater at Plymouth, England; made plans for enlarging the harbor of Kustendjie, Roumania, and harbor at Bourgas; in 1884–85 became a member of the international technical commission for the improvement of the Suez Canal. Author of *The Delta of the Danube*, *Public Works of the United States and Canada*, and *Inland Navigation in Europe*. He has received the orders of Medjidie and the Star of Roumania, and the Stephenson prize, Telford medal, Watt medal, Telford premium, and Manby premium of the Institution of Civil Engineers.

William R. Hutton.

**Hartley**, David, M. D.: philosopher; b. at Armley, Yorkshire, Aug. 30, 1705; became a fellow of Jesus College, Cambridge, where he graduated M. A. in 1729; was educated for the Church, but on account of conscientious scruples chose the profession of medicine. He practiced at Newark, Bury St. Edmunds, London, and Bath. He was a man of simple and benevolent character and virtuous life; wrote some medical works, but is chiefly remembered for his

*Observations on Man* (1749), which gave him a brilliant though transient fame. He was a firm necessitarian, and was perhaps the first philosopher who attempted to explain psychological phenomena by reasoning based mainly upon physiological data. He made some valuable observations, especially on the theory of the association of ideas, anticipating later theories. D. in Bath, Aug. 25, 1757.

**Hartley**, JONATHAN SCOTT: See the Appendix.

**Hartlib**, SAMUEL: See the Appendix.

**Hart'mann**, KARL ROBERT EDUARD, von: philosopher; b. in Berlin, Germany, Feb. 23, 1842. He was educated at the School of Artillery, and became an officer in 1861; but in 1862 he accidentally hurt his foot, and an incurable disease which set in has since that time confined him almost without interruption to his bed, where he occupies himself with literary and philosophical studies. In 1868 he published *Ueber die dialektische Methode*; in 1869 *Schellings positive Philosophie*; in 1871 *Das Ding-an-sich und seine Beschaffenheit*; but his principal work is his *Philosophie des Unbewussten* (1869). His idea is to connect the results of the abstract philosophy with those of the concrete inductions of natural science. The point in which these two lines of research meet each other and prove each other is the unconscious. The unconscious in nature has a will—not a merely blind, irrational will (*Schopenhauer*), but one which can determine itself to prototypal ideas; and an idea—not a merely logical idea (*Hegel*), but one which can reach reality by will. In the mind this will and this idea become conscious by means of brain and nerves, but the unconscious is still at work in the instincts, in love, in the formation of language, etc., and in the unconscious the "first principles" are to be found. The execution of this idea is very ingenious, and has attracted great attention in Germany, in spite of the sad coloring of pessimism which pervades it. Among his works are *Die Selbstzersetzung des Christenthums und die Religion der Zukunft* (1874); *Kritische Grundlegung des transcendentalen Realismus* (1875); *Philosophische Fragen der Gegenwart* (1885); *Spiritismus* (1885); *Moderne Probleme* (1885).

**Hartmann**, JACOB, Baron von: soldier; b. a French citizen in the Bavarian palatinate, Feb. 4, 1795; received his education in the military institutions of Bonn and St.-Cyr, and entered Dec. 1, 1811, as a lieutenant, the First Regiment of the grand duchy of Berg. He fought 1813–15 under French colors in the Twenty-seventh Regiment of the line. At Waterloo he saved the eagle of the regiment, and was made a knight of the Legion of Honor. After the peace of Paris (1815) he left the French service and entered the Tenth Bavarian Regiment of infantry. In the topographical department and by travels in foreign countries he extended his knowledge, and was attached to the staff in 1824. In 1842 he was appointed adjutant to the Crown Prince Maximilian, in 1848 adjutant to the king, and in 1849 major-general. In this position he exerted himself for the improvement of the Bavarian army, its organization, and its fighting capacity, but he encountered great difficulties from the political situation of the kingdom. In 1854 he visited France, especially Paris, and carefully studied the French military system. His investigations of this subject, together with a study of the Italian war of 1859, were embodied in a military work which he published in 1860. In 1861 he became lieutenant-general and commander of the fourth division of infantry, and as such took part in the war of 1866. In 1869 he became a general of infantry, and led the second Bavarian Army-corps against France in 1870 and 1871. He took part with great distinction in the encounter at Weissenburg, contributed considerably to the victory in the battle of Wörth by his energetic advance on the French left wing and line of retreat, took the fortress of Marsal, fought at Sedan, and kept, during the siege of Paris, the plateau of Chatillon occupied. D. at Würzburg, Feb. 22, 1873.

**Hartmann**, JULIUS, von: soldier; b. Mar. 2, 1817, at Hanover, where he received his education at the military school. In 1834 he entered the Tenth Prussian Regiment of Hussars, and in 1848 he was attached to the staff. He was often employed in diplomatic missions on account of his elegant education and address; thus he was sent in 1850 to Schleswig-Holstein, and later to Austria and Saxony, to represent Prussian interests. After various occupations in the ministry of war and in the staff, he was made a major-general in 1865, and commander of Coblentz. In 1866 he commanded a division of cavalry, and took part in the encounters of Zwithau, Tobitschau, and Rokeinitz. In 1867 he was given the difficult task of reorganizing the Bavarian army in harmony with the army organization of Prussia, a task which he performed with great success. In the Franco-German war he received the command of the first division of cavalry, and fought at Courcelles and Gravelotte. Jan. 6, 1871, he was appointed commander of a larger detachment, comprising all arms, with which he operated in the region between the Loire and the Loir, and took Tours Jan. 13. After the war he became governor of Strassburg, a position of great political importance, and in 1874 was made a general of cavalry. D. Apr. 30, 1878.

**Hartmann**, MORITZ: novelist and poet; b. of Jewish stock at Duschnik, in Bohemia, Oct. 15, 1821; was educated at Prague and Vienna; left the empire on account of his political liberalism 1844; published *Kelch und Schwert* (1845), a volume of poems expressing radical opinions both on Church and state, followed by *Neuere Gedichte* (1847). He was in the Frankfort Parliament of 1848; went to Vienna with Blum and Fröbel, and escaped thence with some difficulty; lived for a time in the East, and then in Paris; began in 1860 to lecture on German history and letters in the Academy at Geneva; went to Stuttgart 1863, to Vienna 1868. He wrote also *Reimchronik des Pfaffen Muricius* (1849), a brilliant political satire, and the novels *Der Krieg um den Wald* (1850); *Der Gefangene von Chillon* (1863); *Die letzen Tage eines Königs* (1866); *Nach der Natur* (1866); *Die Diamanten der Baronin* (1868); and others. Among his works are *Schatten* (1851); *Tagebuch aus der Provence und Languedoc* (1853); *Briefe aus Irland*; and the idyllic poem *Adam und Eva* (1851). D. in Vienna, May 13, 1872.

Revised by JULIUS GOEBEL.

**Hartmann von Aue**: mediæval German poet; the date of his birth is unknown. He was a feudal dependent of the Herr von Aue in Swabia. He took part in a crusade, either that of Frederick I. (1189–91), or, more probably, that of Henry VI. (1197–98). He is mentioned by Gottfried von Strassburg as living in the first decade of the thirteenth century; by Heinrich von Türlin as dead, about 1220. He calls himself a scholar, i. e. able to read and write; and he was one of the most eminent of the German poets of the second half of the twelfth century, who, through the study and imitation of the poets of Northern France, brought about a revival of poetry in Germany. He tried his hand both at songs (*Minnelieder*) and at narrative poems; but his reputation rests mainly upon the latter. His contemporaries had a remarkably high opinion of his powers. Thus Gottfried (*Tristan*, 117, 30, *seq.*) says of his style:

> Wie lûter und wie reine
> sîn kristallînin wortelîn
> beidin sint und iemer müezen sîn!

The works of Hartmann which have come down to us are, besides the *Lieder*, the following: (1) Two *Büchlein*, as the poet modestly called them, one a monologue on love (*Minne*), the other a dialogue between heart and body on love's pains and harms. (2) A version, based upon a French original, of the curious legend about Pope Gregory the Great, which makes him, the son of a brother and sister, marry unwittingly, like Œdipus, his own mother, and finally, after years of repentance, becomes pope. (Cf. Fr. Lippold, *Ueber die Quellen des Gregorius von Hartmann von Aue*, Leipzig, 1869; *La Vie du pape Grégoire le Grand*, ed. Luzarche, Tours, 1857.) (3) The pious and sentimental legends, apparently connected with the house of Aue, called *Der arme Heinrich*—perhaps the most famous of Hartmann's poems, giving the story of a pure maiden who was ready to sacrifice her life in order to relieve her lord of leprosy, but who of course finally happily married him. Longfellow has used this tale for the framework of his *Golden Legend*. (4) The romance of *Erek* (written about 1190), a free version, with many additions, of the French romance of the same name by CHRESTIEN DE TROYES (*q. v.*). (5) The romance of *Iwein* (written soon after 1200), also based upon a poem by Chrestien, *Le chevalier au lion*. Editions of Hartmann are: F. Beeh, in *Deutsche Classiker des Mittelalters* (3 vols., Leipzig, 1871–73); Henrici (2 vols., 1891–93); the *Gregorius* (ed. Paul, Halle, 1873); *Der arme Heinrich* and the *Büchlein* (ed. Haupt, Leipzig, 1881, and Paul, Halle, 1883); *Erek* (ed. Haupt, Leipzig, 1871); *Iwein* (ed. Benecke und Lachmann, Berlin, 1877). See also Fr. Saran, *Hartmann von Aue als Lyriker* (Halle, 1889); L. Schmid, *Des Minnesängers Hartmann von Aue Stand, Heimat, und Geschlecht* (Tübingen, 1874).

A. R. MARSH.

**Har'tranft**, John Frederic: soldier; b. in New Hanover township, Montgomery co., Pa., Dec. 16, 1830; graduated at Union College, New York, 1853; admitted to the bar of Pennsylvania 1859. At the outbreak of the civil war he raised the Fourth Pennsylvania; served as its commander during the three months' term, and as volunteer aide to Gen. Franklin in the first battle of Bull Run. Commissioned colonel Fifty-first Pennsylvania volunteers Nov. 16, 1861, and with it accompanied the Burnside expedition, leading it in the attack on Roanoke island Feb. 7, and in the battle near Newbern, N. C., Mar. 13, 1862; was engaged in the second battle of Bull Run and Chantilly, and in the Maryland campaign at South Mountain and Antietam. In June, 1863, he commanded a brigade before Vicksburg, and subsequently accompanied Gen. Sherman in his advance to Jackson, Miss. In the Richmond campaign of 1864 he commanded a brigade in the battles of the Wilderness and Spottsylvania; was commissioned brigadier-general May 12, 1864, and engaged in all the army movements to and before Petersburg, and was breveted major-general for conspicuous gallantry in recapturing Fort Steadman, Mar. 25, 1865. In Oct., 1865, he was elected auditor-general of Pennsylvania, and re-elected in 1868. He was Governor of that Commonwealth 1873–76, and collector of the port of Philadelphia in 1880. D. at Norristown, Pa., Oct. 17, 1889.

**Hartshorn**: See Ammonia.

**Hartshorne**, Edward, A. M., M. D.: son of Dr. Joseph Hartshorne (*q. v.*); b. in Philadelphia, May 14, 1818; graduated at Princeton, A. B. in 1837, A. M. in 1840, and M. D. at the University of Pennsylvania in 1840; was elected assistant physician to the new hospital for the insane of the Pennsylvania Hospital on its opening, Jan. 1, 1841; was elected resident surgeon to the Pennsylvania Hospital in Apr., 1841, and after two years' service there was elected physician to the Eastern State Penitentiary of Pennsylvania. He published two reports (1843 and 1844) in favor of the innocuous sanitary influence of the "separate system of prison discipline" when properly administered, which attracted much attention in Europe and the U. S. as the first evidence of the kind derived from practical experience upon the spot. He began general practice in Philadelphia in 1848; was soon elected one of the attending surgeons of Wills' (eye) Hospital, and subsequently one of the attending surgeons of the Pennsylvania Hospital; served throughout the civil war as consulting surgeon and in other professional capacities in the U. S. army medical service, chiefly in Philadelphia U. S. army hospitals; also as active member and secretary of the executive committee of the U. S. Sanitary Commission in Philadelphia. He served as secretary to the first prison discipline convention in Philadelphia (1847), and to the first sanitary convention in the U. S. (Philadelphia, 1857); also as secretary for several years of the College of Physicians of Philadelphia. During many years he was a frequent contributor to *The American Journal of the Medical Sciences*, *The North American Medico-Chirurgical Review*, and *The Medical Examiner* of Philadelphia, chiefly in their review departments. He edited two successive editions of Taylor's *Manual of Medical Jurisprudence*, with notes and references. D. June 22, 1885.

**Hartshorne**, Henry, A. M., M. D.: son of Dr. Joseph Hartshorne; b. in Philadelphia, Mar. 16, 1823; graduated B. A. at Haverford College in 1839, and M. D. in the medical department of the University of Pennsylvania in 1845. He was appointed in 1859 Professor of the Practice of Medicine in the medical department of Pennsylvania College. In 1865 he was elected Professor of Hygiene in the University of Pennsylvania, on the institution of this chair, under an endowment for the purpose by Dr. George B. Wood. He held also successively a number of other professorships, the most important of which were at Haverford College and in the Woman's Medical College of Pennsylvania. He was the author of several works, among them a *Monograph on Glycerin*; *Essay on Cholera*; *Guide to the Medicine-chest*; *Conspectus of the Medical Sciences* (1869); and *Essentials of the Principles and Practice of Medicine* (4th ed. 1874). He published a small volume of poems, *Summer Songs*, in 1865, and became editor of *The Friends' Review* in 1874. D. at Tokio, Japan, Feb. 10, 1897.

**Hartshorne**, Joseph, M. D.: b. near Alexandria, Va., Dec. 12, 1779; became a resident pupil at the Pennsylvania Hospital and a medical student in the University of Pennsylvania in 1800, and graduated M. D. in 1805. He was elected a colleague of Dr. Physick as one of the attending surgeons of the Pennsylvania Hospital, and served also in other similar posts. His chief publication was an appendix, with illustrations, to an American edition of a London translation of Boyer's work on *Diseases and Injuries of the Bones*, in which he reports a number of important cases, and describes a dressing for fractured clavicle and a new apparatus for the treatment of fractured thigh, afterward popular for many years as Hartshorne's splints. He was a member of the Society of Friends. D. near Wilmington, Del., Aug. 20, 1850.

**Hart'suff**, George Lucas: soldier; b. at Tyre, Seneca co., N. Y., May 28, 1830; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of artillery July 1, 1852. In Mar., 1861, he was appointed a captain and assistant adjutant-general, and in April sent to Fort Pickens with the secret expedition under Gen. Brown. In July he became chief of staff to Gen. Rosecrans in Western Virginia, participating in the action at Carnifex Ferry, Sept. 10. In 1862 he was appointed a brigadier-general of volunteers, took command of a brigade, and was engaged at Cedar Mountain and Manassas. He also fought at South Mountain and Antietam, being severely wounded in the last-named action, and incapacitated from duty in the field till Apr., 1863. Having been promoted major-general of volunteers he commanded the Bermuda front of the siege-works before Petersburg, assuming command of that city on its capture, and subsequently of the district of Nottoway, which command he held till he was mustered out of the volunteer service Aug., 1865. He afterward resumed duty in the adjutant-general's department, with the rank of lieutenant-colonel, and was retired from active service on the full rank of major-general. D. May 16, 1874.

**Hartt**, Charles Frederic: geologist; b. at Fredericton, New Brunswick, Aug. 23, 1840. He studied under Prof. Louis Agassiz, and was one of his assistants in the Thayer expedition to Brazil 1865–66. On his return he became Professor of Geology at Vassar College, and in 1868 was chosen to the chair of Geology in Cornell University. During his vacations he made repeated excursions to Brazil, exploring the coast provinces and the Amazon. In 1875, at the invitation of the Imperial Government, he organized the Commissão Geologica do Brazil, which was continued until his death. Nearly all our knowledge of the geology of Brazil is due to Prof. Hartt and to the assistants who have continued his work. His largest published work was *Geology and Physical Geography of Brazil* (1870). D. at Rio de Janeiro, Mar. 18, 1878. The immense collections formed by the commission were incorporated with the national museum.

Herbert H. Smith.

**Hart'wig**, John Christopher: a German Lutheran minister; b. in Saxe-Gotha, Germany, June 6, 1714; was called to North America to take charge of Lutheran churches in New York State; was a member of the first Lutheran synod in America (1748); held pastorates in New Jersey, Pennsylvania, and New York, and founded the Hartwick Theological Seminary at Hartwick, Otsego co., N. Y., which was opened in 1815. He received in 1761 a patent of 21,500 acres of land, comprising the greater part of the present town of Hartwick. D. at Livingston Manor, N. Y., July 17, 1796.

**Hartz**, or **Harz**: an isolated group of mountains in Northwestern Germany, forming an elevated plateau, intersected with deep valleys and rising in different places into high peaks. These mountains, which cover an area of about 800 sq. miles, occupying Brunswick and parts of Hanover and Prussian Saxony, are covered with forests, and are exceedingly rich in minerals—gold, silver, lead, iron, marble, and alabaster. As they form the first wall against which the moist and cold winds from the North Sea are broken, most of the summits are destitute of trees; but the slopes are generally heavily wooded—the northern by pines and firs, the southern by oak, elm, and beech trees. Much wood is exported for building and other purposes. The mines were opened in the tenth century, and are still very far from being exhausted. The most important mineral is a peculiarly rich argentiferous lead. Cattle-raising and dairy-farming are important branches of industry. Deer, foxes, and wild cats are still found in the forests. The highest peak is the Brocken, 3,740 feet high, and is the birthplace of many weird superstitions and fairy-tales. The Hartz is one of the most frequented tourist resorts in Germany, accessible by rail from any of the principal towns of the empire and traversed by excellent roads.

**Hartzenbusch**, haarts'*en*-boosh, JUAN EUGENIO: Spanish dramatist and man of letters: b. in Madrid, Sept. 6, 1806; the son of a German cabinet-maker. He studied theology, but owing to the death of his father was obliged to learn his trade, which he practiced until 1833, when he became stenographer of the Government journal. Having been inspired, by the first dramatic performance which he attended in 1821, with the desire of writing plays, he began by translating French and Italian dramas, and rewriting old Spanish comedies for the modern stage. The signal success of his drama *Los Amántes de Teruel*, in 1837, decided him to devote himself entirely to a literary career. In 1844 he was made assistant librarian of the National Library at Madrid, succeeding to the position of chief librarian in 1862, a position which he held until his death, Aug. 2, 1880. In 1847 he was elected a member of the Spanish Academy. Of his dramatic works, which show the influence of the French romantic school, the following may be mentioned as the more important: *Doña Mencia* (1838); *La Redóma encantáda* (1839); *Alfonso el Casto* (1841); *El Bachillér Mendarias* (1842); *La Madre de Pelayo* (1846); *La vida por honra* (1854). Other works of his are the *Ensáyos poéticos y artículos en prosa, literários y de costúmbres* (1843); and *Cuéntos y fabulas* (1861). Hartzenbusch's critical editions of Lope de Vega, Tirso de Molina, Calderon, and Alarcon, published in Rivadaneyra's *Colección de Autóres españoles*, are unfortunately far from being faithful reproductions of the original texts.

H. R. LANG.

**Haruga'ri**, haă-roo-gaa'rĕĕ [O. H. Germ., priest, diviner, deriv. of *harug*, temple, grove]: a German order in the U. S., established in 1847. The aim of this order is principally benevolent and social, though the introduction to the constitution also sets forth, as a general purpose, the preservation and extension of the German language in the U. S. The organization comprises 235 subordinate lodges, which in the different States combine into great State lodges, and these again into one national lodge. The order has its own organ, called *Deutsche Eiche* (German Oaks). Most of the lodges possess libraries, and lectures are often given in the lodge-rooms.

**Haruspices**: See ARUSPICES.

**Harvard**: city (chartered 1891); McHenry co., Ill. (for location of county, see map of Illinois, ref. 1–F); on the Chi. and N. W. Railway; 63 miles N. W. of Chicago. It is in an agricultural region, and has electric lights, artesian water system, flour-mill, carriage-wheel factory, sewing-machine works, and two weekly newspapers. Pop. (1880) 1,607; (1890) 1,967; (1900) 2,602. EDITOR OF "INDEPENDENT."

**Harvard**, JOHN, M. A.: the founder of Harvard College; b. in Southwark, England, in Nov., 1607; was educated at Emanuel College, Cambridge, graduating in 1635. He was ordained as a Dissenting minister, married the daughter of a clergyman, and in 1637 emigrated to Massachusetts, where he was made a freeman. In 1638 some land was set off for him in Charlestown, where he performed the duties of minister. In that year he was one of a committee to consider matters "tending toward a body of laws." D. at Charlestown, Mass., Sept. 14, O. S. (24 N. S.), 1638. He left his library and half his estate toward the founding of a college. Mr. Everett delivered the address at the dedication of his monument at Charlestown in 1828. A bronze statue of Harvard, on the Delta, Harvard University, was unveiled Oct. 15, 1884.

**Harvard University**: the oldest and largest institution of learning in the U. S. It had its beginning in 1636 in a vote of the general court of Massachusetts Bay, which in September of that year agreed to give £400 toward its foundation. The following year the proposed college was ordered to be at Newtown or Cambridge (as, in remembrance of the English university town, it then began to be called), at a spot 3 miles distant from the present Boston Statehouse. No students, however, had been received in 1638, when John Harvard, a young minister of Charlestown, who had been in the colony but a year, died and left half his property and his entire library to the hardly existent college. His gift amounted to nearly £400, with 260 volumes. The general court immediately ordered "that the college agreed upon formerly to be built at Cambridge shall be called Harvard College." The first class was formed in the same year, and graduated, nine in number, in 1642. About the same number appear in the other classes of the seventeenth century, except that in 1644, 1648, 1672, 1682, and 1688 there were no graduating classes. These are the only empty years in the entire history of the college. Through the eighteenth century the annual number of graduates was between twenty and forty; during the first half of the nineteenth century between fifty and seventy. The class of 1860 first crossed the line of 100; 1883, that of 200; 1893, that of 300. The quinquennial catalogue of 1890 contains the names of 16,930 graduates of Harvard University, more than half of whom were then living. In the year 1893–94 there were 3,156 students in attendance, of whom 2,188 were in the charge of the faculty of arts and sciences. In 1900 there were 4,288 students, and the professors and other instructors numbered 496.

By the circumstances of its foundation Harvard unites the characteristics of the three types of college prevalent in the U. S.—the sect college, the State college, and the college of individual benefaction. Its charter declares its aims to be "the education of the English and Indian youth of this country in knowledge and godliness." Its first board of overseers were charged with "furthering the college in piety, morality, and learning." Its two mottos, *Veritas* and *Christo et Ecclesiæ*, have a similar significance. During the first century of its existence half its graduates entered the pulpit of Puritanism, and few colleges even now send more men into the ministry than Harvard. Yet it has from the first stood for the humane rather than the rigid spirit in religion. Into none even among its earliest constitutions does a word of dogmatic restriction enter. Its Divinity School is forbidden to exact "assent to the peculiarities of any denomination of Christians" from either instructors or students. Until 1870 it was mainly a Unitarian college, but it is now managed in the interest of no single sect. All its faculties and all its governing boards include men of diverse religious beliefs. Its chapel exercises—daily morning prayers, Sunday preaching, and Thursday vesper services—are voluntary. The board of six preachers in charge of these services has had ministers of six denominations among its members. The president, who until 1829 had, with a single exception, been a minister, has since that date generally been a layman. The university, in short, while under strong religious influence, is thoroughly unsectarian.

The relations of the university to the State have been no less peculiar. The general court at first intrusted the government of the college to a board of overseers; but in 1650 a charter was granted, by which the college was made a corporation, consisting of the president, five fellows, and a treasurer, to be known as "the president and fellows of Harvard College." This corporation had power to fill vacancies in its numbers, with the approval of the overseers, and continues in its original form as "the corporation," acting under the charter first issued in 1650, and with its rights and privileges confirmed by a special section in the constitution of the Commonwealth of Massachusetts, framed in 1780. The State government retained control of the board of overseers until 1865, when all official connection between the college and the State was broken by the passage of a legislative act directing that vacancies occurring in the board of overseers thereafter should be filled by the alumni of the college "voting on commencement-day in the city of Cambridge." Instructors are allowed neither to vote nor to become overseers. The corporation holds and manages the property of the university, the overseers having ordinarily no voice in the investment or other disposition of university funds. But in all matters relating to statutes and regulations, the appointment of professors and other instructors, and in general the internal administration of university affairs, the consent of the overseers is necessary. That board consists of the president and treasurer, *ex officio*, and of thirty other persons elected for terms of six years, five retiring each year. All indications of State control have disappeared, except that the Governor is still escorted to commencement by his bodyguard, and that the assembly there gathered is called to order by the county sheriff.

From the beginning, Harvard has derived its chief support from private benefactions. The exemption of its property from taxation is a continual and weighty public gift, but the university has received no other subsidy from the State since 1814. Throughout its entire history government grants seem never to have discouraged individual bounty; since 1870 the gifts from private sources have amounted to $350,000 a year. Its property at present consists of $12,000,000 of interest-bearing funds, of nearly 700 acres of land, and of more than 60 buildings occupied by the university. To these should be added the immense collections of its

museums, and its library of 540,000 volumes and 420,000 pamphlets, a library increasing at the rate of 13,000 volumes a year. In round numbers, $1,500,000 is received and expended annually for university purposes. As the majority of the students are poor or in moderate circumstances, $90,000 is appropriated each year to fellowships, scholarships, and other forms of aid. In the public dining-halls 1,500 persons are boarded at a charge of $3 to $4 a week, but the college dormitories are sufficient to lodge hardly more than a third of the students in residence.

The name Harvard University designates the entire complex institution; its central portion is the college. In this the degree of A. B. is given to students of four years' standing who have completed satisfactorily eighteen courses, sixteen of them elective. By a course is understood a single line of study in which three hours a week of instruction are given throughout a year. Each student chooses four such courses at the beginning of the year from a list printed by the faculty of arts and sciences. The courses offered for election number 349. The plan of the elective system, gradually matured at Harvard during half a century, is to fix the quantity and quality of study, but to leave the choice of topic to the individual student. Accordingly, it may in a sense be said that members of the three upper classes are free to choose any studies they desire; but as the advanced and technical courses of each department presuppose careful elementary training, the choice is in practice much restricted. During his brief college life a student is able to pursue only about one-thirteenth of the instruction offered.

Each department of the university has its own dean and faculty, but the College, the Graduate School, and the Lawrence Scientific School have also a faculty in common, called the faculty of arts and sciences. The Graduate School, giving the degrees of A. M., Ph. D., and S. D., has this year (1893–94) 252 students; the Scientific School (1847), giving the degree of S. B., has 280. In Cambridge, too, though governed by independent faculties, are the Divinity School (1819), with its 36 undergraduate and 11 graduate students, which requires of candidates for its degree of D. B. that they shall already possess the degree of A. B.; and the Law School (1817), whose course is three years and whose students number 353. The other departments of the university are not in Cambridge. In Boston are the Medical School (1783), containing 446 students and 81 instructors, and requiring a four years' course of study; the Dental School (1867) and the School of Veterinary Medicine (1882), each giving its degree after a graded course of three years. The School of Agriculture and Horticulture, known as the Bussey Institution (1861), is in Jamaica Plain, within the limits of Boston. The beautiful Arnold Arboretum occupies 120 acres of the Bussey estate. The library (1839–77), observatory (1846), botanic gardens (1805), university (1852–89) and Peabody museums (1876–89), memorial hall (1870–76), the gymnasiums (1879 and 1890), boat-houses (1870 and 1890), and athletic-grounds are all in Cambridge. To students in one department of the university instruction in all others is open without additional charge. Summer school courses, yielding no degree, and mainly in science, history, language, and physical training, are offered in Cambridge during six weeks of July and August for a small fee, and are attended by large numbers of teachers and other students. The annual fee in most of the departments of the university is $150, but that of the Divinity School is $50, and that of the Medical School $200.

*Radcliffe College.*—In 1878 a company of men and women of Cambridge and Boston were organized under the title of "A Society for the Collegiate Instruction of Women." This society, quickly known to popular speech as "The Harvard Annex," employed such teachers of Harvard College as were willing to undertake the labor of giving to young women the instruction already given in the college to young men. Its building, overshadowed by the Washington elm, is known as Fay House. In 1893 application was made to the Legislature for a charter and for the right to grant degrees. Prior to that date it had given only certificates of study. The institution is now called Radcliffe College, in memory of Anne Radcliffe, Lady Moulson, the founder of the first scholarship in Harvard College; its board of visitors (without whose consent no instructor can be appointed) is the corporation of Harvard University; its degrees will be signed by Harvard's president; but its property is held by an independent board. Radcliffe College started with an enrollment of 250 students.

The following are the names of the presidents of Harvard University: Henry Dunster, 1640–54; Charles Chauncy, 1654–72; Leonard Hoar, 1672–75; Uriah Oakes, 1675–81; John Rogers, 1682–84; Increase Mather, 1685–1701; Samuel Willard, 1700–07; John Leverett, 1707–24; Benjamin Wadsworth, 1725–37; Edward Holyoke, 1737–69; Samuel Locke, 1770–73; Samuel Langdon, 1774–80; Joseph Willard, 1781–1804; Samuel Webber, 1806–10; John Thornton Kirkland, 1810–28; Josiah Quincy, 1829–45; Edward Everett, 1846–49; Jared Sparks, 1849–53; James Walker, 1853–60; Cornelius Conway Felton, 1860–62; Thomas Hill, 1862–68; Charles William Eliot, elected in 1869.

Quincy's *History of Harvard University* (Cambridge, 2 vols., 1840) gives the fullest account of the college. W. R. Thayer's *Historical Sketch of Harvard University*, in the *History of Middlesex County* (Boston, 1890), is compact and interesting. *The Harvard Graduates' Magazine*, a quarterly journal begun in 1892, contains a careful record of whatever concerns the university. The annual reports of the president and treasurer are sent free on application, as are also pamphlets descriptive of each of the departments and of the conditions of admission. GEORGE HERBERT PALMER.

**Harvest-bug**: (*Leptus autumnalis*) one of the *Acarus* family, which receives its name from the fact that it attacks the workmen at harvest. It thrives especially about the middle of July, is found on blades of grass and other growths, and thence gains access to the legs, thighs, and abdomen of persons walking in the fields. It has a minute, brilliant red or pink body, and occasions intolerable itching and sometimes even ulceration. WILLIAM PEPPER.

**Harvest-flies**: See CICADA.

**Harvest Moon**: the name given in high northern latitudes to the full moon of the lunation which occurs about the time of the autumnal equinox. The circumstance which has made it noticeable and given it its name is that during its lunation the rising of the moon for several successive days before and after the full takes place nearly at the same hour, thus favoring the work of the farmer during harvest, whereas, taking the year through, the rising is retarded on an average about fifty minutes per diem. The cause of this phenomenon is to be found in the inclination of the earth's orbit, or the ecliptic to the equator. The moon's apparent daily motion (in rising and setting) is parallel to the equator, but its progressive motion in its own orbit is nearly coincident with the ecliptic, there being an inclination of only about five degrees between these two paths. To an observer on the Arctic Circle, when the first point of Libra (the autumnal equinox) comes to the western horizon, the ecliptic coincides with the horizon all around; and if the sun is on the first of Libra at that time, it is sunset to the observer. If full moon occurs at the same moment, the moon will be in the first of Aries, opposite to the sun, and it will be moonrise to the observer. The next evening the sun will have advanced about one degree in its orbit, and the moon thirteen degrees; but this movement will affect the hour of the moon's rising comparatively little, though it will change considerably the azimuth (or distance from north or south point) of its position on the horizon at rising. And, as for several evenings before and after the equinox the moon's orbit will continue to be nearly coincident with the horizon at the close of the day, it follows that for several successive days the moon will rise not very far from the same hour. Though it is to observers on the Arctic Circle that this phenomenon is most strikingly apparent, it is more or less noticeable in all high latitudes, as in Great Britain, Norway, and to some degree in Canada. It does not occur at all at the equator.

**Harvey**, GEORGE: artist; b. at St. Ninians, near Stirling, Scotland, in Feb., 1806; early showed a great talent for drawing; entered in 1824 the Trustees' Academy in Edinburgh; made rapid progress; became an associate of the Royal Scottish Academy in 1826, in 1829 a fellow, and in 1864 its president. His best-known paintings are those treating subjects of religious history from a Puritan point of view; as, for instance, *Covenanters Preaching*, *Covenanters' Communion*, *John Bunyan and his Blind Daughter*, etc. But he was also very successful as a genre-painter (*The Curlers*, *A Skule Skailin'*, etc.) and as a painter of landscapes. He was knighted in 1867; wrote *Color of the Atmosphere*, which was published, with illustrations, in *Good Words*. In 1870 he published *Notes of the Early History of the Royal Scottish Academy*. D. in Edinburgh, Jan. 22, 1876. Revised by RUSSELL STURGIS.

**Harvey**, Moses, LL. D., F. R. G. S., etc.: scientist and author; b. at Armagh, Ireland, Mar. 25, 1820; graduated at Belfast College; was Presbyterian minister of Maryport, Cumberland, England, in 1844; from 1852–78 was minister of the Free Presbyterian church at St. John's, Newfoundland, where he also engaged in literary and scientific studies and became a popular lecturer; author of *Lectures, Literary and Biographical*; *Thoughts on the Poetry and Literature of the Bible*; *Lectures on Nineveh and Egypt*; *The Harmony of Science and Revelation*; *Newfoundland, the Oldest British Colony* (1883); *Where are We and Whither Tending?* (London, 1887); *Newfoundland as it Is* (1894); *Newfoundland in the Jubilee Year* (1897).

**Harvey**, William, M. D.: the discoverer of the circulation of the blood; b. at Folkestone, Kent, Apr. 1, 1578; the son of a substantial yeoman; was educated at Caius College, Cambridge, and at Padua, where he studied under Fabricius and took his doctor's degree; returned to England in 1602; became physician to Bartholomew's Hospital, London; Lumleian lecturer on Anatomy and Surgery 1615; was physician to James I. and Charles I.; was attached to the court of the latter, followed his fortunes in the civil war, and became warden of Merton College, Oxford, probably in 1643. Harvey's great discovery of the circulation of the blood seems to have been suggested by him in 1616, announced in 1619, and published in the *Exercitatio de motu cordis et sanguinis* (1628). Other *Exercitationes* on the subject appeared in 1649. His later years were occupied in observations upon generation, upon which he published a treatise in 1651. Servetus, Paolo Sarpi, Cæsalpinus, and perhaps Fabricius, Harvey's tutor, would appear to have believed in the circulation of the blood, but Harvey first established the truth of the doctrine. D. in London, June 3, 1657. (See *Life* by Willis, 1878.) The capillary channels by which the blood is transferred from the arteries to the veins were discovered in 1661 by Marcello Malpighi.

**Harvey**, William Henry, M. D.: botanist; b. near Limerick, Ireland, Feb. 5, 1811; educated at Ballitore School; spent six years (1835–41) studying the botany of the Cape of Good Hope; keeper of the herbarium of Trinity College, Dublin (1844–56); Professor of Botany (1856–66). He is best known for his published works upon the algæ; e. g. *Manual of British Algæ* (1841); *Phycologia Britannica* (1846–51); *Nereis Boreali-Americana* (1852–58); *Phycologia Australica* (1858–63). His *Flora Capensis*, begun in 1859, was left incomplete. D. in Dublin, May 15, 1866.

Charles E. Bessey.

**Harveyized** or **Harveyed Steel**: steel that has been face-hardened by the process invented by Hayward A. Harvey (d. Aug. 28, 1893). The process is based on the fact that steel when exposed to a moderate temperature in contact with carbonaceous material absorbs some carbon and becomes harder, that being a characteristic of higher carbon-steels. Although Harveyized steel has been employed for commercial purposes, as in the manufacture of stone-crusher jaws and bicycle and typesetting-machine parts, subject to specially severe wear, its principal application has been in the manufacture of armor. The navies of practically all the maritime powers now specify that armor shall be Harveyized. The armor-plate is placed in a coal or gas-fired furnace, the part to be treated being packed in a mixture of charcoal and bone-black. The parts which are to remain in the original condition are bedded in sand. The plate is exposed to a temperature approximating that of the melting-point of cast iron, the time required being about three weeks, including the period needed to heat the furnace to the required temperature. As soon as withdrawn the plate is chilled by spraying with water. The depth of action usually aimed at is about 1 to 1½ inches, the carbon contents being raised from originally 0·20 to 0·30 per cent. to 0·90 to 1 per cent. The resistance of the armor-plate to impact from projectiles is increased from 60 to 100 per cent., according to the thickness of the plate treated, the increase being smaller with thicker plates. C. K.

**Harwich**: town of England, in the county of Essex; at the mouth of the Stour; 71 miles by rail N. E. of London (see map of England, ref. 11–L). Its harbor is safe, spacious, fortified, protected by breakwaters, and one of the best on the east coast of England. Harwich exports cement and fish, etc., and imports principally grain, timber, and tobacco. Ship-building and the manufacture of cement are important industries. Dovercourt, near Harwich, is a sea-bathing resort. Pop. (1891) 8,191.

**Harwich**: town (settled in 1694); Barnstable co., Mass.; on the Old Colony Railroad and the south side of Cape Cod; 85 miles S. E. of Boston (see map of Massachusetts, ref. 5–K). It has 6 churches, 14 public schools, public library, and weekly newspaper; is the center of a large cranberry region; and has important fishing and coasting interests. Pop. (1890) 2,734; (1900) 2,334. Editor of "Independent."

**Harwood**, Andrew Allen: rear-admiral U. S. navy; b. in Settle, Bucks co., Pa., in 1802; midshipman Jan. 1, 1818; lieutenant Mar. 3, 1827; commander Oct. 2, 1848; captain Sept. 14, 1855; chief of bureau of ordnance and hydrography Aug. 6, 1861; commodore July 16, 1862; commandant of Washington navy-yard and in command of Potomac flotilla 1862–63; secretary of lighthouse board and member of examining board 1864–69; rear-admiral Feb. 16, 1869; retired Oct. 9, 1864. In 1819–21, on board the Hornet, engaged in suppression of African slave-trade and piracy in West Indies; on board Sea Gull, under Com. Porter, operating in West Indies against pirates, 1823; in 1844 member of a commission to visit dockyards and foundries in Great Britain and France and report on ordnance improvements; 1851–52 member of board to prepare ordnance instructions for navy; during the civil war prepared a small work on *Summary Courts Martial*, and in 1867 published his *Law and Practice of United States Naval Courts Martial*. D. at Marion, Mass., Aug. 28, 1884. S. B. Luce.

**Harz**: See Hartz.

**Hasdeu**, haas'dow, Bogdan Petriceicu: Roumanian historian and philologist; b. at Hotin (or Chotin), in Bessarabia, Feb. 16, 1838. He studied at Charkov (Kharkof); became Professor of History at Jassy after the Crimean war, and settled in Bucharest after his marriage in 1864, where he became Professor of Comparative Philology at the university. Among his works, besides some poems, are (*Poesiĭ*, 1873) also dramatic works, such as *Rĕsvan Vodă* (1867); but his most important works are historical and linguistic, and these show wide learning and research. Among them may be mentioned *Archiva istorică a Românilor* (3 vols., 1865–67); *Istoria critică a Românilor* (vol. i., 1875); *Fragmente pentru istoria limbei române* (1876); *Cuvente den bătrâni* (contains texts and studies of the Roumanian language between 1550 and 1600; 2 vols., 1878–80); *Psaltirea publicată rumânesce la 1577 de Coresi* (1881); and above all the great Roumanian dictionary, *Etymologicum magnum Romaniæ*, a work planned on an immense scale, and, so far as completed, superior to any previous work in Roumanian lexicography. Hasdeu has also written numerous articles in scientific journals, and is the editor of *Revista Nouă* (*The New Review*), a literary review begun in 1888. E. S. Sheldon.

**Hasdrubal** [Lat.]: the name of many famous Carthaginians, among whom may be mentioned—(1) son of Hamilcar Barca and brother of Hannibal; was defeated by the Scipios in a battle on the Iberus, 216 B. C. In 207 B. C. he crossed the Alps and entered Italy for the purpose of bringing help to his brother. He was intercepted, however, and defeated and slain at the Metaurus in Umbria. The first news of this defeat and the consequent ruin of the Carthaginian cause in Italy was conveyed to Hannibal by the bloody head of Hasdrubal, thrown into the camp by soldiers of the Roman army. (2) A son of Gisco, who served in Spain in the second Punic war; was totally defeated by Scipio at Silpia, 206 B. C.; was defeated before Carthage by Scipio, 204 B. C., and committed suicide by poison. (3) A general in the last Punic war. G. L. Hendrickson.

**Hase**, haa'ze, Benedikt: scholar; b. at Sulza, in Saxony, May 11, 1780; went in 1801 to Paris; was appointed in 1805 to a place in the Royal Library in the MS. department, where he inaugurated a very liberal policy toward foreign scholars; in 1816 Professor of Modern Greek and of Palæography in the School of Oriental Languages; Professor of the German Language and Literature in the Polytechnic 1830; Professor of Comparative Grammar at the Sorbonne 1852; edited *Laurentius Lydus de Ostentis* (Paris, 1823); wrote an introduction to the edition of *Lydus de Magist. Rom.* by Fuss; edited Leo Diaconus for the *Corpus Byz. Script.* (Bonn, 1828); and the new edition of *Stephani Thesaurus Linguæ Græcæ*, aided by De Sinner and Fix, afterward by W. and L. Dindorf, who continued the work after his death. D. Mar. 21, 1864. See Guigniaut, *Notice historique sur la vie et les travaux de C. B. Hase* (Paris, 1867). Revised by A. Gudeman.

**Hase**, haa'ze, Karl August: theological author; b. at Steinbach, Saxony, Aug. 25, 1800; studied at Leipzig; im-

prisoned in 1819 for belonging to the Burschenschaft; became a private tutor in divinity at Tübingen 1823; graduated at Leipzig 1828; became in 1829 Professor of Philosophy there; Professor of Theology at Jena 1830. He was long a prominent rationalist; in 1844 became an editor of the *Protestantische Kirchenzeitung*. He published *Des alten Pfarrers Testament* (Tübingen, 1824); *Lehrbuch der Evangelischen Dogmatik* (Stuttgart, 1826; 6th ed., Leipzig, 1870); *Gnosis* (Leipzig, 1826–28; 2d ed. 1870); *Hutterus Redivivus* (Leipzig, 1828; 12th ed. 1883); *Das Leben Jesu* (Leipzig, 1829; 5th ed. 1865; in English by J. F. Clarke, 1859); *Kirchengeschichte* (Leipzig, 1834; 11th ed. 1886; English trans. by Blumenthal and Wing); *Ideale und Irrthümer* (Leipzig, 1872; 4th ed. 1891); *Geschichte Jesu* (Leipzig, 1876; 2d ed. 1891); *Annalen Meines Lebens* (Leipzig, 1891). D. Jan. 3, 1890.

**Hasebroek**, haa'se-brook, Johannes Petrus: poet; b. in Leyden, Holland, Nov. 6, 1812; educated in his native place; completed his theological studies in 1836, and became pastor at Heiloo. In 1840 he was called to Breda. In 1849 he transferred his labors to Middleburgh, but in 1851 went to Amsterdam, where he remained till his retirement from active life in 1883. As a poet, Hasebroek is chiefly known for the gay, tender, half-humorous, half-serious verses put by him in the mouth of one *Jonathan*. The volume containing these (*Waarheid en Droomen door Jonathan*) appeared first in Haarlem in 1840 (7th ed., Leyden, 1887). Besides this, he has published in verse *Windekelken* (1859); *Nieuwe Windekelken* (1864); *Sneeuwklokjes* (1878); *Winterbloemen* (1879); *Vesper* (1887). A list of Hasebroek's prose essays and discourses is given by J. ten Brink, *Geschiedenis der Noord-Nederlandsche Letteren in de XIX^e Eeuw* (vol. i., Amsterdam, 1888). A. R. Marsh.

**Haseltine**, James Henry: See the Appendix.

**Haseltine**, William Stanley: See the Appendix.

**Hashish**, hash'ēesh [Arab. *hashīsh*, hay, herbage]: a variety of *Cannabis sativa* (hemp); is cultivated in districts N. of Calcutta for the production of (1) *bhang* (Hindustani), *hashish* (Arabic), the dark-green stalks and green leaves used in smoking, or as a constituent of a sweetmeat (*majun*); (2) *ganja*, the flowering shoots brought into the London drug-market under the name of *guaza*; (3) *charas*, or *churrus*, the resin which exudes from the branches and leaves of the plant. It has been shown that an extract of the hemp grown in the U. S. shares the qualities of that of India, but doubtless in a less degree, for the hemp of hot countries has more of the active resin (*churrus*) than the hemp of temperate climates. Hashish has long been employed in medicine in Asia. Arabs, Persians, Indians, Chinese, and South Africans esteem it for its intoxicating powers, the symptoms produced by it seeming to be particularly agreeable to them. Many people of European race experience very disagreeable effects from overdoses, and upon those who are intoxicated by its use the effects are extremely varied. This uncertainty of effect greatly limits its use in medicine, but carefully prepared extracts give, as a rule, satisfactory results medicinally. Upon some persons its influences as an anodyne and hypnotic in certain diseases are very happy. Though poisonous doses produce alarming symptoms, the drug does not cause death. Revised by H. A. Hare.

**Haskell**: town (founded 1884); capital of Haskell co., Tex. (for location of county, see map of Texas, ref. 2–F); 60 miles N. of Abilene. It is on an attractive table-land in an agricultural and stock raising region, and has an abundant water-supply from springs and artesian wells. The county, which is in the southern part of the famous Panhandle of Texas, was created in 1858. Pop. (1890) 745; not returned separately in 1900.

**Haskell**, James Richard: See the Appendix.

**Haskins**, Charles Homer: See the Appendix.

**Has'lingden**: town; in Lancashire, England. It is situated 7 miles S. E. of Blackburn (see map of England, ref. 6–G), in a mountainous region rich in coal mines and stone quarries, and carries on extensive manufactures of woolen and cotton. Pop. (1891) 18,225.

**Hassam**, Childe: genre and landscape painter; b. in Boston in 1859; pupil of Boulanger and Lefebvre, Paris; member Society American Artists (1890), American Water-color Society, and president New York Water-color Club; gained third-class medal, Paris Exposition, 1889. He usually paints street scenes, finding his subjects in New York, Boston, and Paris, and his landscape work is notable for luminousness and brilliancy of color. Studio in New York. W. A. C.

**Has'sard**, John Rose Greene: journalist: b. in New York city, Sept. 4, 1836; graduated at St. John's College, Fordham, N. Y., in 1855. He assisted in preparing *The New American Encyclopædia*; was editor of *The Catholic World* in 1865, and was engaged on the Chicago *Republican* in 1865–66. From 1866 he was on the editorial staff of *The New York Tribune*, first as musical critic and after as literary editor. He published a *Life of Archbishop Hughes* (1866); *The Ring of the Nibelungs* (1877); a *Life of Pius IX.*, and a school *History of the United States* (1878); and *A Pickwickian Pilgrimage* (1881). D. in New York city, Apr. 18, 1888. Revised by H. A. Beers.

**Hasselquist**, Tuvey Nelson, D. D.: Lutheran theologian; b. at Ousby, Sweden, Mar. 2, 1816; removed to North America 1852; for many years the leader of the Swedish Lutheran Church in the U. S.; was for nearly twenty-three years president of the Theological Seminary at Roek Island, Ill. D. at Rock Island, Ill., Feb. 4, 1891. H. E. J.

**Hasselt**: town of Belgium; the capital of the province of Limbourg, on the Demer; 18 miles by rail N. W. of Maastricht (see map of Holland and Belgium, ref. 9–G). It has large distilleries, salt-refineries, and manufactures of linen and lace. On Aug. 6, 1831, the Dutch troops under the Prince of Orange won a victory over the Belgians here. Pop. (1891) 14,314.

**Hassler**, haas'ler, Ferdinand Rudolph: surveyor; b. at Aarau, Switzerland, Oct. 6, 1770; was brought to notice in the U. S. by Albert Gallatin; Professor of Mathematics at West Point Military Academy 1807–10; sent as scientific ambassador to Europe, with salary of a foreign minister; the first superintendent of the U. S. Coast Survey, which he conducted in 1816–18 and in 1832–43 (see Coast and Geodetic Survey); for years chief of the Bureau of Weights and Measures. He was author of text-books on mathematics; of a *System of the Universe*, in 2 vols.; and of many valuable scientific reports, including *Report to the United States Senate on Weights and Measures* (1832), and another to the Secretary of the Treasury on the same subject (1842). D. at Philadelphia, Nov. 20, 1843.
Revised by J. W. Powell.

**Hassler Expedition** (so known from the vessel used, the Hassler, which was named in honor of the first superintendent of the U. S. Coast Survey): an expedition by the Coast Survey along the Atlantic coast and to the Pacific, by way of the Straits of Magellan. Prof. Agassiz and a few assistants accompanied the expedition. The steamer sailed from Boston Dec. 4, 1871. Only surface observations were made on the passage to St. Thomas. At Barbados dredgings rich in results were made in 100 to 120 fathoms, and along the coast of Brazil the dredge was used with success. Rio de Janeiro was reached Jan. 23, 1872. After stopping at Montevideo for coal, the next halting-place was San Matias Bay, Patagonia, where the bluffs showed fine sections of the strata underlying the Patagonian plains. In the Straits of Magellan stoppages were made every night, and occasionally a day or two was spent in interesting localities. Thus at Possession Bay an excursion inland was made by members of the party as far as Mt. Aymon, which was found to be an extinct volcano, and the easternmost of a chain of similar ones extending in a westerly direction. Elizabeth and Magdalen islands, great breeding-places of birds; Sandy Point, a Chilian penal settlement; Glacier Bay, with a glacier which reached nearly to the sea-level; and Sholl Bay were other stopping-places where abundant collections were made and interesting observations recorded on the former and present state of glaciers. The channels of internal navigation were followed through Smyth's Channel to the Gulf of Penas. On the coast of Chili, San Carlos, Lota, and Talcahuano were visited. The steamer went from the latter place to Juan Fernandez, while Prof. Agassiz went by land to Valparaiso. Some deep soundings were taken in the neighborhood of that island. Valparaiso, Caldera, Pisco, Callao, Payta, and the Galápagos islands were next visited, and finally San Francisco was reached in Aug., 1872, after touching at Panama, Acapulco, Magdalena Bay, and San Diego. Some of the zoölogical results of the expedition have been published by Messrs. A. Agassiz, Lyman, and Pourtalès, but the death of Prof. Agassiz prevented the publication of his numerous observations, except in the preliminary form of letters to Prof. Peirce. Revised by J. W. Powell.

**Hastings**, hās'tingz: parliamentary and municipal borough of England, in Sussex; on the English Channel; 62

miles S. S. E. of London (see map of England, ref. 14–L). Here William the Conqueror landed, and the decisive battle known as the battle of Hastings was fought in 1066 at Senlac, in the vicinity. (See Battle). The excellent harbor was ruined in the time of Elizabeth by a storm, and Hastings is now best known as an elegant and much-frequented watering-place. It is the premier Cinque port. There are numerous hotels, excellent schools, a public park, three public gardens, a fine esplanade 3 miles long, and a long pier having at its extremity a pavilion accommodating from 2,000 to 3,000 people. One member is returned to the House of Commons. St. Leonards-on-Sea is practically part of Hastings. Pop. (1901) 65,528.

**Hastings**: city; capital of Barry co., Mich. (for location of county, see map of Michigan, ref. 7–I): on the Thornapple river and the Chi., Kal. and Saginaw and the Mich. Cent. Railways; 32 miles S. E. of Grand Rapids. It is in a wheat-growing region, and has 6 churches, 2 public schools (cost $60,000), 2 ward schools, new jail and court-house ($60,000), 5 periodicals, and manufactures of felt boots, furniture, lawn hose-reels, steam-engines, etc. Pop. (1880) 2,531; (1890) 2,972; (1900) 3,172.

Editor of "Banner."

**Hastings**: city (founded 1853); capital of Dakota co., Minn. (for location of county, see map of Minnesota, ref. 10–F); on the Mississippi river, and the Chi., Mil. and St. P. Railway; 20 miles S. E. of St. Paul. It is an important grain and lumber market; has 3 flour-mills, several elevators, saw-mills, and manufactures of furniture, carriages and wagons, and foundry products, and contains 12 churches, good public and parochial schools, public library, and 3 newspapers. Pop. (1880) 3,809; (1890) 3,705; (1900) 3,811.

Editor of "Gazette."

**Hastings**: city; capital of Adams co., Neb. (for location of county, see map of Nebraska, ref. 11–F); on the Burl. and Mo. River, the Fre., Elk. and Mo. Val., the St. Jo. and Grand Is., and the Mo. Pac. Railways; 96 miles W. of Lincoln. It has 14 churches, German Baptist College, Presbyterian colleges (cost of grounds and buildings $75,000), Roman Catholic convent and College of the Visitation (grounds and buildings $80,000), high school ($25,000), Bethany Home, Asylum for the Incurable Insane, free hospital, sewage system ($100,000), water-works ($100,000), gas and electric light plants, and 3 daily, 6 weekly, and 2 other periodicals. It is in an agricultural and stock-raising region, and has numerous manufactures of importance. Pop. (1880) 2,817; (1890) 13,584; (1900) 7,188. Editor of "Nebraska."

**Hastings**, Thomas, Mus. Doc.: b. in Washington, Conn., Oct. 15, 1784; removed to Clinton, N. Y., with his father when twelve years of age; was editor of a religious journal of Utica, N. Y., 1824–32; became a music instructor and composer of sacred music in New York city. Author of *Spiritual Songs* (1832); *Christian Psalmist* (1836); of several volumes of poems, hymns, etc., and compiler of many collections of church music. Many of his compositions are widely known and very popular. D. in New York, May 15, 1872.

**Hastings**, Thomas Samuel, D. D., LL. D.: clergyman; b. in Utica, N. Y., Aug. 28, 1827; graduated at Hamilton College 1848, and at Union Theological Seminary 1851, and after another year there of study was pastor of the Presbyterian church, Mendham, N. J., 1852–56. From 1856 to 1881 he was pastor of the West Presbyterian church, New York city. In 1881 he was made Professor of Sacred Rhetoric in Union Theological Seminary, and was its president from 1888 to 1897 when he resigned.

**Hastings**, Warren, LL. D.: statesman; b. at Churchill, Oxfordshire, England, Dec. 6, 1732; was educated at Westminster, where he distinguished himself as a scholar. He went to Bengal in 1750; was taken prisoner by Surajah Dowlah 1756; served under Clive 1757; was resident at the court of Meer Jaffier 1757–61, and became a member of the council at Calcutta 1761, under the presidency of Vansittart, who had been introduced by Lord Clive from Madras. Generally, the period of Vansittart's government is described as forming the most revolting page of the history of British rule in India. The members of the council, the commanders of the troops, and the commercial residents plundered on a great scale. The youngest servant of the company claimed the right of trading on his own account, free from taxation and independent of any local jurisdiction. Hastings returned to Great Britain in 1764, and expended the considerable fortune he had acquired for the relief of his poor relatives; returned in 1769 to India, where he had hitherto been a general favorite. He now secured rapid advancement. He was made second in the Madras council 1769; became president of the supreme council of Bengal 1772; assisted the Nabob of Oude against the Rohillas 1773–74; and was appointed the first Governor-General of India 1774–85. He immediately quarreled with the councilors in 1774. The next four years were years of turbulent discord between the Governor-General and the council, each claiming supreme authority. Hastings received notice in 1778 that his resignation was accepted, but disavowed the resignation and refused to give up the office; married the divorced Baroness Imhoff, to whom he had for nine years been avowedly attached, in 1778; sent an expedition against the French in 1778; fought a duel with Philip Francis in 1780; made Sir Elijah Impey judge of the court of appeal in 1781; compelled the Madras government to give up the revenues of the Carnatic to the nabob in 1783, in disobedience of the orders of the directors; made the conquest of Benares in 1784, and concluded the treaty of Chunar; resigned and went to England in 1785. Meanwhile, a long struggle had gone on in Great Britain between the East India Company and the ministers of the crown for the supreme control of Indian affairs and the attendant patronage; and Hastings's success was the company's mainstay. Articles of impeachment for high crimes and misdemeanors were presented by Burke against Hastings in Feb., 1786. In his famous trial, which began Feb. 13, 1788, and ended Apr. 23, 1795, the ability and eloquence of Burke, Sheridan, and Fox failed to convict him, it having been conclusively shown that India had improved greatly under his rule, and that he was extremely popular with the natives and with the majority of the Europeans of his government. As a ruler he was one of the ablest India ever had; but being a man of positive character, he could not fail to make enemies; and there is no doubt that his quarrel with Francis in India made the latter his bitter opponent. Hastings expended his fortune in defending himself, and was afterward supported by a large yearly allowance from the East India Company. D. at Daylesford, Aug. 22, 1818. See Mill, *History of India*; Lyall, *Warren Hastings*; Stephen's *Nusscomar* in *National Biography*; and Macaulay's brilliant but untrustworthy essays on *Warren Hastings*.

Revised by C. K. Adams.

**Haswell**, Charles Haynes: See the Appendix.

**Hat**: See Head-dress and Hat-making.

**Hatasu**, hăă'ta-soo (variously called *Hatshepset*, *Chnemt-Amun*, *Ma-ka-Ra*, or *Ramaka*): an Egyptian queen of the eighteenth dynasty; daughter of Thothmes I., sister of Thothmes II., and half-sister of Thothmes III. She was associated successively with all three in royal office; as coregent in the later years of the first, as queen of the second, and as guardian and coregent with the last. She left many monuments, some of which were dedicated to her father. After the death of Thothmes II., she erased his name from some of his inscriptions, inserting instead her father's name or her own. In turn her name was similarly treated by Thothmes III., an evidence of the lack of good feeling between them. Further mutilation of her monuments on account of the presence of the name of the god Amon is to be traced to the fanatic zeal of the heretic king of the same dynasty, Amenophis IV., or Khunaten. She assumed man's attire and caused herself to be addressed as a male. A significant change of costume, involving the covering of the upper part of the body, occurred at this time. (See Egypt, Ancient.) The chronology of her reign is uncertain. She probably ruled in all about twenty years; Thothmes III. was associated with her in her sixteenth year. The monuments mention the names of all three of the children singly and together, indicating their association in office. With Thothmes III. she was engaged in mining in the Sinai peninsula, as their cartouches, found in Wadi Maghara, show. Gradually, however, Thothmes III. gained the supreme power and the final fate of the queen is unknown, but it is suspected that she was the victim of violence. The inscriptions at Ombos and Medinet Habu show the changed relations of the two.

Hatasu built at Thebes the wonderful temple known as Deir el-Bahri. She also erected several obelisks near it, one of which, 97½ feet high and composed of Syenite granite, according to its own inscription was quarried, cut, moved, polished, inscribed, and set up in the short space of seven months. The temple stands against the sandstone cliffs to the W. of the Nile, beyond the low ground. It is a gigan-

tic structure on four levels connected by majestic staircases. An avenue of sphinxes led toward the river. The building is among the finest in Egypt and its inscriptions are executed with great care and fidelity. On its rear wall against the limestone cliff is a series of representations of the famous naval and trading expedition sent out by Hatasu in her ninth year to the land of Punt in quest of incense. Five ships, equipped with oars and sails and fully manned, proceeded to the south along the Red Sea coast. The arrival and meeting with the natives and some native scenes are depicted; the loading and the arrival of the ships at Thebes also are shown. The objects brought back were gold, precious stones, ivory, ebony, balsam, incense, and even living trees, apes, greyhounds, and giraffes. Hatasu's period was one of peace at home, but of growing insubordination among tributary people both east and west. Thothmes III. had practically to reconquer the whole world anew.

CHARLES R. GILLETT.

**Hatch**, EDWIN, D. D. (Church of England): b. at Derby, England, Sept. 4, 1835; graduated at Oxford 1857; was Professor of Classics in Trinity College, Toronto, Canada, 1857–62; rector of the high school, Quebec, 1862–67; vice-principal of St. Mary Hall, Oxford, England, 1867, till his death there, Nov. 10, 1889. In 1883 he became rector of Purleigh, and in 1884 university reader in Ecclesiastical History. He was Bampton lecturer 1880, and as such produced that remarkable book, *The Organization of the Early Christian Churches* (London, 1881; 2d ed. 1882.; Germ. trans., by A. Harnack, Giessen, 1883). He also wrote *The Growth of Church Institutions* (1887); *Essays in Biblical Greek* (1889); and the posthumous Hibbert lectures, *Greek Influence on Christianity* (1890); and with H. A. Redpath, *Concordance to the Septuagint and other Greek Versions of the Old Testament* (1892, *sqq.*). See *Memorials* edited by his brother (1890). SAMUEL MACAULEY JACKSON.

**Hatch**, JOHN PORTER: military officer; b. in Oswego, N. Y., Jan. 9, 1822; graduated from the U. S. Military Academy, and was appointed brevet second lieutenant of infantry July 1, 1845, rising through successive grades to be colonel of Second U. S. cavalry 1881; in the Mexican war he took part in various engagements from Palo Alto to the final capture of the city of Mexico, and was breveted first lieutenant and captain for gallantry in battle; subsequently in garrison and on frontier duty; engaged on frequent expeditions against hostile Indians up to 1861. In the civil war he was appointed brigadier-general of volunteers Sept., 1861, and commanded a cavalry brigade in the Shenandoah valley and Northern Virginia; engaged at second battle of Bull Run and Chantilly; at the battle of South Mountain Sept. 14, 1862, commanded a division and was severely wounded; subsequently commanded various districts in the South; breveted from major to major-general for gallant services during the war; promoted colonel Second Cavalry June 26, 1881; retired 1886. D. Apr. 12, 1901.

**Hatchel**: See HACKLE.

**Hatch'ie River**: a stream having its source in the N. E. of Mississippi. It flows N. into Tennessee, and then W. N. W. to the Mississippi river. Its mouth is 25 miles N. of Memphis. Small steamboats can run for half the year as far up as Bolivar, Tenn., 150 miles from its mouth. Its valley is very fertile. Its lower portion is often called the *Big Hatchie*.

**Hatching**: See INCUBATION.

**Hatchment**: an *achievement* or display of the heraldic bearings of any person. (See HERALDRY.) Especially, in modern Great Britain, a tablet painted with the escutcheon, etc., and hung on the front wall of a house in which there has died, or which belonged to, the person whose arms are represented on the *hatchment*. R. S.

**Hatfield**: town; Hampshire co., Mass. (for location of county, see map of Massachusetts, ref. 3–E); on the Connecticut river and the N. Y., N. H. and H. Railway; 5 miles N. of Northampton. Hatfield has considerable manufactures of lumber, etc., and is the seat of an academy. It was during colonial times much exposed to Indian attacks, and spirited fights occurred here May 30 and Oct. 19, 1675. On Sept. 19, 1677, the Indians made a bloody assault upon the settlement. Pop. (1880) 1,495; (1890) 1,246; (1900) 1,500.

**Hatfield**, EDWIN FRANCIS, D. D.: b. in Elizabethtown, N. J., Jan. 9, 1807; graduated at Middlebury College, Vermont, in 1829; spent two years (1829–31) in Andover Theological Seminary; was ordained by the third Presbytery of New York May 14, 1832; was pastor of the Second Presbyterian church of St. Louis, Mo., 1832–35; of the Seventh Presbyterian church of New York city 1835–56; and of the North Presbyterian church 1856–63. He became special agent of the Union Theological Seminary in New York 1864–66, and again 1870–73, raising a large sum of money for its endowment. From 1846 he was stated clerk of the General Assembly. In 1850 he received the degree of D. D. from Marietta College, Ohio. Dr. Hatfield also did much literary work. He published *Universalism as it Is* (New York, 1841); *Memoir of Elihu W. Baldwin, D. D.* (1843); *St. Helena and the Cape of Good Hope, with Incidents in the Missionary Life of the Rev. J. M. Bertram* (1852); *The History of Elizabeth, N. J.* (1868); *The Church Hymn-book, with Tunes* (1872); *The Chapel Hymn-book* (1873); *The Poets of the Church: a Series of Biographical Sketches of Hymn-writers, with Notes on their Hymns* (1884). He also edited *The New York Observer Yearbook* for 1871, 1872, and 1873. He was moderator of the General Assembly in 1883. D. at Summit, N. J., Sept. 22, 1883. He gave his library of more than 6,000 volumes to Union Theological Seminary. Revised by S. M. JACKSON.

**Hathor**, haa'thor ("House of Horus"): the Egyptian goddess of love, beauty, and joy; daughter of Ra, and wife of Tum. Among her other titles were "Lady of Heaven," and "Eye of Ra." She was represented in many forms, corresponding to the attributes for which she was worshiped, and in the later periods she was variously identified with Nut, the sky, Isis, Mut, Sechmet the cruel, and Bast the friendly. In general she was pictured as a cow, or as a cow-headed woman with horns and the sun-disk. The Hathor columns were so called from their capitals, which consisted of a Hathor-head adorned with cow's ears. Her sanctuary at Denderah in the sixth nome of Upper Egypt was said to have been founded by Khufu (Cheops, fourth dynasty) and repaired by Pepi (sixth dynasty), and has been preserved as a building of the Græco-Roman period. She also had a sanctuary at Hermopolis. She was one of the few Egyptian deities served by female attendants. An exceedingly early cult of Hathor in connection with the god Sopt, which continued till Ramses III., was that in Sinai, especially in Wadi Maghara, where she was regarded as the protectress of the mines. She was also called "Mistress of Punt," and was a patron of the sailor, being invoked for a favorable wind. The "Seven Hathors" were regarded as a sort of fairy godmothers who presided at the birth of royal children and foretold their fates, more especially the manner of their death. Another distinct deity of the same name presided in the nether regions, and there dispensed the water of life.

CHARLES R. GILLETT.

**Hat-making**: the processes involved in the manufacture of hats, the term in its generally accepted sense having reference to those processes in which special tools or special kinds of machinery are used, and including the making of caps. The manufacture of felt caps as a distinct trade was established in Nuremberg, Germany, as early as 1380, and in France during the reign of Charles VI. (1380–1422). In 1510 the manufacture of beaver hats was begun in England, and in ten years' time the industry was established in Scotland and Ireland, as well as in France and other continental countries. In 1604 a felt-makers' society was incorporated in England, and in 1667 a hatters' society, which included manufacturers in Scotland and Ireland. By 1691 the quality of the hats made in England had improved to such a degree that the importation of hats from the Continent almost ceased. Meanwhile the English colonies in North America had achieved success in the same line of business. About 1655 the General Assembly of Virginia offered a premium of 10 lb. of good tobacco for every good fur or felt hat made in the province. About 1670 some hatters of Massachusetts petitioned the general court for exclusive privileges connected with their trade, and were promised them on condition that they would produce as good and as cheap articles as were imported. In 1675 the exportation from Massachusetts of wool and of raccoon furs was forbidden, and nine years later the felt-makers of Pennsylvania made an attempt to prevent the exportation from that colony of furs used in the manufacture of hats. In 1723 petitions were presented to Parliament asking that the importation of hats from the colonies be prohibited, because the business of the hat-makers of that city was injured thereby. The colonial governments accordingly were ordered to impose severe penalties upon any one who attempted to export hats, and the law remained in force until

the colonies declared their independence. The hat-making industry was established in Danbury, Conn., soon after the Revolution broke out, and it is said that a regular factory was opened in Salem, Mass., as early as 1761. Up to 1834, when the silk hat or "water-proof hat," as it was then called, was introduced from France, napped hats, or those having a nap of beaver fur felted into a prepared "body," were made in nearly every town in the U. S., the materials being mostly bought at home. The inability to make silk hats, or at least to make them for the same price as that for which the imported ones were sold, and the growing custom among storekeepers of selling ready-made hats of various kinds, drove many old-fashioned hat-makers out of the business and tended to concentrate the manufacture in cities. The principal centers of hat and cap making in the U. S. are New York, Philadelphia, Danbury and Bethel, Conn., Newark and Orange, N. J., Boston, Baltimore, Chicago, St. Louis, and San Francisco. In 1880, according to the census returns, the number of establishments (not including those making wool hats) was 489; the capital employed was $5,455,468; the number of hands employed, 17,240; the amount of wages paid, $6,635,522; the value of materials used, $9,341,352; and the value of products, $21,303,107.

Beaver or napped hats were in general use in the U. S. up to about 1835. In the finer qualities the beaver nap was felted into a body of rabbit's fur. When beaver's fur became scarce the fur of other animals was substituted, and the wool of the lamb and llama took the place of rabbit's fur for the body. The fur was cut from the skins by hand, until machinery for the purpose was invented in the U. S. Up to 1810 all hats were made on round blocks, no allowance being made for possible differences in the shapes of heads. Hats in general use nowadays are mostly of three kinds: felt, silk, and straw.

*Felt Hats.*—The furs of the coney, hare, nutria, muskrat, and beaver are used the most in the manufacture of felt hats. Before cutting the fur from the skins they are washed and the projecting hairs removed, either by plucking or shearing; coney skins are generally plucked, hares' sheared. The fur then undergoes a process called carroting, to increase the felting property of the fur. This process is accomplished by laying the skins on a table, fur uppermost, and applying the carrot (nitrate of mercury) with a stout brush; the skins are then laid together in pairs, fur sides in, and put into a drying-room. After remaining in the room long enough for the mercurial solution to have the desired effect, they are taken to a machine made expressly for the purpose and the pelt cut from the fur. The various kinds and qualities of fur are then mixed together, according to the body required and the fancy of the manufacturer, generally in the proportion of two of carroted fur to one of raw. Raw fur is that which has been treated the same as carroted, excepting that the mercurial solution is omitted. It is generally finer in quality, and the felting remains on the surface. The fur is then again cleaned in a cone-shaped box with large teeth on the inside, between which the teeth of a rapidly revolving cone move. On the large end of this cone are fan-blades which cause a draught of air to flow inward through a feed-hole in the front and into a receptacle for the fur placed back of the machine. The mixture is thoroughly stirred and then fed into the machine. The teeth separate the fleeces, intermingle the mixture, and prepare it for the blowing-machine. This is a large structure divided into several sections. The fur is fed evenly to a slowly turning apron, from which it is passed into a pair of rollers. In front of the rollers is a rapidly revolving picker which tosses the fur, the lighter particles falling on an apron which conveys it to the next section, while the heavier substances, such as hair, pelt, dirt, etc., fall through a space between the apron and picker. The fur is thus treated in each section, till at last it leaves the machine thoroughly cleaned and ready to be formed. The machine on which forming is done consists of a wide oil-cloth belt, a pair of feed-rolls, picker, a hollow metallic drum with small blades running longitudinally across its surface, an open turntable, and a powerful exhaust fan. A copper cone full of small holes is placed on the turntable, the fan creates a current of air into which the fur is thrown from the drum, the drum takes it from the picker, the picker from the feed-rolls, and the feed-rolls from the apron. The apron and feed-rolls revolve slowly, the picker, drum, and fan at a tremendous speed. When the fur is all on the cone, just enough for one hat, it is wrapped in wet cloths and immersed in hot water for about a minute, is then stripped from the cone and given to the hardener. The next process is the shrinking of the body from a large loose, cone-shaped mass, about 28 by 36 inches, to a strong closely felted fabric not much more than one-third of its original size. Superfluous hairs are then shaved off and the body is given a second shrinking. When all moisture has been removed the body is ready to be stiffened, the process consisting of the application of a solution of shell-lac, so that each and every fiber will be incrusted. The next process is that of blocking, which is done by immersing the bodies in boiling water and shaping them one at a time over blocks suited to the final shape of the hat. Dyeing comprises two operations, mordanting and coloring. The mordant mostly used consists of a solution of bichromate of potash and tartar, in which the hats are left about an hour and a half, after which they are soaked to remove all chemicals not fastened to the fiber. A good black dye can be made of logwood and a small quantity of madder, and fancy colors either by using the various woods alone or combining them; for instance, logwood yields a blue, fustic a yellow, madder a red, and the three combined, in proportion to their strength, a brown. The hat should remain in the dye-bath from one and a half to two and a half hours. The next step is finishing, for which purpose the hat is taken to a steaming-table, in the middle of which are iron pots through which live steam passes. The hat is held in the steam until it becomes soft, and is then pulled over a block, which gives to the crown its final shape. It is then put into a drying-room, and left there long enough to dry out the condensed steam, when a coat of water-stiffening is applied to the inside to strengthen weak places. The hat is again dried and pulled a second time over the block and ironed, to remove wrinkles and unevenness. After the hat has been thoroughly ironed, both crown and brim, it is pounced with emery-paper; this, aided by singeing, removes the hair and long nap, and leaves it as smooth and fine as a piece of doeskin. It is next curled. The brim is first cut to the desired width, and the edge softened with a hot iron, and turned over with small hand-tools to suit the fashion. It is next placed on a hollow iron table called a baker, through which steam passes. This heats the brim from the under side, while the upper is covered with hot sand-bags. When the brim is soft enough it is taken from the baker to a bench, the sides rolled up, and the front and rear pitched down in accordance with the prevailing style. The trimming which follows is done by girls, and consists of sewing on the binding and band, whipping in the leather, and sticking in the lining with cement.

The above relates wholly to stiff hats. Soft hats are treated essentially the same, excepting that in the stiffening process very little shell-lac is used, and they are pounced before they go to the finishing-room.

*Silk Hats.*—These are made mostly of muslin and silk plush. The muslin is torn up into short lengths, about 7 feet, immersed in water-stiffening, and stretched upon frames to dry. The muslin for the brim is heavy and framed four ply, one ply being put on the frame at a time, and the whole rubbed together; that for the side crown is light and framed one ply; the tip is medium and one ply. The side crown-pieces are cut on the bias, the brim and tip into squares. The side crown is cut to fit the block, the ends stuck together with a hot iron, and the block set in. The first ply of the tip is the surplus piece from the side crown, which is ironed over and to the side, and the two joined firmly together by a very narrow and thin piece of prepared muslin called robbin. The heavy top piece is now laid on and ironed to the first. The center of the brim piece is cut out, the edges of the cut are softened with an iron, and the piece is drawn over the tip down to the brim board. After the edge of the margin is beveled down the joint between the brim and crown is still further strengthened by ironing a piece of robbin over the seam; the brim is ironed and rounded, and two small pieces of muslin are stuck on the upper brim to brace the front and rear. The side crown is now varnished and a thin piece of unstiffened, unbiased muslin ironed to the first ply, and a like piece ironed to the second in the same manner. The whole crown is now varnished, and two pieces of plain muslin are laid together on the tip and ironed fast. The body now receives a coat of varnish, after which it is dried and varnished twice more. The plush is cut into three pieces, side crown and upper brim on the bias, tip oval, and a piece of merino for the under brim is cut square. The side crown is sewed

to the tip, but the selvage ends are left free. The cover, body, upper and under brims are now ready to be finished. The under brim is first ironed on and the surplus merino trimmed off, and the plush is fastened to the upper brim in the same manner. The cover is drawn over the body and the seam place marked. It is then laid upon the bench and the nap brushed back from one side to avoid cutting, and to be used later to assist in hiding the seam. The plush is cut with a large pair of shears at the marked place and the cover drawn over the body again, the tip stuck, and the seam laid. The plush is then moistened with a wet sponge, the nap worked out and ironed dry, after which it is taken to a velvring-machine, in which it is revolved under a velure till the nap is properly arranged and thoroughly cleaned and straightened out; after this it is dry-ironed and blocked. The block on which the body is made and the hat finished is in five pieces, which being very large in the tip must be separable to get it in the hat. The pieces expanding and contracting unequally make the surfaces uneven where they meet. These irregular places, owing to ironing, show through the plush, and are worked out over a poutanee block. The curling and trimming in silk hatting are nearly identical with the same operations in felt hatting.

*Straw Hats.*—The principal material used in this branch is straw braid, which comes prepared for sewing together. Before the braid is made into hats it is washed with soap and alkali, and while wet is suspended from the roof of a tight wooden apartment, and bleached by burning sulphur. The sewing is done on machines by young women, and about the only thing used besides the machines is a block to fit the hat on. The braid is first dampened to make it pliable, and allowed to remain in this state for several hours. A few rows, called a button, are sewed by hand, and all the rest by machine. A flat piece, a little larger than the tip of the block, is sewed, laid on the block, and bent over its edges to start the sides, which, when sewed a layer or two beyond the band edge, are bent at right angles, and the sewing is continued till the brim is made to the required width. The hat is then immersed in glue, the surplus being removed with a sponge, and is then hung up to dry. The next step is pressing, done by men. Hand pressing consists of moistening and steaming the body, and ironing it over a block and flange till it is thoroughly shaped. It is then trimmed, which requires about the same operations as silk and felt hatting. The majority of straw hats are pressed on hydraulic machines, which, though giving a high-class finish, is hardly the thing for fine goods. Yet some shapes, principally ladies' hats, could not be done so well by hand. ROBERT DUNLAP.

**Hat'temists**: the followers of one Pontianus van Hattem, a Dutch minister who was deposed from his pastorate in Zealand for Spinozism in 1683, and died in 1706. He was, indeed, a pupil of Spinoza and his doctrinal system, a mystical pantheism in which all clear distinction between good and bad disappeared. The Hattemists were fatalists and Antinomians, and taught that the whole duty of the elect was to be patient and to maintain tranquillity of mind. They denied the existence of moral evil and the corruption of the nature of man. The sect was suppressed by the Dutch Government in 1733.

**Hatteras, Cape**: See CAPE HATTERAS.

**Hatte'ria**: a genus of reptiles embracing the sole living representatives of the order *Rhynchocephalia*. Externally they resemble the common lizards, but in their structure, especially in their osteology, they present many peculiarities which are of great interest to the naturalist, since they show these forms to be the modern representatives of the ancestors of not only the true lizards, but the crocodiles as well. Thus the vertebræ are concave at either end (amphicœlous), the ribs have but a single head, there is an infratemporal bar in the skull, there is a well-developed parietal foramen, through which, as Spencer has shown, nervous connection is made with a highly developed PARIETAL EYE (*q. v.*). Another interesting peculiarity is the immovable union of the quadrate bone (see OSTEOLOGY) by a suture with the skull. There is but a single living species, *Hatteria* (or *Sphenodon*) *punctata*, from New Zealand, where it is called Tuatara by the natives. The fossil representatives of the order *Rhynchocephalia* are found in rocks as early as the Permian.
J. S. KINGSLEY.

**Hatton**, JOHN LIPTROT: composer and pianist; one of the most prolific and popular of England's song-composers; b. in Liverpool, 1809; was self-taught in music. He settled in London in 1832, and began a professional career as composer, pianist, and conductor. His earliest opera was *The Queen of the Thames*, brought out in 1842; then came *Pascal Bruno* at Vienna (1844). He visited the U. S. in 1848 on a concert tour, and again in 1867. His opera *Rose, or Love's Ransom* was produced in 1864, the cantata *Robin Hood* in 1856 at the Bradford festival, and the oratorio or sacred drama *Hezekiah* in 1877, at the Crystal Palace. He wrote incidental music for many of Shakspeare's plays, two cathedral services, several anthems, and an immense number of songs and part-songs both for male and for mixed voices. He died at Margate, Sept. 20, 1886.—His daughter, Mrs. CHARLES G. MOORE, living in Canada, has inherited much of his musical talent, and is a fine composer. D. E. HERVEY.

**Hatzfeldt**, haats'felt, PAUL MELCHIOR HUBERT GUSTAV, Count von: German statesman; b. Oct. 8, 1831; son of Countess Sophie von Hatzfeldt, the friend of Lassalle; accompanied Bismarck to Paris in the Franco-German war; was minister at Madrid 1874; ambassador at Constantinople 1878; foreign secretary 1882; ambassador to London 1885.
C. H. T.

**Hauberk**, haw'bėrk [M. Eng., from O. Fr. *hauberc*, older *halberc*, from O. H. Germ. *halsberge*; *hals*, neck + *bergan*, protect]: a defensive garment of chain-mail, the most important piece of body-armor of the Middle Ages, during the thirteenth and fourteenth centuries. The haubergeon, or HABERGEON (*q. v.*), was probably a shorter garment of the same kind, but the true hauberk reached the knees or came below them; it had long sleeves, and often mittens forming part of the sleeves, and pierced with openings in the palms to allow of thrusting out the hands; moreover, a hood or coif which covered the head was also made in one piece with the body, and could be drawn forward or thrown back on the shoulders at pleasure. Such a hauberk weighed about 25 lb., without its necessary linings of leather or other material, meant to keep the body from the severe bruises of sword-strokes taken upon the steel links. In the excessive piling-up of bodily defenses peculiar to the knights of the fourteenth and fifteenth centuries stuffed garments were worn under the hauberk, and plates or splints over it, but it was not abandoned until the advance in the armorer's art made complete and manageable suits of plate possible for the noble, and plate arm-pieces, leg-pieces, gorgets, and the like, accessible to the poorer man, who secured them to his stuffed *gambeson*, or quilted *jazerant*, or *brigandine*. See ARMOR. RUSSELL STURGIS.

**Hauch**, howkh, JOHAN CARSTEN: Danish writer; b. May 12, 1790, at Frederikshald, Norway, where his father was a Danish official; studied at the University of Copenhagen, where in 1821 he took the degree of Ph. D.; 1827–46 lectured on Physics at the Academy of Sorö; 1846–48 held the professorship of Scandinavian Language and Literature at the University of Kiel, but on the outbreak of the rebellion in Holstein returned to Denmark, and became (1851) Oehlenschlager's successor as Professor of Æsthetics at the University of Copenhagen. His lyrical poems are comparatively few, and not very prominent, though some of his ballads and elegies are beautiful. His dramas include *The Two Sisters from Kinnacliff* (1849); *Tycho Brahe's Youth* (1852); and *The King's Favorite* (1853). Among the largest and most interesting of his dramatic works are his tragedies *Tiberius* (1836); *Svend Grathe* (1841); *Mark Stig* (1850). He attracted most attention, however, by his excellent novels, *Vilhelm Zabern* (1834); *The Alchymist* (1836); *The Castle on the Rhine* (1845); *Charles de la Bussière* (1855), and others. D. at Rome, Mar. 4, 1872.
Revised by D. K. DODGE.

**Hauck**, howk, MINNIE: opera-singer; b. in New York city, Nov. 16, 1852; made her first appearance in a concert in New Orleans about 1865; studied under Errani in New York, and made her operatic *début* in America in *La Sonnambula* in 1868; appeared in London in 1868, in Vienna in 1869, and later in Brussels, Paris, and Moscow, and again in London in 1878, everywhere making a great success. She sings with equal facility in English, French, German, Italian, and Hungarian, and has a very large operatic *répertoire*. Her best parts are considered to be Carmen in Bizet's opera of that name, and Katherine in Goetz's *Taming of the Shrew*. She is married to the Chevalier de Hesse-Wartegg.
D. E. HERVEY.

**Hauff**, howf, WILHELM: romance-writer and poet; b. in Stuttgart, Germany, Nov. 29, 1802; studied divinity at Tü-

bingen 1820–24; and in 1827 became editor of *Das Morgenblatt* (Stuttgart). He was a writer of romances and poems, some of which have become true *Volkslieder*. Among his works are the still popular novel *Lichtenstein* (1826); *Die Bettlerin vom Pont des Arts*; *Das Bild des Kaisers*, *Märchen* (1826; many later editions); *Mittheilungen aus den Memoiren des Satans* (1827); *Der Mann im Monde*, a satire on Clauren (1827); *Phantasien im Bremer Rathskeller* (1827) See Klaiber, *Wilhelm Hauff, Ein Lebensbild des Dichters* (1881). D. in Stuttgart, Nov. 18, 1827.

Revised by JULIUS GOEBEL.

**Hauge**, how'ge, HANS NIELSEN: reformer; b. in the Smaalenene country, Norway, Apr. 3, 1771. After only a common peasant's education he began to preach in 1795. He protested against the rationalism and secularization prevalent among the Norwegian clergy, and opposed to them a movement laying especial stress upon the spiritual priesthood of all believers, but connecting therewith, as was charged, very serious extravagances in undervaluing an educated ministry, ordination, etc. His zeal attracted many followers, who did not, however, withdraw from the established church, and led to his imprisonment from 1804–14. D. at Aker, near Christiania, Mar. 29, 1824. His followers became known as Haugians, or Readers. In the U. S. Elling Eilsen, who adopted Hauge's position, founded a synod in 1846, which numbered 14,000 communicants in 1893, chiefly in Minnesota, South Dakota, and Wisconsin, and has a theological seminary at Red Wing, Minn. See his *Life* by Bang (Christiania, 1874), and by Belsheim (1881). H. E. JACOBS.

**Haugians**, or **Readers**: See HAUGE, HANS NIELSEN.

**Hauksbee**, or **Hawksbee**, FRANCIS (the elder), F. R. S.: the inventor of one of the first machines for electrification by friction, and of a variety of other apparatus. He wrote numerous papers on natural philosophy, also a work entitled *Physico-mechanical Experiments on Various Subjects touching Light and Electricity, etc.* (1709). He is not to be confused with Francis Hauksbee the younger (1687–1763), an instrument-maker and experimental lecturer on physics, who was educated, elected clerk and housekeeper to the Royal Society in 1723, but was not a fellow. Of the life of the elder Hauksbee but little is known. His first paper appeared in the *Philosophical Transactions* in 1704, and he was elected to the Royal Society in 1705. His last three papers, published early in the year 1713, were posthumous, and it is supposed that he died in 1712. E. L. NICHOLS.

**Haultain**, THEODORE A.: See the Appendix.

**Haupt**, howpt, HERMAN, A. M.: engineer; b. in Philadelphia, Pa., Mar. 26, 1817; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July 1, 1835. In September following he resigned from the army and adopted the profession of civil engineering. He was in 1844 appointed Professor of Civil Engineering and Mathematics in Pennsylvania College, which position he held till 1847, when he was appointed principal assistant engineer of the Pennsylvania Railroad. From 1849 to 1852 he was general superintendent, and subsequently became chief engineer and director of that company. For many years he was engaged upon the Hoosac Tunnel, Massachusetts, as chief engineer and contractor. During the civil war he was aide to Gen. McDowell, with the rank of colonel, and chief of bureau of U. S. military railways in charge of construction and operation. In Sept., 1862, he was promoted to be brigadier-general U. S. volunteers, but declined the appointment; general manager of the Piedmont Air-line Railway from Richmond, Va., to Atlanta, Ga., 1872–76; chief engineer Pennsylvania Transportation Company and Seaboard Pipe-line 1876–78; general manager N. P. Railroad 1881–85; and its general superintendent 1885–86. Revised by JAMES MERCUR.

**Haupt**, LEWIS MUHLENBERG: civil engineer; b. at Gettysburg, Pa., Mar. 21, 1844. He was educated at the Lawrence Scientific School of Harvard College, and at the U. S. Military Academy, where he graduated in 1867. During 1867–69 he served on the U. S. Lake Survey. In 1869 he resigned from the U. S. Corps of Engineers and was appointed engineer of Fairmount Park, Philadelphia. From 1872 to 1892 he was Professor of Civil Engineering in the University of Pennsylvania, and in charge of the geodesy of Pennsylvania for the U. S. Coast and Geodetic Survey. He is the author of many papers on rivers and harbors, and has devised a method of improving harbors by the use of vertical deflectors for currents and reaction breakwaters for littoral drift, and has published *Engineering Specifications and Contracts* (1878); *The Topographer* (1884); and *The American Engineering Register* (1886). In 1892 he resigned his professorship in order to engage in civil and maritime engineering practice.

**Haupt**, MORITZ: philologist; b. in Zittau, Germany, July 27, 1808; pursued his university course at Leipzig 1828–30; privat-docent 1837; professor extraordinary 1838, and Professor of the German Language and Literature 1843; called in 1853 to the University of Berlin as Professor of Classical Literature; in 1861 secretary of the Academy of Sciences. He devoted himself to both classical philology and the Old German; edited with Hoffman *Altdeutsche Blätter* (1836–40, 2 vols.); founded in 1841 *Zeitschrift für deutsches Alterthum* (Leipzig): published a new edition of Lachmann's *Nibelungen* (Berlin, 1852); in same year poems of *Walther von der Vogelweide*; *Der arme Heinrich* (1842), his masterpiece, and other Old German works; his classical publications were editions of Catullus, Tibullus, and Propertius, Ovid's *Halieutica* and *Metamorphoses* with German notes, the *Cynegetica* of Gratius and Nemesianus Olympius; also from Hermann's unpublished remains, *Bion and Moschus* (1849); and *Æschyli Tragœdiæ cum Commentariis* (2 vols., Leipzig, 1852; 2d ed. 1859). His numerous contributions to philological journals were collected in three volumes of *Opuscula* (1875–76). Cf. Chr. Belger, *M. H. als akademischer Lehrer* (Berlin, 1879); Bursian, *Gesch. der class. Philol. in Deutschland* (p. 800 ff.) D. in Berlin, Feb. 5, 1874. Revised by ALFRED GUDEMAN.

**Hauptmann**, GERHARDT: See the Appendix.

**Hauran**, haä-oo-raän' [Heb. *Chāuran*, deriv. of *hur*, cave]: the present Arabic as well as English name of a district in Syria S. of Damascus and E. of the Jordan, mentioned by Ezekiel (xlvii. 16, 18), and nowhere else in the Old Testament, as the appointed northeast boundary of the Holy Land after the captivity in Babylon. Its dimensions are not indicated. In the Greek and Roman period, Hauran (Gr. Αὐρανῖτις) was one of the four provinces of BASHAN (*q. v.*). The Arabian geographers make it embrace the greater part of ancient Bashan; and so do some modern travelers, who say the natives regard it as consisting of three parts—*en-Nûkrah*, *el-Lejah*, and *Jebel Hauran*. This whole region is volcanic, very fertile, and contains hundreds of deserted or ruined towns, with many Greek inscriptions, referred mostly to the Roman period. Druses, Bedouin, and a few Christians now inhabit the region. Others restrict the application of the name to the more level part of the district (the ancient *Auranitis*), which has a gently undulating surface and slopes strongly westward. It yields great crops of grain. See works by Robinson, Porter, and Wetzstein.

Revised by S. M. JACKSON.

**Hausa** (how'sa) **States**: the large area in the Western and Central Sudan, where the Hausa language predominates, but not constituting any political division. This area embraces the present great Fulbe states of Gando and Sokoto with Adamawa, tributary to Sokoto. The region is mostly E. of the Niger river, and N. of its Benue affluent, with the Sahara as its northern and Bornu as its eastern boundaries. The field of the Hausa language is greater than that of any other in Central Africa. It is in fact a Lingua Franca, and is the common vehicle of communication among tribes speaking different languages. The Hausa people are still the predominating element in the population. Brave but not fond of war, commercial rather than fanatical, they were very gradually subjugated (1600–1800 A. D.) by the Fulbe, the warlike and fanatical propagators of Islam. While the Fulbe imposed their rule and religion upon the Hausa, the language of the conquered became to a large extent that of the conquerors. The Hausa are of the pure Negro type, and their land is the only part of Africa which, without the aid of Caucasian influences, has carried cattle-raising, agriculture, manufactures, particularly of cloth, leather, and metals, trade and commerce, to an advanced position. They are well clothed, and have many large, well-built towns. The Central Sudan, of which the Hausa territories form a large part, is estimated (*Bevölkerung der Erde*, 1891) to have eighteen people to the square kilometer, making it more densely peopled than any other division of Africa except Zanzibar. See Barth's *Travels in North and Central Africa*; Staudinger's *Im Herzen der Haussaländer* (Berlin, 1889); Hallen's *On Opening Relations with the Hausa Race*; and *Proceedings of the British Association* (1891). C. C. ADAMS.

**Hauser**, how'zer, KASPAR: a foundling whose origin and history have given rise to much interesting discussion. On May 26, 1828, he was found in the streets of Nuremberg, with a letter directed to a cavalry officer in the city, and dated "From the Bavarian border, place unknown, 1828." The letter contained a meager and doubtful account of his life, giving the date of his birth as Apr. 30, 1812, but not disclosing his birthplace. His helplessness excited sympathy, the more so as he was a fine-looking youth, and the mystery which surrounded him made him and his history the subject of intense curiosity. He himself could tell little about his past life, except that he had been kept in a dark place under ground, and attended by a man who did not show his face. Shortly before he was released, this mysterious attendant had taught him to walk and to write a few words. He was well cared for in Nuremberg, and his education began, but attempts to assassinate him were made in a most mysterious manner, and at last he was stabbed in the royal garden at Anspach, and died Dec. 17, 1833. Very different views have been propounded in explanation of this story. The noted jurist Feuerbach made it the subject of his *Crime against a Soul* (1832), in which he made out a strong case for the identity of Hauser with the hereditary Prince of Baden born in 1812. Julius Meyer, *Authentische Mittheilungen über Kaspar Hauser* (1872), considers him an impostor. Prof. Daumer, *Kaspar Hauser, sein Wesen, seine Unschuld, seine Erduldungen und sein Ursprung* (1873), like Feuerbach, considers him a son of the Grand Duke Charles of Baden. But the greatest interest in the story of Hauser arises from the curious psychological facts presented by his career, and the important speculations and discussions to which they gave rise among philosophers.

Revised by F. M. COLBY.

**Hausrath**, hows'raat, ADOLF, D. D.: German professor of the Reformed Church, but of the Tübingen school; b. at Carlsruhe, Jan. 13, 1837; studied at the Universities of Jena, Berlin, and Heidelberg. In 1867 he became Extraordinary and in 1872 Ordinary Professor of Theology in Heidelberg. He published *Der Ketzermeister Konrad von Marburg* (Heidelberg, 1861); *Der Apostel Paulus* (Heidelberg, 1865; 2d ed. 1872); *Geschichte der altestamentlichen Literatur in Aufsätzen* (1864; 2d ed. 1877–79); *Neutestamentliche Zeitgeschichte* (1868–73, 4 vols.; 2d ed. 1873–77; 3d ed. of vol. i., 1879; Eng. trans., London, 2 vols., 1878–80); *Religiöse Reden und Betrachtungen* (Leipzig, 1873; 2d ed. 1882); *David Friedrich Strauss und die Theologie seiner Zeit* (Munich, 2 vols., 1876–78); *Kleine Schriften religionsgeschichtlichen Inhalts* (Leipzig, 1883); *Arnold von Brescia* (1891). Under the pseudonym George Taylor he has published the historical romances *Antinous* (1880; 6th ed. 1886; Eng. trans., London, 1884); *Klytia* (1883; 5th ed. 1884; Eng. trans. 1883); *Jetta* (1884; 3d ed. 1884; Eng. trans. 1886); *Elfriede* (1888; Eng. trans., 2 vols., 1888).

SAMUEL MACAULEY JACKSON.

**Haussmann**, Baron GEORGES EUGÈNE: b. in Paris, Mar. 27, 1809; was educated at Paris; studied law, and became an advocate; was sub-prefect of various departments, and prefect under the presidency of Louis Napoleon. In 1853 the latter appointed him prefect of the Seine, and under his administration various beautiful and costly improvements were completed. Much opposition was made to his enormous expenditures, which involved the city in a debt of some 800 million francs. Prudently leaving France for a time after the fall of the empire, he was appointed Sept. 3, 1871, director of the Crédit Mobilier. He was elected to the Chamber of Deputies 1877. D. in Paris, Jan. 11, 1891.

Revised by C. H. THURBER.

**Hautboy**, hō'boi: See OBOE.

**Haute-Garonne**, ōt'gaă'ron' [Fr., Upper Garonne; *haute*, femin. of *haut*, high + Garonne]: department of France; on the frontiers of Spain. Area, 2,429 sq. miles. The southern part is high, occupied by the Pyrenees, and rich in minerals; lead, copper, iron, and zinc are mined; excellent marble is quarried. The northern part is very fertile, and produces much wine, fruit, and grain. The transit trade with Spain is very considerable. Capital, Toulouse. Pop. (1896) 459,377.

**Haute-Loire**, ōt'lwaar' [Fr., Upper Loire]: department of Central France; on the upper part of the Loire. Area, 1,916 sq. miles. It is mountainous, mostly occupied by the Margerides, which connect the Cévennes with the mountains of Auvergne, and whose lofty peaks are covered with snow half the year. The chief industries are agriculture, coal-mining, and the manufacture of lace. Capital, Le Puy. Pop. (1896) 316,699.

**Haute-Marne**, ōt'maarn' [Fr., Upper Marne]: department of Northeastern France; on the upper part of the Marne. Area, 2,402 sq. miles. It is hilly and mountainous, rich in vines and forests. Its chief product is iron; numerous mines and furnaces are worked throughout the whole department. Capital, Chaumont. Pop. (1896) 232,057.

**Hautes-Alpes**, ōtz'aalp', or ōt' aalp' [Fr., Upper Alps, *hautes*, femin. plur. of *haut*, high + *Alpes*, Alps]: department of Southeastern France. Area, 2,158 sq. miles. It is entirely covered by the Alps. The lofty summit, Des Écrines, is situated here, and rises 13,442 feet above the level of the sea. The soil is unproductive, but there are heavy forests and mines of lead, copper, iron, and coal. Capital, Gap. Pop. (1896) 113,229.

**Haute-Saône**, ōt'sōn' [Fr., Upper Saône]: department of Northeastern France; on the upper part of the Saône. Area, 2,062 sq. miles. It is mountainous, traversed by numerous branches of the Vosges Mountains, which here are covered with splendid forests, and are rich in coal and iron. Besides agriculture and the timber-trade, a considerable industry is carried on in mining and in the manufacture of glass and china. Capital, Vesoul. Pop. (1896) 272,891.

**Haute-Savoie**, ōt'saă'vwaă' [Fr., Upper Savoy]: department of France; separated from Switzerland in part by the Lake of Geneva, which extends along the northern border. Area, 1,667 sq. miles. It contains Mont Blanc, and its surface is elevated and not very productive. Forest products, cattle, wool, and cheese are the leading articles exported. Capital, Annecy. Pop. (1896) 265,872.

**Hautes-Pyrénées**, ōt'peĕ'rā'nā [Fr., Upper Pyrenees]: department of France; on the frontier of Spain. Area, 1,749 sq. miles. Branches of the Pyrenees traverse it, and form beautiful valleys watered by the Adour, the Arros, and the Gave-de-Pau. The mineral springs, especially those of Bagnères, Barèges, and Cauterets, are celebrated and much frequented. The well-known woolen stuff called barège is made here. Capital, Tarbes. Pop. (1896) 218,973.

**Haute-Vienne**, ōt'veĕ'en' [Fr., Upper Vienna]: department of Northwestern France. Area, 2,130 sq. miles. It is covered with low mountains, the highest point of which is Le Puy de Vieux, 3,200 feet high, and which are rich in minerals—copper, lead, tin, and porcelain clay. The soil is not very fertile. Horses, cattle, and sheep are reared in great numbers. Capital, Limoges. Pop. (1896) 375,724.

**Haüy**, aă'weĕ', RENÉ JUST, Abbé: mineralogist; b. of humble parents at St.-Just, Picardy, Feb. 28, 1743; became a church-singer at Paris, and a teacher in the College of Navarre 1764, laid before the Academy of Sciences in 1781 his brilliant discovery of the geometrical law of crystallization; was chosen to the Academy 1783; took orders in the Church; was imprisoned in 1792, and escaped death at the hands of the revolutionists through the exertions of Geoffroy Saint-Hilaire, his pupil; keeper of the cabinet in the School of Mines 1794, a member of the Institute 1795, Professor of Mineralogy in the Museum of Natural History in 1802, officer of the Legion of Honor in 1815. His principal works are an *Exposition de la théorie de l'électricité et du magnétisme* (1787); *Traité de minéralogie* (1801); *Traité élémentaire de physique* (1803); *Traité des caractères physiques des pierres précieuses* (1817); *Traité de crystallographie* (1822).

**Haüy**, VALENTIN, Abbé: a brother of the mineralogist Haüy; b. at St.-Just, Nov. 13, 1746. Becoming acquainted with Mlle. Paradis, a blind pianist, he resolved to devote his time to the instruction of the blind, and invented the art of printing with raised letters for the blind. The schools of this philanthropist were everywhere failures, owing to his lack of judgment, yet he is universally recognized as the "apostle of the blind." Though a cleric of the Roman Catholic Church, he was twice married, the second time to an ignorant market-woman. He was also for a time, it appears, a sub-priest of the Theophilanthropists. From 1806 till 1817 he lived at St. Petersburg. He had, says Dr. Howe, "genius, generosity, and zeal, but lacked common sense." Author of *Essai sur l'éducation des aveugles* (1786) and *Mémoire historique sur les télégraphes* (1810). D. in Paris, Mar. 19, 1822. See Strebitzky, *Valentin Haupt à St.-Pétersbourg* (Paris, 1884).

**Havana**: a province of Cuba, of which the capital of the island is the port. It produces a variety of agricultural products. The industries are almost solely sugar and cigar making. Pop. (1899) 424,811.

**Havana**, ha-van'a [Eng. spelling of Span. name, *La Habana*]: capital of the island of Cuba; the most important city of the West Indies, and one of the principal commercial marts of America; situated on the northern shore of the island, on an inlet of the Gulf of Mexico; in lat. 23° 8′ N., lon. 82° 22′ W. (see map of West Indies, ref. 3–B). Its harbor is one of the finest in the world; entered through a narrow, strongly fortified channel three-eighths of a mile long; opening into a large and deep basin capable of accommodating 1,000 vessels; lined with commodious, mostly covered wharves, and provided with a capacious dry dock. In the older part of the city the streets are generally very narrow and dirty, but the more modern portion contains many spacious and beautiful avenues, with a broad macadamized drive in the center, lined with palm-trees. The architecture of the city is mostly that of Southern Spain—the houses low, with one or two stories, massive, with flat roofs, the large windows provided with iron shutters and wooden blinds, but not glazed, and the walls gayly painted with red, blue, and yellow. The most prominent public buildings are the opera-house, one of the largest in the world; the cathedral, built in 1724, long containing, it is believed, the ashes of Christopher Columbus, transferred from St. Domingo in 1796, and to Spain in 1898; and the palace of the governor-general, with apartments for the government officers. None of these buildings, however, is very remarkable, but with respect to its public parks and promenades Havana perhaps surpasses all other cities in the world. The Pláza de Armas, in front of the governor's palace; the Alaméda de Paula, along the bay; the Párque de Isabel; the Paséo de Taeon, a magnificent drive with double rows of trees; and other promenades traverse and surround the city, charming the visitor not less with their liveliness and gayety than with their trees, flowers, fountains, and statues. The city is well provided with water from the Chorrera by an aqueduct about 7 miles long, and has about fifty public fountains. It has a university, an excellent botanical garden, many scientific, educational, and benevolent institutions, and is the seat of the government of Cuba and of a Roman Catholic bishop. Its manufactures are not important, with the exception of those of tobacco. Of the cigar-factories more than 100 may be reckoned as of first rank. The factory of La Hauradez, which occupies a whole square, produces daily 2,500,000 cigarettes. Havana is the chief commercial port of the island, exporting sugar, tobacco, fruits, etc., in large quantities. The principal imports are rice, lard, flour, and jerked beef. Havana communicates by lines of steamers with Spain, France, England, and the U. S.; by telegraph with Key West, Kingston, and Aspinwall; and by rail with Cardenas, Cienfuegos, Matanzas, and all important western parts of Cuba. Havana was founded in 1519; previous to that time there was a place of the same name on the south side of the island. Yellow fever has broken out frequently since 1761, and its ravages are often severe. Measures for its eradication were first taken under the American occupation in 1899. Pop. (1899) 235,981.

**Havana**: city (founded 1827); capital of Mason co., Ill. (for location of county, see map of Illinois, ref. 5–D); on the Illinois river, opposite the mouth of Spoon river, and the Ill. Cent., the Fulton Co. N. G., and the Jack. S. E. Railways. It is a shipping-point for corn and Osage-orange hedge-plants; has 6 churches, 3 public schools, and manufactures various agricultural implements. Pop. (1880) 2,118; (1890) 2,525; (1900) 3,268.

**Havana**: village; Schuyler co., N. Y. (for location of county, see map of New York, ref. 5–F); on the Chemung Canal and the N. Cent. Railway; 3 miles from the head of Seneca lake; 18 miles N. of Elmira. It has magnetic springs, and manufactures foundry and machine-shop products, flour, woolen goods, plaster, pottery, etc. Pop. (1880) 1,274; (1890) 1,751; not returned separately in 1900.

**Hav'elock**, Sir Henry, K. C. B.: soldier; b. at Bishop-Wearmouth, England, Apr. 5, 1795; studied at the Charterhouse, and read law in the Middle Temple under Chitty; entered the army in 1815; went to India 1823; met with a great change in his religious views on the voyage, after which he joined to his military duties the religious instruction of the men under him; became a preacher of the Baptist denomination; served with distinction in Burma 1824–26, and during the Afghan war; became adjutant-general for the Queen's troops in India 1851; served in Persia 1856–57; became a brigadier 1857; gained over Nana Sahib the brilliant victories of Cawnpore, Bithoor, etc.; relieved and re-enforced Lucknow Sept. 25, 1857; was made K. C. B. and baronet, the patent for the latter title being sealed the day after his death. D. at Alum-Bagh, Nov. 25, 1857.

**Havelock-Allan**, Sir Henry M.: See the Appendix.

**Haven**, Erastus Otis, D. D., LL. D.; bishop of the Methodist Episcopal Church; b. in Boston, Mass., Nov. 1, 1820; graduated at Wesleyan University 1842; was for some years an instructor at Sudbury, Mass., and principal (1846–48) of the Amenia Seminary, New York; entered the ministry 1848; was stationed in New York until 1853, when he became Professor of Latin in the University of Michigan; in 1854 took the professorship of English Language, Literature, and History; editor of *Zion's Herald*, Boston, 1856–63; member of the Massachusetts board of education 1858–63; member of the State Senate 1862–63; president of the University of Michigan 1863–69; president of Northwestern University, Evanston, Ill., 1869–72; corresponding secretary of the board of education of his Church 1872–74; became chancellor of Syracuse University 1874; was elected bishop May 12, 1880. He published *Young Men Advised* (New York, 1856); *Pillars of Truth* (1866); *Rhetoric* (1869). D. at Salem, Ore., Aug. 3, 1881.

**Haven**, Gilbert: bishop of the Methodist Episcopal Church; b. in Malden, Mass., Sept. 21, 1821; graduated at Wesleyan University, Connecticut, in 1846; was appointed the same year Professor of Greek and Latin in Amenia Seminary, New York, and principal of the same institution in 1848. In 1851 he joined the New England conference of the Church, and occupied several important pulpits. In the civil war he was the first commissioned chaplain (Apr. 18, 1861), and served in Butler's regiment. In 1865 he was appointed to special service in Mississippi; was (1867–72) editor of *Zion's Herald*, Boston, and in 1872 was elected bishop. Author of *The Pilgrim's Wallet* (New York, 1865); a sketch of his travels (1862) in Europe; of a volume of sermons, chiefly relating to slavery and the war, entitled *National Sermons* (Boston, 1869); and of *Our Next Door Neighbor, or a Winter in Mexico* (1875). D. in Malden, Mass., Jan. 3, 1880. His *Christus Consolator*, with notes by his son, William Ingraham Haven, was published in 1893.

**Haven**, Joseph, D. D., LL. D.: theologian; b. in Dennis, Mass., Jan. 4, 1816; graduated at Amherst College 1835; ordained pastor of the Congregational church in Ashland, Mass., 1840; pastor at Brookline, Mass., 1846–50; Professor of Mental and Moral Philosophy in Amherst College 1850–58; Professor of Systematic Theology in the Chicago Theological Seminary 1858–70. In 1873 he became Acting Professor of Mental and Moral Philosophy in the Chicago University, and died there May 23, 1874. In addition to numerous sermons and articles in the religious journals and reviews, Dr. Haven published *Mental Philosophy* (1857); *Moral Philosophy* (1859); and a collection of essays entitled *Studies in Philosophy and Theology* (1869).

**Hav'ercamp**, Siegebert: numismatist; b. at Utrecht, Holland, in 1684; studied theology, and was for several years a minister, but in 1721 was appointed to the chair of Greek in the University of Leyden, which he afterward changed for that of history in the same university. He published new editions of Josephus, Sallust, Tertullian's *Apologeticus*, Lucretius, Censorinus, and Eutropius; wrote *Introductio in Antiquitates Romanas* (1730); *Introductio in Historiam Patriæ* (1739), etc.; but it was as a numismatist that he showed the greatest merit. His principal works in this line were *De Numismate Alexandri Magni* (1722); *Thesaurus Morellianus, sive familiarum Romanorum numismata omnia* (1734); *Nummophylasium reginæ Christinæ* (1742); and other minor essays and criticisms. D. at Leyden, Apr. 23, 1742.

Revised by Alfred Gudeman.

**Hav'erford College**: an institution in Delaware co., Pa.; founded in 1832 by members of the Society of Friends under the name of Haverford School, and made a college, with authority to grant degrees, in 1856. It has a large farm and beautiful grounds. Besides the two chief college halls there are two well-furnished astronomical observatories, laboratories, a gymnasium, and a commodious library and alumni hall, with an admirably selected library of 37,000 vol-

nnes. The plan of the institution limits the number of the resident students. Since 1849 others besides the sons of Friends have been admitted. The principals have been Samuel Hilles, John Gummere, Daniel B. Smith, and Joseph Harlan; the presidents, Samuel J. Gummere, Thomas Chase, and Isaac Sharpless. Haverford College was the first collegiate institution founded and conducted entirely within the Society of Friends. In 1900 it had 121 students.

**Haverfordwest**: town; capital of Pembrokeshire, Wales (see map of England, ref. 11–C); picturesquely situated on the Cleddy; carries on considerable export trade in cattle, butter, cheese, and corn. Pop. (1891) 10,254.

**Haverhill**: city (settled 1640, incorporated as a town 1645 and as a city 1870); Essex co., Mass. (for location of county, see map of Massachusetts, ref. 1–I); at the head of navigation on the Merrimack river, and on the Boston and Maine Railroad; 32 miles N. of Boston. It contains 34 churches, high school, 9 grammar schools, public library containing 70,000 volumes, soldiers' monument in marble, Hannah Dustin monument in bronze, 12 parks, 5 hotels, 29 miles of street railway, and 1 daily and 2 weekly periodicals. Ayers and Rocks villages are within the city limits. Two iron bridges connect Haverhill with the town of Groveland and the Bradford district, the town of Bradford having been annexed to Haverhill January 1, 1897. A bridge also connects Rocks village with the town of West Newbury, Mass. The census of 1890 showed 722 manufacturing establishments (representing 64 industries). These had $7,925,810 capital, employed 14,988 persons, paid $6,815,474 in wages, and had products valued at $25,340,361. The principal manufactures were boots and shoes ($5,926,222 capital); boot and shoe stock ($1,525,865); woolen hats ($460,919); and slippers ($440,353). Pop. (1880) 18,472; (1890) 27,412; (1900) 37,175. EDITOR OF "GAZETTE."

**Haverhill**: town; one of the capitals of Grafton co., N. H. (for location of county, see map of New Hampshire, ref. 6–E); on the Connecticut river and the Concord and Montreal Railroad; 84 miles N. N. W. of Concord. It has several villages, and manufactures of leather, lumber, starch, paper, whetstones, boxes, etc., and has a large granite industry. It has an academy and a fine park, near which the public buildings stand. Pop. (1880) 2,455; (1890) 2,545; (1900) 3,414. EDITOR OF "COURIER."

**Haverschmidt**, haa'ver-shmit, FRANÇOIS: poet; b. at Leeuwarden, Holland, Feb. 14, 1835; educated at Leyden, became pastor of the little parishes of Fondgum and Raard in 1859; in 1862 he was called to Nieuwediep in North Holland, and thence in 1864 to Schiedam. His poetical career began in his student days, and he contributed many pieces to the Leyden *Studenten-Almanak*. These pieces he represented to be from the poetic remains of one Piet Paaltjens, and by this name he is chiefly known in Holland. The influences that were strong upon the young poet were those of Alfred de Musset and Heinrich Heine. Yet there is much that is native and original in these grotesque utterances of Dutch *Welt-Schmerz*. In later years Haverschmidt gathered his pieces together, with additions, under the title *Snikken en Grimlachjes, Academische Poezie van Piet Paaltjens* (Schiedam, 1867; 6th ed. 1889), and this collection constitutes his main achievement. Worth mentioning, however, are his prose sketches published with the title *Familie en Kennissen* (Schiedam, 1876). For his *Life*, with bibliography of his works, see J. ten Brink, *Geschiedenis der Noord-Nederlandsche Letteren in de XIX^e Eeuw* (vol. iii., Amsterdam, 1889). A. R. MARSH.

**Haversian Canals**: See BONE and HISTOLOGY.

**Haverstraw**: village; Rockland co., N. Y. (for location of county, see map of New York, ref. 8–J); on the Hudson river, and the N. J. and N. Y., the N. Y., Ont. and W., and the W. Shore Railways; 38 miles N. of New York city. It has good schools, large print-works, employing about 1,000 hands, a rolling-mill for copper, and a mill for making paper bags. Principal business, brick-making. Pop. (1880) 3,506; (1890) 5,070; (1900) 5,935.

**Havet**, ăă'vā', PIERRE ANTOINE LOUIS, Doct. Litt.: philologist; b. in Paris, France, Jan. 6, 1849; educated in Paris; Professor of Latin successively in l'École pratique des hautes études, la Faculté des Lettres de Paris, and le Collège de France; author of *Le Querolus, comédie latine anonyme* (1880); *De saturnio Latinorum versu* (1880); *Abrégé de grammaire latine* (1886); *Cours élémentaire de métrique grecque et latine* (1886; 3d ed. 1892). B. I. W.

**Havre**, or **Havre de Grâce**, aav'r'de-graas': town; in the department of Seine-Inférieure, France; at the mouth of the Seine, 143 miles N. W. of Paris by rail (see map of France, ref. 2–D). It is beautifully situated at the foot of a range of hills whose tops are lined with elegant villas. The city has fine broad streets; the new city-hall and barracks are magnificent buildings; the Church of Notre Dame was built in the sixteenth century. The old fortifications of Havre were demolished in 1856; it is now defended by forts erected on the surrounding heights. Its harbor, consisting of ten spacious basins, and well provided with wet and dry docks, is one of the best harbors of the world, and, next to Marseilles, Havre is the most important commercial place of the country. One-fifth of the foreign commerce of France is transacted in this city. The average number of vessels entering the harbor is 6,100, with a tonnage of 2,900,000. It is prominent as a place of embarkation for emigrants, and communicates directly with New York, Havana, Rio de Janeiro, Calcutta, and all the chief commercial places in Europe, exporting wine, brandy, oil, and different kinds of French manufactures, cloth, leather, jewelry, etc., and importing cotton, sugar, coffee, tea, and spices. Notwithstanding all its natural facilities and costly improvements, it has not been able to compete with Antwerp, for the reason that its inland communications are still insufficient. Pop. (1896) 119,470.

**Havre de Grace**, hav'er-de-gras': city; Harford co., Md. (for location of county, see map of Maryland, ref. 1–F); on the Susquehanna river near its entrance into Chesapeake Bay, and on the Balt. and O., and the Phila., Wil. and Balt. Railways; 36 miles N. E. of Baltimore. It is at the natural outlet to tide-water, through the Pennsylvania and Susquehanna Canal, for the anthracite coal of the Wyoming and Shamokin regions, and for the bituminous coal of the Juniata, as well as the lumber, minerals, manufactures, and agricultural products from the valleys of the Susquehanna and its tributaries. It has an extensive shoe-manufactory, tin-can factories, flour-mills, ship-yards, saw and planing mills, fruit-canning and fish-packing establishments, etc. The village has a fine harbor and a large trade in coal and lumber, also extensive shad and herring fisheries, and in this vicinity the celebrated canvas-back ducks are secured in large numbers. Pop. (1880) 2,816; (1890) 3,244; (1900) 3,423. EDITOR OF "REPUBLICAN."

**Hawaii**, hăă-waa'ee-ee: an island of the Hawaiian or Sandwich islands; in lat. 20° N., lon. 155° W., of triangular form, about 90 miles long by 70 broad. Area, 4,384 sq. miles. It was called Owhyhee by Capt. Cook. It contains two-thirds of the area of the islands, but only one-third of the population. The interior is in general an uninhabited wilderness. A northern plain and the eastern slope are most productive. Here are sugar estates and cattle and sheep ranches. The mountains are relatively low and the slopes gradual. On Hawaii are the great volcanoes of Mauna Kea in the N. E., Heralalai in the N. W., and Mauna Loa in the S. Kilauea is an enormous crater, 1,000 feet deep, lying to the E. of Mauna Loa. Pop. (1890) 26,754; (1900) 46,843. Hawaii was also the name of the republic, 1894–98.

**Hawaii-Nei, Hawaiian Islands**, or **Sandwich Islands**: an archipelago in the Pacific Ocean; 3,500 miles W. of Mexico and 2,700 miles S. W. of San Francisco; from July, 1894, to July, 1898, a republic. See HAWAII, HISTORY OF, in Appendix.

*Configuration and Area.*—The islands are between lats. 18° 50′ and 22° 50′ N., and lons. 154° 50′ and 161° 40′ W. They are twelve in number, with a total area of 6,449 sq. miles; Hawaii, about 4,015 sq. miles; Maui, 728 sq. miles; Kahoolawe, 69 sq. miles; Lanai, 135 sq. miles; Molokai, 261 sq. miles; Oahu, 600 sq. miles; Kauai, 544 sq. miles; Nühau, 97 sq. miles—habitable; and Molokim, Lehua, Kaula, and Nihoa, barren rocks. The group extends in a N. N. W. direction from Hawaii. The islands are all high, increasing in size and altitude toward the S. E.

*Physical Features.*—There are two active volcanoes on Hawaii—viz., Kilauea and Mauna Loa. The following eruptions are known to history: (1) In 1789, from Kilauea, accompanied by earthquakes and the discharge of poisonous gases, by which nearly 100 persons were killed; (2) in 1801, from Mt. Hualalai, the third in height on Hawaii; (3) in 1823 from Kilauea; (4) in 1832 from Kilauea and Mauna Loa; (5) in 1840, from Kilauea; (6) in 1843, from new craters and fissures near the summit of Mauna Loa; (7) in 1852, from a fissure on the north side of Mauna Loa; (8) in 1855, from the same place, continuing thirteen months; (9)

HAWAIIAN ISLANDS
PACIFIC OCEAN
KAUAI
NIIHAU
LEHUA
Nanopapa
Ki
Pueo Pt.
Kawaihoa Pt.
Kumukahi Channel
Haena Pt.
Hanalei
Kilauea
Anahola
Mana
Waimea
Nawiliwili B.
Koloa
KAIEIE WAHO OR KAUAI CHANNEL
OAHU
Waialua
Kahuku
Laie
Kaena Pt.
Kualoa
Waianae
Mokapu
Kaneohe
Waimanalo
Makapuu
Barber's Pt.
HONOLULU
Leahi or Diamond Head
Koko Head
KAIWI CHANNEL
MOLOKAI
Kalaupapa
Kalae
Lae o Ka Ilio
Lae o Ka Laau
Halawa
Pukoo
Kaunakakai
Pailolo Channel
LANAI
Kaa
Auau Channel
Lahaina
Wailuku
Spreckelsville
Paia
MAUI
Maalaea
MOLOKINI
Haleakala
Hana
Nuu
KAHOOLAWE
ALENUIHAHA CHANNEL OR HAWAII CHANNEL
HAWAII
Upolu Pt.
Kohala
Mahukona
Waipio
Honokaa
Paauhau
Kawaihae
Waimea
HAMAKUA
Laupahoehoe
Kiholo
Mauna Kea 13,953 ft.
Hilo Bay
Hualalai
Hilo
Kailua
Olaa
Kuolo
Kumukahi
Cape Kumukahi
Mauna Loa 13,760 ft.
Hookena
Kealakekua B.
Kilauea 3,970 ft.
Hoopuloa
Kalapana
Pahala
Punaluu
Kaalualu
Kalae Pt.
SCALE OF MILES
10 20 40 60 80
Longitude West from Greenwich
160 159 158 157 156 155
22 21 20 19
21° 10′
158°
HONOLULU
AND VICINITY.
SCALE OF MILES
0 2 4 6 8 10
WAIANAE
Kaala
Kalaeloa Pt.
Barber Spr.
Kupako
Fish Wear Spr.
Puuloa
Waikele
Honouliuliu
West Loch
Pearl Lochs
Middle Loch
East Loch
FORD I.
Krau-wau
Salt Lake
Kariki
HONOLULU
Pearl R.
Reef
Nuuanu Valley
Punch Bowl Hill
KOOLAU RANGE
Waikiki
Kapiolani Park
Diamond Spr.

in 1859, from Mauna Loa; (10) in 1866, from Mauna Loa; (11) in 1868, from a new fissure, nearly 3 miles long, in the slope of Mauna Loa, 10 miles from the sea, accompanied by violent earthquakes and irruption of great sea-waves upon the land, by which 79 persons and 200 houses were destroyed; (12) in 1880–81, from Mauna Loa, continuing nine months. The altitude of Mauna Kea, the highest point on Hawaii, is 13,805 feet; of Haleakala, the highest point on Maui, 10,032 feet. The extinct crater of Haleakala is 7 miles long, 3 wide, and 19 in circumference, and is from 700 to 2,000 feet deep. Kaala, the highest point on Oahu, is 4,060 feet above the sea; the altitude of Kauai is about 5,000 feet.

*Geology.*—The rock of the whole group is volcanic, with the exception of the ancient elevated coral reef and the resulting sandstone. No true fossiliferous rocks are found, although the tufa contains fossilized shells and corals of recent species. On the tops and in the interior of the mountains a variety of trachyte is found, and the bulk of the mountains seem to be composed of phonolites and graystones, forming a complete series from basalt to trachyte. The following are some of the minerals that have been noticed: Sulphur, pyrites, common salt, sal-ammoniac, limonite, quartz, augite, chrysolite, garnet, labradorite, feldspar, gypsum, soda-alum, copperas, glauber salt, niter, and calcite.

*Fauna.*—By far the greater proportion of animals peculiar to the Hawaiian islands are birds, which number over seventy species, of which nearly fifty have been catalogued and partially described. The larger part of these consist of waterfowl, beach and sea birds. The difficulty with which the forest birds can be observed and procured has rendered progress in describing them necessarily slow. David Malo, the native historian, enumerates as native hogs of several varieties, dogs, mice, the domestic hen, dragon-flies, two kinds of butterflies, millers, moths, flies, wasps, grasshoppers, cockroaches, winged ants, two kinds of spiders, and two kinds of lizards.

The vegetable kingdom is rich in interesting forms. Many new species and varieties have been discovered, and much work has been done in their description and classification.

*Climate.*—The climate is much affected by locality, and varies from cool, frosty weather to a high average of heat the year through. The N. E. trades blow the greater part of the year, and prevent the heat from becoming oppressive. Certain leeward portions of the island are cut off from the trades by the mountains, and are consequently oppressed with sultry weather, which, however, is tempered by the sea-breezes which in such places almost invariably blow through the day. Showers are frequent in the summer, and in the winter severe southerly and westerly rainstorms, lasting for days and even weeks, are liable to occur. Thunder-storms are rare, but severe. At Honolulu the average height of the barometer is 30·054 inches. The thermometer at the same place ranges from 62° F. at sunrise to 89° at 3 P. M., with an average of 75·7°. At Waimea, Hawaii, at an elevation of 4,500 feet, the average is 64°, the lowest 48°. The average rainfall at Waikiki, near Honolulu, is 48 inches per annum; on the hill, a mile back of the town, 56 inches; at Kalaea plantation, on the opposite side of the island, 61 inches. The rainfall in Honolulu for the year 1837 was 21·1 inches; for 1838 was 46·8 inches, 12 of which fell in October. The former year had 295 days of trade-winds, 44 of S. winds, and 26 variable; and 285 fine, 37 rainy, and 43 variable days; while the latter had 258 days of trade-winds, 71 of southerly winds, and 36 variable, and 275 fine days, 41 rainy, and 49 variable weather.

*Soil and Productions.*—The soil is fertile and well adapted to planting and grazing. It is estimated that there are nearly 2,000,000 acres of grazing land, besides 290,000 acres of arable land. The mountain sides abound in forests, in which there is a plenty of ship-timber and ornamental woods. Numerous streams, many of them large, flow down the mountains to the sea. Sugar is the principal product. There are between forty and fifty plantations, which raise and manufacture an aggregate of about 40,000 tons of sugar per annum, besides molasses; wool, tallow, hides, rice, pulu, and bananas are exported in considerable quantities, their production being generally profitable. Nearly all the crops of temperate climates can be successfully grown, but are not profitable for want of markets.

In 1890 the value of all the sugar plantations on the islands was estimated at $32.347.690, owned as follows: By citizens of the U. S., $24,735,610; by British, $6,038,130; by Germans, $2,008,600; by Hawaiians, $266,250; and by other nationalities, $299,100. The area of land under sugar-cane cultivation was about 67,849 acres, and the production in 1900 was 289,544 tons, manufactured at 68 factories.

*Ethnology.*—There are two theories of the origin of the Hawaiians—one pointing to the East, the other to the West. The former claims their relationship with the Toltec branch of the great Nahoa family of Mexico, and presents certain slight physiological and psychological similarities in proof thereof. This hypothesis makes the Hawaiians the oldest Polynesian colony, from which the other branches of the family originated. It is supported by the prevailing direction of the winds and ocean-currents. The other theory, carefully tracing the relationship of all the island-nations of Oceanica, supports the hypothesis, based mainly upon philological research and analogies in customs and implements, that all the Pacific archipelagoes and islands were colonized by successive migrations from Southern Asia; that the family which includes the Hawaiians, New Zealanders, Samoans, Marquesans, Tahitians, Tongans, the Austral islanders, and the natives of Minihiki, was an extremely ancient and primitive member of the great Malay race; and that the Malay Archipelago was the starting-point of their distinct migration. This theory is consistent with the evidence from language, race, manners, and customs, and has the additional support of Hawaiian tradition. A junk from the W., with survivors on board, drifted ashore at the Hawaiian islands in Dec., 1832.

*Finances.*—The real and personal property had an estimated value in 1891 of $39,000,000; the public debt on Dec. 31, 1899, was $4,890,351. For 1899 the revenue was $3,345,-231, and the expenditure $2,553,727.

*Trade and Commerce.*—In 1899 the foreign trade aggregated in value $41,687,000, an increase of 44 per cent. over the previous year. Sugar amounted to 97 per cent. of the total exports, all going to the U. S. The number of vessels engaged in foreign trade which visited the various ports was 656, of 768,842 tons. In 1900 the imports from the U. S. were valued at $13,509,148; the exports to the U. S. at $20,707,903. See HAWAIIAN ISLANDS in the Appendix.

*Population.*—From the time of Capt. Cook's visit to the arrival of the missionaries in 1820 the decrease of population through war and disease was immense; a pestilence in 1804, called *ahulau okuu*, the character of which is not known, decimated the nation. Cook's estimate of a population of 400,000 in his time was probably too great by 100,000. In 1823 the population was estimated at 142,-000. In 1832 the first census was taken, making the number 130,313. In 1884 the number was 80,578—51,539 males and 29,039 females. Of these, 40,014 were natives, 4,218 half-castes, 2,170 born in Hawaii of foreign parentage, 17,-939 Chinese, and 12,237 foreigners. The population in 1890 was 89,990. The natives numbered 34,436; half-castes, 6,186; born in Hawaii of foreign parents, 7,495; Chinese, 15,301; Japanese, 12,360; Portuguese, 8,602; natives of the U. S., 1,928; British, 1,344; Germans, 1,034; Norwegians, 227; French, 70; Polynesians, 588; other foreigners, 419. According to the U. S. census the population in 1900 was 154,001. The foreign population is rapidly increasing. The immigration in 1898 was 17,229, and the emigration 7,313, showing an excess of 9,916 arrivals. Most of the immigrants are Chinese and Japanese.

*History.*—The Hawaiian islands were discovered by Gaetano, a Spanish navigator, in 1542. Mendana, another Spanish discoverer, ascertained the correct position of the island of Kauai in 1567. Long before these dates (probably about 1527) one or two Spanish vessels were wrecked on the coast of Hawaii, and the few survivors intermarried with the natives. Their descendants are known at the present day by a light skin, which is liable to freckle, and by a Caucasian facial contour, and are designated as *Kekea*. Capt. Cook visited the Hawaiian islands in 1778, sighting the islands of Oahu and Kauai on Jan. 18, and anchoring at Waimea, Kauai, on the 19th. After visiting the island of Niihau, he sailed for the American coast, and, returning, arrived at the island of Maui on Nov. 20, when he met Kamehameha I., then a young man. Capt. Cook afterward spent some time with his vessels at the island of Hawaii, where, by his abuse of the unbounded hospitality and reverence of the natives, he lost their friendship, and was killed by them in a quarrel at Kealakekua Bay on Feb. 14, 1779.

The Hawaiians at this time supported an elaborate feudal system, closely analogous to that of Europe in the Middle

Ages. From a collection of savage tribes, each led by its own chief, the movement from generation to generation, through incessant fighting, had been toward centralization, until, at the time of Capt. Cook's visit, under the sovereignty of five or six independent dukes or kings, they had, in a degree, emerged from barbarism. High chiefs did fealty to the king, supplying food or forces for military service according to royal demands, while lower chiefs in like manner supported them, and were themselves served by the *konohikia*—middlemen between chiefs and people—who were the last representatives of kingly power, and oppressed the common people with great severity. The status of the latter was that of vassals, tenants, and serfs, who, with all they possessed, belonged to the chiefs and were under their protection. In 1790 Kamehameha, then king of a portion of Hawaii, was attacked by Keoua, king of the other part, whom he defeated and captured, thus obtaining possession of the whole island. Inspired with this success, he invaded the neighboring islands, and after several years of hard fighting conquered them all except the territories of Kaumualii, with whom Kamehameha, after one or two futile attempts at invasion, made a treaty, under which the possessions of Kaumualii were to vest in Kamehameha upon the death of the former.

In 1792 and the two following years Vancouver visited the Hawaiian islands, and introduced cattle on May 8, 1819. Kamehameha died at Kailua, Hawaii, after a long and most successful reign, in which he had firmly established his kingdom over the whole group. His eldest son, Liholiho, succeeded him under the title of Kamehameha II., with Kaahumanu, widow of Kamehameha I., as premier, who in influence and power was the real sovereign. Under her sagacious leadership, aided by the bold recklessness of the king, the mighty taboo system of centuries was overthrown, and the conservative party totally routed in a sanguinary battle which lasted for six hours. The universal destruction of the idols followed. Shortly after, on Apr. 4, 1820, the first missionaries arrived from the U. S.—seven men, with their wives. They immediately began to reduce the language to writing. The first printing was done in 1822. In 1823 the king and Kamamalu, his queen, visited Great Britain, where they both died the year following; whereupon Kaahumanu, the premier, became regent, and governed until the majority of Kauikeaouli, brother of the late king, a period of nine years. In 1825 the Ten Commandments were adopted as laws by the Government, and a few criminal laws were enacted in 1827 and 1829. The first Roman Catholic missionaries arrived July 7, 1827. The priests and their converts were from time to time exposed to severe persecutions by the Government until 1839, when Commander Laplace of the French frigate Artémise obtained, under threats of war, civil and religious privileges for Roman Catholics. Kauikeaouli assumed the government in 1833 as Kamehameha III. In 1840 Kamehameha III. and the chiefs promulgated a constitution granting civil rights to the people. On Feb. 25, 1843, the provisional cession of the islands to Great Britain, in consequence of the harsh demands of Lord George Paulet, occurred; which arrangement was terminated and the Hawaiian flag restored by Admiral Thomas on July 31 in the same year. In 1846 Kamehameha III. approved of the famous Land Act, by which he released the royal right to a large portion of the lands of the kingdom and provided for their conveyance to the people. In 1849 the temporary occupation and embargo of the port of Honolulu by the French took place. In 1852 the constitution was revised by the king and legislature, by which free suffrage was established as a civil right. Kamehameha III. died on Dec. 15, 1854, and was succeeded by Alexander Liholiho (son of Kinau, the daughter of Kamehameha I.), who reigned as Kamehameha IV. The chief monument of his reign is the Queen's Hospital. In 1856 he married Emma Naea (adopted daughter of Dr. Rooke), who in 1858 gave birth to a son who lived but little over four years. After a quiet and prosperous reign of nine years, he died on Nov. 30, 1863. In 1862 an English Reformed Catholic mission arrived. Lot Kamehameha, brother of the late king, succeeded him as Kamehameha V., and was noted for his forcible abrogation of the national constitution and promulgation of a new one limiting the right of suffrage by a property qualification. His reign was commercially prosperous, and Honolulu, the capital, was beautified with fine public buildings. He died Dec. 11, 1872, without issue, leaving the Kamehameha dynasty extinct. After a four weeks' interregnum under the regency of the cabinet, Lunalilo, a high chief, upon the unanimous nomination by the people, was elected king by the Legislature. His short reign of one year was noted for the institution of measures for the restoration of the liberal principles of the old constitution, for the unpopular ministerial effort for commercial reciprocity with the U. S. on the basis of the cession of the Pearl river lagoon, and for the bloodless mutiny of troops at the barracks in Honolulu. Lunalilo died Feb. 3, 1874, and left no issue. On Feb. 12 Kalakaua was elected king by the Legislature, notwithstanding the determined opposition of Queen-Dowager Emma, which culminated at the election in a riot by her supporters, in which many of the representatives were severely injured and the legislative hall was partially demolished. Order was restored by armed forces from British and U. S. war-ships in the harbor. In 1887 the progressive party demanded a new constitution providing for a cabinet removable only by vote of the Legislature. This was accepted by Kalakaua, who afterward, however, tried to regain his lost power. Kalakaua died in Jan., 1891, and was succeeded by his sister, Queen Lilinokalani, who from the first was opposed to the new constitution. Soon she began to evade some of its essential provisions, especially by the repeated appointment of ministries in opposition to the votes of the legislature, and gave further offense by her alliance with a lottery project and the opium interest. Finally it was learned that she intended to proclaim a new constitution restoring the royal power. This caused her overthrow by a small but influential portion of the population. A provisional government, representing for the most part the U. S. element, was promptly organized, and the marines and sailors of the U. S. S. Boston were landed for the protection of American life and property, and the prevention of incendiarism. This circumstance was regarded by the friends of the queen as indicating the intention of the U. S. to support the revolutionists. The provisional government at once took steps to secure annexation to the Union. A treaty with this end in view was arranged at Washington, and had been sent to the U. S. Senate for ratification when President Cleveland came into power. The treaty was then withdrawn by the President, who condemned the action of the U. S. minister to Hawaii at the time of the revolution as compromising the neutrality of the nation that he represented. Overtures to the provisional government for the restoration of the monarchy were rejected, and on July 4, 1894, the islands were proclaimed a republic under the presidency of Sanford B. Dole. The islands were annexed to the U. S. in 1898.

The independence of the Hawaiian islands was recognized by the U. S. in 1829, and again more formally in 1843; by Belgium in 1844, and by Great Britain and France later in the same year.

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S. B. Dole.

**Haweis**, Hugh Reginald: clergyman and author; b. at Egham, Surrey, England, Apr. 3, 1838; graduated at Trinity College, Cambridge, B. A. in 1859; from 1866 was curate of St. James's, Marylebone. In 1868 he became editor of *Cassell's Magazine*. He was a prominent advocate of cremation, and has written much on religion and music. His publications include *Music and Morals* (London, 1871); *Ashes to Ashes* (1874); *Christ and Christianity* (1886–87); etc.—His wife, Mary Eliza (Joy) Haweis, has written *Chaucer for Children* (1876); *Beautiful Houses* (1882); and other books relating to Chaucer and to the decorative arts. D. in London, Eng., Jan. 29, 1901.

H. A. Beers.

**Hawesville**: city; capital of Hancock co., Ky. (for location of county, see map of Kentucky, ref. 3–E); on the Ohio river and the Lv., St. L. and Tex. Railway; 84 miles W. S. W. of Louisville. It is the center of a large coal-mining region, has several mines in operation in its vicinity, is chiefly engaged in coal-mining, tobacco-growing, and hard-wood lumbering, and contains 6 churches, 2 public schools, flour-mill, hub-factory, shingle-mills, distillery, and weekly newspaper. Pop. (1880) 872; (1890) 1,013; (1900) 1,041.

Editor of "Plaindealer."

**Hawfinch** [*haw*, hedge < O. Eng. *haga*, akin to *hecg* (> *hedge*) : Germ. *hecke*]: the common grosbeak of Europe and Asia, *Coccothraustes vulgaris*. It is a shy forest bird, but is quite destructive of small fruits, seeds, and the like. It is variegated with black, white, brown, and gray of various tints, and is 7 inches long.

**Hawick**, haw'ik : town of Scotland ; in the county of Roxburgh, at the confluence of the Teviot and the Slitrig ; 45 miles N. N. E. of Carlisle (see map of Scotland, ref. 13–I). It is the center of the Scotch manufactures of stockings, plaids, shawls, and blankets. There are also dye-works and tanneries. Pop. (1891) 19,204.

**Hawk** [M. Eng. *hauk*, older *havok* < O. Eng. *hafoc* : O. H. Germ. *habich* (> Germ. *habicht*) : Icel. *haukr*]: a popular name for the many birds of prey of the family *Falconidæ*, mostly smaller than those known as eagles, and having, as a rule, shorter wings than the true or noble falcons. The term is, however, a very vague one, simply excluding on the one side the vultures and eagles, and on the other the buzzards, falcons, harriers, and kites. It may include more than a hundred species which may be arrayed in genera varying in number from twelve to twenty, according to the fancy of the student. The genus *Accipiter* is, however, regarded as the typical one. The more important species are described under their alphabetical heads. The differences between the various forms are such as can be appreciated only by the specialist. Revised by F. A. Lucas.

**Hawk'bit**: the fall dandelion (*Leontodon autumnalis*); naturalized from Europe, and now a common weed in meadows and roadsides from New England to Pennsylvania. It is a perennial, composite plant, with a cluster of toothed root-leaves, and a tall scape bearing one or more yellow flower-heads in the autumn. Charles E. Bessey.

**Hawkesbury**: a river of New South Wales ; flows first N. E. nearly parallel with the coast, and then S. E., entering the Pacific at Broken Bay, 20 miles N. of Sydney. The Sydney-Newcastle railway crosses it by a seven-span bridge 2,900 feet long, opened in 1889. The river is 330 miles long, but the upper portion is called the Wollondilly.

**Hawkesbury**: a village of Prescott County, Ontario, Canada; on the river Ottawa, opposite Grenville, with which it is connected by ferry (see map of Ontario, Canada, ref. 1–I). It is at the end of a branch of the Canada Atlantic Railway. It has manufactures of lumber. Pop. 2,000.

**Hawkesworth**, John : author; b. in London, 1715 or 1719 ; was a clockmaker's apprentice ; read law, and in 1744 became compiler of parliamentary debates for *The Gentleman's Magazine* ; for the same periodical was critic 1765–72 ; was the author of 70 of the 140 papers published in *The Adventurer* (1752–54), in consequence of which he received the doctorate from the Archbishop of Canterbury. He was author of *Zimri*, a good oratorio (1760) ; *Edgar and Emeline*, a drama (1761) ; *Almoran and Hamet*, a tale (1761) ; prepared for the Government an account of the first voyage of Cook and the voyages of Byron, Wallis, and Carteret (1773), which called forth severe criticisms; translated Fénelon's *Télémaque* (1768) ; prepared a *Life of Swift*. D. Nov. 17, 1773.

**Hawking** : See Falconry.

**Hawkins**, Anthony Hope : See the Appendix.

**Hawkins**, Benjamin : b. in North Carolina, Aug. 15, 1754 ; educated at Princeton ; was an excellent French scholar ; became Washington's interpreter in his intercourse with the French officers of his army ; was with him at the battle of Monmouth. In 1780 was chosen commercial agent of North Carolina, and 1781–84 and 1786–87 was a delegate to Congress ; 1789–95 was a Senator from the same State under the new Constitution. In the latter year he was appointed by Washington agent for superintending all the Indians S. of the Ohio, an office which he retained until his death, making his headquarters at a station in Georgia, now known as the town of Hawkinsville. To each successive President, from Washington to Madison, he tendered his resignation, which was not accepted. D. June 6, 1816. See Chappell's *Historical Miscellanies of Georgia*.

**Hawkins**, Benjamin Waterhouse, F. G. S., F. L. S. : writer on anatomy ; b. in London, Feb. 8, 1807 ; educated at St. Aloysius's College ; studied art under William Behnes, the sculptor ; began the pursuit of natural science in 1827, and in 1852 began the restoration of extinct animals in model, his previous labors (1842–47) in studying living forms of animal life at Knowsley Park having fitted him for the work. In 1868 he removed to the U. S. His lectures did much to popularize science. He was author of *Popular Comparative Anatomy* (1840) ; *Elements of Form* (1842) ; *Comparative View of the Human and Animal Frame* (1860) ; *Atlas of Comparative Osteology* (with Huxley, 1865) ; *Artistic Anatomy of the Horse* (1865) ; *Artistic Anatomy of Cattle and Sheep* (1867) ; *Artistic Anatomy of the Dog and Deer* (1876), etc. D. in 1889.

**Hawkins**, Hamilton Smith : See the Appendix.

**Hawkins**, Sir Henry : See the Appendix.

**Hawkins**, Sir John : naval hero ; b. at Plymouth, England, 1532. He early began a seafaring life, became master of a vessel, and in 1562 carried a cargo of slaves from Africa to the Spanish West Indies ; though Spanish law prohibited foreigners from trading there, he easily disposed of his cargo ; and his success led him to undertake similar and more extensive expeditions in 1564 and 1567 ; in these he had several ships. English noblemen and, it is said, Queen Elizabeth had financial interests in the voyages. Ultimately Hawkins was attacked by a Spanish fleet in the harbor of Vera Cruz (Sept. 24, 1568), and escaped with difficulty after losing several vessels. Notwithstanding their irregularity, Hawkins's exploits won him great fame ; he was elected to Parliament in 1572, was appointed treasurer of the navy in 1573, and had great influence in all naval affairs. As rear-admiral he commanded a division of the English fleet in the fight with the Spanish Armada July, 1588, and shortly after was knighted. In 1590 he was associated with Frobisher in an unsuccessful descent on the Portuguese coast. Four years later he was second in command in Drake's expedition to the West Indies, and died at sea, off Puerto Rico, Nov. 12, 1595. Herbert H. Smith.

**Hawkins**, or **Hawkyns**, Sir Richard : naval hero ; son of Sir John Hawkins ; b. probably at Plymouth, England, about 1562. He made several trading or freebooting voyages to the West Indies, commanded the Swallow in the fight against the Armada July, 1588, and in 1590 was with his father on the Portuguese coast. In 1593 he undertook a voyage around the world in the Dainty. He passed the Straits of Magellan, ravaged the coasts of Chili, and took and sacked Valparaiso. A strong Spanish fleet under Don Beltran de Castro was sent in pursuit of him, and he was eventually defeated and captured after a splendid resistance in San Mateo Bay (June 22, 1594). Don Beltran took him to Lima, where the viceroy refused to give him up to the Inquisition ; he was sent to Spain in 1597 and imprisoned ; escaped in 1598, but was recaptured, and was finally ransomed in 1602. Next year he was knighted ; in 1604 he was elected to Parliament, and shortly after he was made Vice-Admiral of Devon. In 1620–21 he was vice-admiral of Sir Robert Mansell's fleet sent against the Algerine pirates. D. in London, Apr. 17, 1622. Herbert H. Smith.

**Hawkinsville** : town ; capital of Pulaski co., Ga. (for location of county, see map of Georgia, ref. 5–H) ; at the head of navigation, on the Ocmulgee river and on the E. Tenn., Va. and Ga. Railway ; 40 miles S. of Macon. It is in a cotton-growing region, and has cotton warehouses, cotton-factory, steam grist-mill, carriage and wagon factories, Masonic temple, Odd Fellows' hall, and weekly newspaper. Pop. (1880) 1,542 ; (1890) 1,755 ; (1900) 2,103.

**Hawk-moth** [named from their manner of flying, which resembles that of a hawk] : any member of the *Sphingidæ*, a family of nocturnal lepidopterous insects, of which there are more than 300 known species, quite largely from tropical America. Among them are some of the largest of the Lepidoptera. They have short bodies and narrow, strong wings, and their flight is swift and powerful. They often stand poised in the air like humming-birds, and in general obtain their food from flowers after the manner of humming-birds, whence they are popularly called humming-bird moths, or hawk-moths. The larvæ have sixteen legs, and are remarkable for their large size and their habit of elevating the fore part in a manner fancied to resemble the position of the sphinx (hence the name *Sphinx* for the typical genus). The larvæ are mostly destructive plant-feeders, and among them is the well-known tomato-worm (*Protoparce celeus*). The U. S. have many species.
Revised by F. A. Lucas.

**Hawks**, Francis Lister, D. D., LL. D. : clergyman ; b. at New Berne, N. C., June 10, 1798 ; graduated at the University of North Carolina in 1815, and became a successful

lawyer, but in 1827 was ordained minister of the Protestant Episcopal Church; and was rector of St. Thomas's church in New York city. In 1837 he became one of the founders of *The New York Review*, and in 1839 established St. Thomas's Hall, a school at Flushing, N. Y., by which he was heavily involved in debt. He was (1840–42) editor of *The Church Record*. In 1843–44 he resided in Mississippi, and was elected bishop of the diocese, but declined the office. He was (1844–49) rector of Christ church, New Orleans, and was chosen first president of the University of Louisiana. In 1854 Dr. Hawks declined the bishopric of Rhode Island. Sympathizing with the South during the civil war, he held (1861–65) the rectorship of Christ church, Baltimore. In 1865 he accepted the ministry of the chapel of the Holy Saviour, New York. When in the practice of law he published several volumes of legal reports and a digest, and afterward *Contributions to the Ecclesiastical History of the United States* (1836–41); *Narrative of Commodore Perry's Expedition* (1856); *History of North Carolina* (1857–68); and in connection with the Rev. William Stevens Perry *Documentary History of the Protestant Episcopal Church* (1863); and a large number of other works. D. in New York city, Sept. 27, 1866. Revised by W. S. Perry.

**Hawksbee**: See Hauksbee.

**Hawk's-bill Turtle**: popular name of the species of sea-turtle (*Eretmochelys imbricata*) which furnishes the "tortoise-shell" of commerce; given on account of its horny beak, which suggests that of a bird of prey. This turtle is an inhabitant of the tropical seas, but usually the individuals of the Indian and Pacific Oceans are separated as a distinct species, *E. squamata*. See also Testudinata. F. A. L.

**Hawkshaw**, John: civil engineer; b. in England, Apr. 9, 1811. He constructed the Southeastern Railway and the Charing Cross and Cannon Street Railways in London, and was also engaged on the East London Railway and the Inner Circle Junction Railway. He built a bridge over the Thames at Staines, a drawbridge at Kingston-on-Hull, the Londonderry bridge in Ireland, Nerbudda bridge in India, and completed the Clifton suspension bridge begun by Brunel in 1843. He was consulting engineer on the navigation of the Weaver, in England, the Suez Canal, the Amsterdam Ship-canal, the navigation of the Nile, and the Panama Canal. He built an intercepting sewer 7 miles long at Brighton, drained Cardiff, and planned sewers for Dover. He was knighted in 1875. He was a frequent contributor to discussions in the Institution of Civil Engineers. The index alone of subjects treated by him prior to 1880 occupies six closely printed pages. In 1862 he was president of the Institution of Civil Engineers, and in 1875 of the British Association, and he was an honorary member of the American Society of Civil Engineers. D. June 2, 1891.

**Hawley**: borough; Wayne co., Pa. (for location of county, see map of Pennsylvania, ref. 2–J); at the junction of the Paupack and Lackawaxen rivers, and on the Erie and the Erie and Wyo. Val. Railways; 35 miles N. by E. of Scranton. It has five churches, public school with eight grades, and weekly newspaper, and its principal industries are silk and lumber manufacturing and glass-blowing and cutting. Pop. (1900) 1,925. Editor of "Times."

**Hawley**, Bostwick: See the Appendix.

**Hawley**, Charles B.: See the Appendix.

**Hawley**, Christopher Eldridge: civil and mining engineer; b. at Binghamton, N. Y., Aug. 17, 1833; educated at College Hill, Poughkeepsie, N. Y.; engaged first on railways in New York and Pennsylvania; in charge of the Enriqueta and New Almaden mines in California 1863–67; in charge of irrigation-works in the province of La Mancha, Spain, 1867–70; engaged in professional work in Arizona, South America, and Europe, and as mining engineer for various coal companies in Pennsylvania; contributed frequently to the press; has written much upon the mechanics of the bicycle, and was the first in the U. S. to declare that the safety type of wheel must be adopted before bicycling could be established on a permanent basis. C. H. Thurber.

**Hawley**, Gen. Joseph Roswell, LL. D.: U. S. Senator; b. at Stewartsville, N. C., Oct. 31, 1826. His parents were natives of Connecticut, and he received his early education in the schools of Farmington and Hartford, Conn., and Cazenovia, N. Y., and graduated at Hamilton College, New York, in 1847. He studied law at Cazenovia and Farmington, and in Sept., 1850, began practice in Hartford. He very early took a deep interest in the politics of the U. S., and was an active opponent of slavery, especially of its extension to the U. S. Territories, and was one of the founders of the Republican party in Connecticut. In Feb., 1857, he gave up the practice of law and became editor of the Hartford *Evening Press*. Upon the outbreak of the war of 1861–65 he enlisted in the army (Apr. 15, 1861), being the first man in Connecticut to enroll his name for the volunteer service. He went to the field as captain in the First Regiment Connecticut Volunteers; was commissioned a colonel in 1862, and a brigadier-general in 1864, though he had commanded a brigade for a long time previous to this promotion. He was military governor at Wilmington, N. C., on the occupation of that city by the Federal troops; was breveted major-general in 1865; was Gen. Terry's chief of staff at Richmond after the surrender of Lee, and was mustered out of service in Jan., 1866. He was elected Governor of Connecticut in Apr., 1866, held the office one year, and returned to journalism as editor of the Hartford *Courant*, with which the *Press* had been consolidated. He was elected to the Forty-second Congress from the first Connecticut district Nov. 5, 1872, to fill the vacancy caused by the death of Hon. Julius L. Strong, receiving the largest Republican vote ever cast in the district; was re-elected to the Forty-third Congress Apr., 1873. On the organization of the Centennial commission to arrange for the celebration of the one hundredth anniversary of the independence of the U. S., he was chosen its president. Afterward he was elected to and served through the Forty-sixth Congress; was elected U. S. Senator Jan. 19, 1881, for six years from Mar. 4, 1881; re-elected 1887, 1893, and 1899.

**Hawthorn**: See Cratægus.

**Hawthorne**, Julian: author; son of Nathaniel Hawthorne; b. in Boston, June 22, 1846. He was prepared for college at Concord; graduated at Harvard College in 1867, and then studied engineering in the Scientific School of Harvard and at Dresden. Being on a visit to New York in 1870, when the Franco-German war broke out, he determined to remain at home, and joined the staff of hydrographic engineers in the New York dock department, under Gen. McClellan. The success which some minor contributions to various New York magazines met with induced him to give up engineering for literature. From 1874 till 1882 he lived in Europe. Author of a number of novels, including *Bressant* (1873); *Idolatry* (1874); *Garth* (1877); *Sebastian Strome*, *Noble Blood* (1884); *John Parmelee's Curse* (1886); *Of Saxon Studies* (1876); the biography *Nathaniel Hawthorne and his Wife* (1885); and *The Professor's Sister* (1888).

**Hawthorne**, Nathaniel: author; b. at Salem, Mass., July 4, 1804. In early youth he was sent, on account of feeble health, to live upon a farm at Raymond, Me. He graduated at Bowdoin College in 1825, in the same class with H. W. Longfellow and G. B. Cheever. He then returned to Salem to live with his widowed mother. While here he published occasional articles, mostly tales, in different periodicals. In 1826 he published anonymously *Fanshawe*, an unsuccessful romance. He went to Boston in 1836 and edited *The American Magazine*, an illustrated periodical, which was soon bankrupt. In 1837 appeared *Twice-told Tales*, which was made up from his previous contributions to periodicals. This work gradually drew the attention of cultivated persons to the wonderful powers of its author, and in 1845 another series appeared. He was (1838–41) employed in the Boston custom-house. In 1842 he joined for a time in the Brook Farm experiment. In 1843 he married and went to Concord, Mass., where he lived in the old parsonage, afterward immortalized by him in *Mosses from an Old Manse* (1846). While here he was the associate of Emerson, Thoreau, Ellery Channing, and other congenial friends. He was (1846–50) surveyor of the port of Salem. While here he wrote that powerful tale *The Scarlet Letter* (1850), his most successful romance. He lived (1850–52) in Lenox, Mass., and here he produced the *House of the Seven Gables* (1851) and *The Blithedale Romance* (1852), and in the latter year published a *Life of Franklin Pierce*, who was a college friend to whom Hawthorne was warmly attached. He was U. S. consul at Liverpool 1853–57, and afterward spent some years in Italy. He lived (1860–64) in Concord, Mass., and while journeying for his health with Mr. Pierce he died at Plymouth, N. H., May 19, 1864. Besides the works mentioned above are *True Stories from History*, etc. (1851); *The Wonderbook* (1851); *The Snow Image*, etc. (1852); *Tanglewood Tales* (1853);

*The Marble Faun* (1860; in some respects his best effort); and *Our Old Home* (1863). After his death appeared a series of *Notebooks* (1868–72); *Septimius Felton* (1872); and parts of the unfinished *Dolliver Romance*. In person he was tall, large, and imposing, but he was as shy, sensitive, and impressible as any woman. Mr. Hawthorne's wife, Sophia Peabody (1810–71), illustrated one of his stories before their acquaintance, and after his death edited the *Notebooks*, and published a volume of *Notes* of her own (1868). Another posthumous romance by him (*Doctor Grimshawe's Secret*) was edited by his son (1883).—His daughter Una edited her father's *Septimius Felton*. His biography was written by his son (1885). Revised by Henry A. Beers.

**Haxo**, aak'sō', François Benoît, Baron: military engineer; b. at St.-Dizier, Lothringia, June 24, 1774; a general of French engineers; distinguished himself at the siege of Lerida, Mequenenza, and Tarragona, under Suchet; directed the construction of fortifications at Belfort, Sedan, Grenoble, and l'Écluse; also the operations at the siege of Antwerp 1830. He is best known out of France by what is called the "Haxo casemate," formed in the parapet, and, though arched over, covered with earth, and open behind to the terreplein; the guns fire through embrasures formed in an extension of the parapet beyond its ordinarily retired position in his system, and are not only secured from the enemy's fire, but may be hidden by masking the embrasures. D. June 25, 1838.

**Hay** [< M. Eng. *hey* < O. Eng. *hīg*: O. H. Germ. *hewi* (> Mod. Germ. *heu*): Goth. *hawi*, cut grass; cf. Germ. *hauen*: Eng. *hew*]: forage-plants cut for fodder and cured for storage. The plants commonly used for making hay are many kinds of grasses, several leguminous plants, particularly the clovers, and a few plants of other natural families. As a rule, plants are in the best state to be cut for fodder when in blossom or just out of blossom, though in general a greater weight of nutritive material at some expense of palatability and digestibility will be obtained if the plants are allowed to stand till nearly mature. During the ripening of the seed the stems become woody and stiff, preparatory to sustaining the weight of the heads, and this woody fiber is formed at the expense of the starch, gum, sugar, and soluble cellulose contained in the cells and juices of the stem and leaves.

The manner of curing is no less important than the time of cutting. If exposed to the sun, turned often, and dried rapidly and thoroughly, grass and clover become harsh and brittle, the leaves fall off, the sweet odor departs, and a great part of the value of the hay is lost. The object sought is not to dry hay so that it will keep, but to cure it so that it will make the most nutritious fodder and be dry enough for storing. Slow drying, with sufficient exposure to the air to prevent fermentation, causes the juices of the plants to become thickened, and when such a degree of inspissation is reached that the hay will not heat and mould when placed in stacks or in the mow—a point not difficult to determine with sufficient accuracy—the process is complete. Such hay will be found green, fragrant, and tough, the leaves even of clover not breaking and falling off. A greater weight of hay will be obtained, and it will prove more nutritious and be better relished by animals. The cutting of grass for hay is done by hand-scythes or by horse-power mowing-machines. The swaths as cut are shaken out and turned to expose all to the action of the sun and air, either by hand or by machines called spreaders or tedders. It is raked together when somewhat dry, either by hand or horse rakes, into long heaps, called windrows, extending in parallel lines across the field. The hay in the windrows is formed into symmetrical, compact conical heaps called cocks, which are of greater or less size according to convenience, and according to the condition of the hay, small cocks heating less readily than large ones. Hay-caps, which are pieces of cotton cloth 4 to 6 feet square, with loops of cord sewed in at the corners, whereby they are pinned with wooden pins or forks to the hay, frequently are used to cover the tops of these cocks in threatening weather. Hay-caps are also made in conical shape of compressed wood pulp treated with oil to make it waterproof. Thus protected, or indeed unprotected, hay will go on curing in the cock for several days. There is no hay superior to that cured in this way, but there is danger of overheating and mildewing. It is stored either under cover in barns or barracks, or in stacks. It may be salted when mowed away, four quarts to a peck of salt being used to the ton. This gives it a fresher color, and it is more relished by the cattle. Moreover, salt may aid in preventing injury from heating in case hay is housed or stacked too green. In addition to the tools already mentioned, horse hay-forks of various kinds are an important aid. They are arranged so that by a system of ropes, blocks, and rods the hay is lifted from the load upon the fork, and delivered in any section of the barn.

*Brown Hay.*—In some parts of Europe the fermentation of hay housed in a half-cured state or only well wilted before housing is so regulated that the mass becomes both cured and cooked by the operation. The result is a very compact mass, in which the plants lose to a degree their individuality, and which is of a dark-brown color, and so compact that it may be cut with an ax, though it can be broken up by hand. This is fragrant, and highly relished by stock, possessing at the same time a higher nutritive value than the best common hay. The fermentation causes a considerable loss in weight from the dissipation of moisture, and from the consumption of a part of the carbonaceous matter. Coarse grass and plants hardly regarded as fit for fodder, if mingled with grass of a better quality, are thus made to contribute largely to the store of winter forage.

Hay varies greatly in composition and nutritive value according to the plant from which it is made, the growth and period of cutting, and the method of curing. Exposure to a single heavy dew causes fermentations and decompositions within the substance of the moistened stems and leaves, both fragrance and flavor are lost, and the nutritious quality of the hay seriously injured. The average composition of hay made in the U. S., according to Dr. E. H. Jenkins, of the Connecticut Agricultural Experiment Station, is as follows (*Compilation of Analyses of American Feeding-stuffs*, U. S. Dept. Agr. Expt. Sta., Bull. No. 11):

| PARTS. | Clover. | Timothy. | Mixed meadow grasses. |
|---|---|---|---|
| Water | 15·3 | 13·2 | 14·3 |
| Ash | 6·2 | 4·4 | 4·4 |
| Protein (albuminoids) | 12·3 | 5·9 | 6·8 |
| Crude fiber | 24·8 | 29·0 | 26·9 |
| Nitrogen-free extract (carbohydrates) | 38·1 | 45·0 | 46·1 |
| Crude fat | 3·3 | 2·5 | 1·5 |
| Totals | 100·0 | 100·0 | 100·0 |

Except for the amount of crude fiber which it contains, good hay compares favorably with the different kinds of grain as nutritious feed, and it is its bulk, caused by the woody fiber, which particularly adapts it to the use of cattle and horses as a general diet. The money value of the hay-crop in all countries where cattle can not graze during the winter and spring is fully equal to any other farm crop, as generally estimated. Its intrinsic value is really greater, for the value of farm crops in money is fixed chiefly by the convenience and expense of marketing, and this places hay at a disadvantage. To be marketed at a distance it must be pressed into as small compass as possible by hay-presses, worked either by hand or power; and even in this form hay is a bulky article and expensive to transport and to market. Ordinary bales measure 2 feet to 2 ft. 6 in. across the ends, and 4 to 5 feet in length, and usually weigh from 200 to 350 lb.; while those made by the most powerful presses, though of the same size, weigh 400 to 500 lb.

The kinds of grasses and forage-plants most valued for hay, generally cultivated for that purpose in the U. S., are the following: (1) Timothy (*Phleum pratense*), called herds-grass in New England, a well-known grass growing to the height of 2 to 4 feet, flowers in July, yields abundantly for the first cutting—little for the aftermath. (2) Orchard grass (*Dactylis glomerata*), called also cock's-foot, a rough, rather coarse, leafy grass, flowering in June, at the same time with red clover, yields a heavy crop of hay very early, escaping late droughts, which it survives well; makes afterward a great growth of root-leaves, useful for fall pasturage. (3) Redtop (*Agrostis vulgaris*), called herds-grass S. and W. of New York, a grass known under many names, and assuming different forms and colors in different soils. It usually matures rather late, but grows wiry before it fairly flowers in July; is most valuable with other grasses, which it is apt gradually to crowd out; makes good hay—not so much as those previously named. (4) Fowl-meadow (*Poa serotina*), an admirable grass for moist meadows, making an abundance of nutritious, fine, soft hay—better for consumption than for market—and good aftermath. (5) June-grass or blue-grass (*Poa pratensis*) is hardly worthy of being in-

cluded among hay-grasses, yet it finds its way into almost all permanent meadows, and makes good sweet hay, excellent pasture, and a close sward. The rye-grasses are good, but not equal to timothy and orchard-grass for hay. Sweet-scented vernal-grass is present in many soils of the Northern and Eastern States. It gives the odor to new-mown hay so much admired, which is not noticed in Western hay on account of the absence of this grass. In addition to these proper grasses, the clovers are most important, as already mentioned. The most valuable is the common red clover (*Trifolium pratense*), of which there are two principal varieties—the mammoth and medium. The latter is preferable for hay, and may be used alone, or, better, in connection with orchard-grass or timothy, or with timothy, orchard-grass, and red-top mixed. Alsike, or Swedish clover (*Trifolium hybridum*), is partially procumbent in its growth, but with grass to sustain it makes excellent hay. Lucerne, or alfalfa (*Medicago sativa*), is sowed by itself, and after becoming established, where it does well yields at least three heavy crops of hay or green fodder each year.

The greatest consumption of hay is of course in those parts where the winter is long and severe. Grasses adapted to the soil throughout these colder portions of the temperate zone afford rich and abundant summer pasturage, but for winter fodder the chief dependence is hay, and in the U. S. corn-fodder, which, though properly included in the general definition of hay, is never reckoned as such by the farmers.

In the U. S. the hay crop for 1900 amounted to 50,110,906 tons, valued at $445,538,870, the product of 39,132,890 acres. Iowa is the chief hay-producing State.

Revised by H. H. Wing.

**Hay**, Charles Augustus, D. D.: Lutheran theologian; b. at York, Pa., Feb. 11, 1821; graduated at Pennsylvania College, Gettysburg, 1839; studied theology at Gettysburg, Pa., and Berlin and Halle, Germany; pastor at Middletown, Md., 1844–45; Hanover, Pa., 1848–49; and Harrisburg, Pa., 1850–65; Professor of Hebrew in Theological Seminary, Gettysburg, Pa., 1845–48, and from 1865 till his death there June 26, 1893. His chief contribution to theological literature is his translation (with Dr. H. E. Jacobs) of Schmid's *Dogmatik* (Philadelphia, 1875, 1888). H. E. Jacobs.

**Hay**, John: author and diplomat; b. at Salem, Ind., Oct. 8, 1838; graduated at Brown University in 1858; studied law at Springfield, Ill., and was admitted to the bar in 1861. Immediately afterward he went to Washington with President Lincoln, serving him as assistant secretary, and subsequently as adjutant and aide-de-camp. During the war of 1861–65 he served for several months under Gen. Hunter and Gen. Gillmore, attaining the ranks of colonel and assistant adjutant-general. He was secretary of legation at Paris 1865–67, when he became *chargé d'affaires* at Vienna by the withdrawal of Mr. Motley, remaining in the latter place till 1868. In 1869 he was appointed secretary of legation at Madrid, and held that position till 1870, when he returned to the U. S. and joined the editorial staff of *The New York Tribune*. Soon after this he became widely known by his dialect poems of *Little Breeches*, *Jim Bludsoe*, *Banty Tim*, etc., afterward published in book-form under the title of *Pike County Ballads* (1871). He also published *Castilian Days* (1871), sketches of Spanish life, character, and politics. Associated with John G. Nicolay in writing the *Life of Abraham Lincoln* (1887–89). In 1897 appointed ambassador to the court of St. James, and in 1898 Secretary of State.

**Hay Asthma, Hay Fever**, or **Autumnal Catarrh**: a disease recurring in some individuals at certain seasons every year, as in June (rose cold), in the haymaking season (hay fever), or (in the U. S. especially) in the autumn, whence the name autumnal catarrh. It is a catarrhal affection of the nasal (and sometimes of the bronchial) passages, often with some fever and more or less asthmatic spasm. Sometimes incessant sneezing and coryza are the only prominent symptoms. It is not observed in very hot or very cold countries, on the sea, or at considerable heights in some mountain regions. Probably it is caused by pollen from some plants, this producing violent irritation of the mucous membrane of the nose, which is generally found hypertrophied. It is likely, however, that various other forms of irritation also take part. Removal from districts where the disease prevails is the only means of cure, but the usual palliatives may be employed, and cocaine applied to the nose alone affords great relief to some patients.

Revised by William Pepper.

**Hay'den**, Ferdinand Vandeveer, M. D., Ph. D., LL. D.: explorer and geologist; b. in Westfield, Mass., Sept. 7, 1829; graduated at Oberlin, O., in 1850, and took a degree in medicine at Albany, N. Y., in 1853, but did not practice medicine until the civil war, when he became surgeon of volunteers and was finally breveted lieutenant-colonel. Except during the civil war he was engaged in the exploration and survey of the great plains and Rocky Mountains from 1853 to 1879, his first work being at private expense and subsequent work under the auspices of the general Government. From 1856 to 1860 his work was carried on in connection with explorations by the War Department. In 1867 he was commissioned by the national Government to make a geological survey of the Territory of Nebraska, and the official organization thus initiated was continued and enlarged year after year, becoming finally the U. S. Geological and Geographical Survey of the Territories, and being succeeded in 1879 by the present U. S. Geological Survey. His writings, chiefly contained in the official reports of his survey, constitute important contributions to geographic, geologic, botanic, and ethnographic knowledge; but his great achievement was the stimulus which his enthusiasm and example imparted to the scientific exploration of the national domain. He was a member of the National Academy of Science and of nearly all the other scientific societies of America, and an honorary member of many scientific societies in foreign countries. D. in Philadelphia, Pa., Dec. 22, 1887. G. K. Gilbert.

**Haydn**, hīd'n, Franz Joseph: composer; b. in Rohrau, near Vienna, Mar. 31, 1732; son of a wheelwright. Music was cultivated in the home, and Franz Joseph very early revealed his inborn talent. At five years of age a distant relation of the family, Johann Mathias Frankh, who was a schoolmaster in the neighboring town of Hainburg, took him to his home and supervised his general and musical education. During the three years spent with Frankh he learned reading and writing, something of Latin, and the elements of music and of the art of singing. He also began to play on the violin, the drum, of which he was very fond, and several other instruments. At eight years of age his fine voice and his intelligence attracted the attention of the dean of Hainburg, who took him to Vienna and, through the influence of Reuter, the chapel-master, procured him a place as chorister in the Cathedral of St. Stephen. There he diligently followed his art, learning what he could from his associates and from observations in the course of his work. At thirteen he made his first effort at composing by writing a mass, which was so crude that Reuter laughed him to shame. But, not disheartened, Haydn set to work with characteristic patience and industry, teaching himself the art of composition from the dry and obscure works of the period. When by the natural change his fine soprano voice was lost, Reuter turned him into the street penniless. A poor barber named Keller gave him a bed in his garret. There, with a worm-eaten harpsichord, a few books, and some scores, he worked in tranquillity. After a while, by giving lessons for a trifle and playing on the violin and the organ, he gained a livelihood. He was so attracted by the sonatas of Karl Philipp Emanuel Bach as to study closely his style, and he mastered it so well that Bach recognized the success of his effort. Sammartini, a prolific Italian composer of clear and graceful style, exerted the only other influence which affected his early work. He was introduced to Porpora, one of the greatest masters of that day, and knowing what inestimable benefits might be derived from such a source, Haydn devoted himself to Porpora as valet. Finally Porpora received him fully, made him his accompanist, his companion, and gave him invaluable knowledge of the art of Italian singing and of correct, elegant composition. His productions improved much after this, and brought him some personal attention. But, although publishers issued many of his works, he derived little or no benefit from them, being either ignorant of their publication or too retiring to enforce his claims.

The precarious period of his life ended at twenty-eight years of age in 1760, when he became chapel-master to Prince Esterhazy and a member of his household, receiving a salary of 400 florins, which was later raised to 1,000. Rarely do circumstances harmonize so completely with character as in Haydn's life from 1760 till 1790. He was the intimate friend of his beloved Prince Nicholas till death severed the bond. The prince played the violoncello, and fully appreciated the genius of Haydn, who wrote 150 com-

positions for his patron's instrument. In his prosperity, remembering his gratitude to the barber, he married Anne Keller. Her exasperating nature was too much for even the serenity of Haydn. They lived together but a short time before he left her, sharing his means generously for her support. His affectionate but dispassionate heart found consolation in Mademoiselle Boselli, a singer of the court, as well as in the friendship of other congenial and appreciative people about him. By the death of the prince the tie which had made Haydn unwilling to travel was broken. In 1790, at the age of sixty, he visited London, where his enthusiastic reception was a proof of his renown surprising to him. At this time his accumulated fortune was $5,000. In 1795, after a second voyage to London and some of the continental cities, having amassed $100,000, he bought a house and garden near Vienna. There he remained till his death, May 26, 1809, modestly receiving the greatest honors from all parts of Europe.

Haydn was small and slight in stature, and of so dark a complexion that he was nicknamed "the Moor." But his face was kind and unaffected, expressing a placid, healthy, genial nature. He was extremely generous in his recognition of other musicians. He was deeply devout, taking every accomplished work as from God. At the beginning of every MS. are the words "In nomine Domini" or "Soli Deo gloria"; at the end of each, "Laus Deo." When, in the midst of a composition, he was arrested by a difficulty or by the cooling of his imagination, he recited his rosary, which he said invariably brought him success. His character was a remarkable union of genius and industry. Early in life he worked sixteen, even eighteen hours per day, and later never less than five.

Haydn is the father of symphony and of the stringed quartet. He did more to develop instrumental music than any hundred of his predecessors. The leading qualities of his compositions are perfect lucidity of ideas, perfect symmetry in their development and treatment, and the perfect finish of every phrase and part. His works number about 800; of this extraordinary number, his most esteemed compositions are the twelve grand symphonies written for production in London, the fifty last quartets for stringed instruments, and the oratorios *The Seasons* and *The Creation*. Yet these were compositions of his later years. The master was already sixty when he turned his attention from instrumental music, in which he had wrought such wonders, to oratorio, in which he expressed the joyous fullness of his nature. Of the 118 symphonies and 83 quartets that he composed, scarcely a tenth part are ever performed, but *The Creation* retains a perennial freshness.

Revised by DUDLEY BUCK.

**Hay'don**, BENJAMIN ROBERT: historical painter; b. at Plymouth, England, Jan. 26, 1786; pupil of the Royal Academy, London, in 1804; exhibited his first picture, *A Riposo of the Holy Family*, in 1807. His *Death of Dentatus* (1809) gained a prize of 100 guineas from the British Institution, and his *Judgment of Solomon* in 1814 was awarded an equal prize by the same institution. He had quarreled with the Academy as a body, and in his efforts to place himself at the head of a new school of art was strongly opposed by people of influence, who could not endure his impetuous temper, and his work was constantly depreciated. His *Christ's Entry into Jerusalem* (1820) brought him in over 3,000 guineas in exhibition fees, but it was finally sold for only £240, and is now in Philadelphia. He was in the debtors' prison several times, and led a life of peculiar hardship, but continued to paint ambitious compositions, firmly believing his efforts would finally be appreciated. His *Banishment of Aristides* and *Nero Watching the Burning of Rome*, exhibited in London in 1846, were received with indifference on the part of the public, and he committed suicide in London, June 22, 1846. *Punch* (or *May Day*), painted in 1829, and *The Raising of Lazarus* (1821–23) belong to the National Gallery, London, and in the South Kensington Museum are *Christ's Agony in the Garden* and a chalk drawing. He published *Thoughts on the Relative Value of Fresco and Oil Painting* in 1842, and his *Lectures on Painting and Design* in 1844–46. His *Life* was written by Tom Taylor and published in 1853. WILLIAM A. COFFIN.

**Hayduk**: See HAIDUK.

**Hayem**, ăă'yăăn', GEORGES: specialist in medicine; b. in Paris, Nov. 24, 1841. He was educated in Paris; was professor in the Faculty of Medicine, Paris; physician of the St. Antoine hospital; member of the Academy of Medicine; chevalier of the Legion of Honor; founder and editor of the *Revue des Sciences médicales en France et à l'étranger*. Author of *les Grandes médications* (1887); *Du Sang et de ses altérations pathologiques* (1889); and of a large number of memoirs on various professional topics. C. H. T.

**Hayes**, ISAAC ISRAEL, M. D.: explorer; b. in Chester co., Pa., Mar. 5, 1832; graduated M. D. in 1853 at the University of Pennsylvania; was surgeon to the second Grinnell expedition, under Dr. Kane, 1853–55; commanded an expedition (1860–61) in the schooner United States, and with a small party in a boat and dog-sledges reached (viâ Smith's Sound) land in lat. 81° 37′ N.; was a medical officer in the U. S. service in the civil war; went in the steamer Panther to Greenland 1869; received gold medals from the geographical societies of Paris and London; wrote *Arctic Boat-journey* (Philadelphia, 1860); *The Open Polar Sea* (Boston, 1867); *The Land of Desolation* (1871); and *Cast Away in the Cold*, a book for boys (1868). D. in New York city, Dec. 17, 1881.

**Hayes**, RUTHERFORD BIRCHARD, LL.D.: nineteenth President of the U. S.; b. at Delaware, O., Oct. 4, 1822; graduated at Kenyon College, Ohio, 1842, and at Harvard Law School 1845; began the practice of law at Fremont, O.; removed to Cincinnati 1849; was city solicitor 1858–61; was appointed, June 27, 1861, major Twenty-third Ohio Volunteers, of which W. S. Rosecrans was the first colonel and Stanley Matthews (afterward justice U. S. Supreme Court) lieutenant-colonel. He was promoted lieutenant-colonel Oct. 24, 1861, from which date he commanded the Twenty-third until Dec., 1862. After the unimportant campaign in West Virginia and the disastrous result of the Peninsular campaign, the Twenty-third Ohio was ordered to Washington, arriving there Aug. 24, 1862, and ten days later, with the army of Gen. McClellan, was on its way into Maryland, following the invading Confederate force of Gen. Lee. In the brilliant action of South Mountain, early in the day, Hayes received a severe wound in the left arm which compelled him to leave the field. After the battle of Antietam the regiment was returned to West Virginia, where, Nov. 30, 1862, Hayes rejoined it as colonel, having been promoted Oct. 24. He was soon after placed in command of the First Brigade of the Kanawha division, which he retained until Sept., 1864, when he succeeded to the command of the division. In the summer of 1863 his command was engaged in the pursuit and defeat of Morgan, then raiding through Ohio, and in Apr., 1864, took part in Crook's raid on the Virginia and Tennessee Railroad. He was soon after commissioned brigadier-general of volunteers, to date from the battle at Cedar Creek, at the close of which he received news of his election to Congress from the second district of Ohio. He was now made brevet major-general for gallant services, and resigning from the army June 1, 1865, returned soon after to Cincinnati. In December he took his seat in Congress; was re-elected in 1866, but left his seat in 1867, having been nominated for Governor of Ohio, to which office he was elected in October, and re-elected in 1869. In 1872 he suffered his first defeat for Congress; in 1875 he reluctantly consented to allow his name to be used once more as a candidate for Governor, and was elected for a third time—an honor never before conferred on a citizen of Ohio. The prominent issues were the currency and school questions, which attracted the attention of the whole country and caused his name to be favorably mentioned as the Republican candidate for President for the proximate term, and on June 16, 1876, he was nominated at Cincinnati on the seventh ballot, receiving 384 votes, to 351 for J. G. Blaine and 21 for B. H. Bristow. The ensuing canvass, which was bitter and exciting, was closed by a disputed election, the electoral votes of Florida, South Carolina, and Louisiana, and one of those of Oregon being claimed by both parties. Under the head PRESIDENTIAL ELECTORAL COMMISSION the proceedings are related which terminated in the announcement, Mar. 2, 1877, that R. B. Hayes had been duly elected President of the U. S. The inauguration ceremonies took place on Mar. 5. During the four years of his office the affairs of the Government were conducted in a manner that will command the favorable judgment of history. Especially noteworthy was the skill with which he selected the representatives of the Government at foreign courts. D. at Fremont, O., Jan. 17, 1893. Revised by C. K. ADAMS.

**Haygood**, ATTICUS GREENE, A. M., D. D., LL. D.: bishop; b. at Watkinsville, Oconee co., Ga., Nov. 19, 1839; graduated at Emory College, Oxford, Ga., 1859; engaged in pastoral and editorial work till 1876, when he became president of

Emory College. In 1890 he became bishop of the Methodist Episcopal Church South. D. at Oxford, Ga., Jan. 19, 1896. He was the author of *Our Children* (1876); *Our Brother in Black* (1881); *Sermons and Speeches* (1883); *Pleas for Progress* (1889); *The Man of Galilee* (1889).

**Hayley,** WILLIAM: author: b. in Chichester, England, in 1745; d. 1820. He was educated at Eton and Cambridge; published *Triumphs of Temper* (1781), a poem which had some popularity, and other writings in verse and prose, but is chiefly remembered for his *Life of Cowper* (1802).

H. A. B.

**Hayne,** PAUL HAMILTON: poet; son of Lieut. Arthur P. Hayne (1790–1867) of the U. S. navy, and nephew of Governor Robert Y. Hayne: b. at Charleston, S. C., Jan. 1, 1830; graduated at the University of South Carolina. He was editor of *Russell's Magazine* and the Charleston *Literary Gazette*. He served for a time in the Confederate army and wrote a number of popular war songs. His publications include *Poems* (1855); *Sonnets and Other Poems* (1857); *Legends and Lyrics* (1872); and *Life of Robert Y. Hayne* (1878). A complete edition of his poems was published in 1882. D. near Augusta, Ga., July 6, 1886. H. A. BEERS.

**Hayne,** ROBERT YOUNG: statesman; b. in Colleton district, S. C., Nov. 10, 1791; studied law with Langdon Cheves, admitted to the bar in 1812; served for a time in the war of 1812; distinguished himself in the State Legislature; was in 1818 Speaker of the House, and soon after attorney-general of South Carolina. During his U. S. Senatorship (1823–32) he displayed abilities of the first order, and was among the leading opponents of a protective tariff. In 1824 he enunciated in an able speech the doctrine that such a tariff is unconstitutional. In Jan., 1830, occurred the famous debate between Hayne and Webster on FOOTE'S RESOLUTION (*q. v.*), in the course of which Hayne urged the constitutional right of secession. He was in 1832 chairman of a committee in the South Carolina State convention which reported the celebrated "ordinance of nullification." In the same year he was chosen Governor. To President Jackson's denunciation of the nullification acts, Governor Hayne made a defiant reply, and prepared for resistance of the Federal authority. Meanwhile Mr. Clay's compromise measure averted the threatened danger, and another State convention repealed the nullification ordinance. In 1834 Mr. Hayne became mayor of Charleston, and in 1837 a railway president. D. at Asheville, N. C., Sept. 24, 1839.

**Haynes,** HENRY WILLIAMSON: See the Appendix.

**Hays,** GEORGE PRICE, D. D., LL. D.: minister in the Presbyterian Church in the U. S.; b. near Canonsburg, Pa., Feb. 2, 1838; graduated at Jefferson College 1857, and the Wesleyan Theological Seminary, Allegheny, Pa., 1860. He was treasurer of the Christian commission, Maryland district, 1861–66; pastor of the Second Presbyterian church, Baltimore, Md., 1861–68; fiscal secretary of Wooster University 1868–69; pastor in Allegheny, Pa., 1869–70; president of Washington and Jefferson College (also supplying churches) 1870–81; Central church, Denver, Col., 1881–85; Second church, Cincinnati, O., 1885–89; Second church, Kansas City, from 1889. He was moderator of the General Assembly 1884. He published *Everyday Reasoning* (Philadelphia, 1879); *The Honest Book* (Cincinnati, 1887); *May Women Speak?* (Chicago, 1889); *Presbyterians* (New York, 1892). W. J. B.

**Hays,** WILLIAM: U. S. soldier; b. in Richmond, Va., 1819; graduated from the Military Academy at West Point, July 1, 1840; served through the Mexican war with the light artillery. During the civil war he commanded the brigade of horse-artillery of the Army of the Potomac in the Virginia Peninsular campaign of 1862, and the reserve artillery in the battles of Antietam and Fredericksburg; appointed brigadier-general of volunteers Nov., 1862; at Chancellorsville, where he commanded a brigade of the Second Corps, he was wounded and taken prisoner; rejoined the army at Gettysburg, and upon the fall of Hancock, severely wounded, was assigned to temporary command of the Second Army-corps. From Nov., 1863, to Feb., 1865, he was provost-marshal-general of the southern district of New York. Breveted colonel and brigadier-general U. S. army for gallant services in battle. D. at Fort Independence, Boston harbor, Feb. 7, 1875.

**Hays City:** city; capital of Ellis co., Kan. (for location of county, see map of Kansas, ref. 5–D); on Bay creek and the Kansas division of the Union Pacific Railway; 289 miles W. of Kansas City. It is in an agricultural and stock-raising region, and contains 5 churches, 3 weekly newspapers, grain elevators, and flour-mills. Pop. (1880) 850; (1890) 1,242; (1900) 1,136. EDITOR OF "FREE PRESS."

**Hay'ter,** HARRISON: civil engineer; b. at Falmouth, England, 1825. After a classical and mathematical education, he in 1840 entered and for three years studied in the department of applied science, King's College, London. In 1857 he became assistant to Sir John Hawkshaw, and was his partner from 1870 until the retirement of the latter in 1888. He was engaged upon all of Hawkshaw's works during this period—railways in England, India, Spain, and Russia; harbors of Holyhead, Alderney, Amsterdam; docks (of Buenos Ayres and elsewhere), bridges, drainage-works, Amsterdam ship-canal, etc. He is author of several important papers in *Proceedings* of the Institution of Civil Engineers, of which he is president. WILLIAM R. HUTTON.

**Hayti:** See HAITI.

**Hayward:** village (founded 1881); capital of Sawyer co., Wis. (for location of county, see map of Wisconsin, ref. 3–C); on the Namakagon river, and the Chi., St. P., Minn. and O. Railway; 55 miles S. of Ashland. It contains 3 churches, 2 public schools, public library, electric-light plant, improved system of water-works, and weekly newspaper, and is principally engaged in lumbering. Pop. (1890) 1,349; (1900) 2,720. EDITOR OF "JOURNAL-NEWS."

**Hazara:** an Afghan race. See AFGHANISTAN.

**Hazara,** or **Huzara:** a district in the Peshawar division, the Punjaub, British India; is between lats. 33° 45′ and 35° 2′ N., and lons. 73° 35′ and 74° 9′ E. It is west of Kashmir, south of Kohistan, and on the east side of the river Indus. Area, 3,039 sq. miles. It is wedge-shaped, and consists essentially of a long, narrow valley shut in by lofty mountains. The scenery is picturesque and every available spot is cultivated. The chief crops are wheat, barley, maize, rice, other grains, oil-seeds, and cotton. The rainfall is 47 inches, but artificial irrigation is common. Pop. about 450,000, nearly all Mohammedans. MARK W. HARRINGTON.

**Hazard** [M. Eng. *hasard*, from O. Fr. *hasard*, hazard (the game), from Span. *azar*, hazard, from Arab. *al zār*, the die]: a game of chance played with dice, for amusement and for money. The character of the game is such that a professional player, who knows all the possibilities and probabilities of the game, has a twofold advantage over another person. Hazard has been long a standing game at all the houses of play in England. The term hazard is used in a technical sense in works on FIRE-INSURANCE (*q. v.*).

**Hazaribagh,** haa-zăă-rĕĕ-baw′: a district of the Chota Nagpur division, Bengal, British India; between the parallels 23° 25′ and 24° 48′ N., and the meridians 84° 29′ and 86° 38′ E. Area, 7,021 sq. miles. A third of this area is in the valley of the Damodar river, the remainder a plateau rising to the north and west. Much of the district is infertile and covered with jungle, making it a good place for hunting. Wheat, barley, maize, opium, sugar-cane, and cotton are common crops. The climate is healthful; the average temperature is 74°, the rainfall 52 inches. The towns are small; the capital, Hazaribagh, is the largest (pop. 12,000). Parsanath Hill is a celebrated place of pilgrimage for Jains. There are six coal-fields in the district, some of which promise to be important. Pop. 1,200,000, of whom about one-fourth are aborigines and one-half Hindus.

MARK W. HARRINGTON.

**Haze:** impalpable solid matters in the atmosphere which deaden the blueness of the sky and cut off the sharpness of definition of distant objects. This kind of haze is sometimes called "dry," to distinguish it from the thin cloud, which is invisible in itself, but serves to deaden the color of the sky. Haze is most common in the interior of continents, especially in dry seasons, when it is due to a fine dust. In the northeastern provinces of China it is sometimes like a thin fog and shuts out distant objects. Large conflagrations, like forest fires, give rise to a dense bluish haze which may drift many hundred miles from the burning districts and last many days. Volcanic eruptions sometimes throw into the air enormous quantities of comminuted materials which carry haze with the wind to astonishing distances. The minute particles in the air when sufficiently numerous tint the color of the sun, making it red, or more rarely blue, and give rise to a series of diffraction phenomena which attract much attention. After the eruption of Krakatoa these phenomena painted the sunset sky in glowing colors and rapidly spread over the entire earth. MARK W. HARRINGTON.

**Hazel** [M. Eng. *hasel* < O. Eng. *hæsel* : O. H. Germ. *hasal* > Mod. Germ. *hasel* < Teuton. *hasala-* : Welsh, *coll* : Lat. *corylus* (for **cosulus*)] : popular name of a genus (*Corylus*) of trees and shrubs of the family *Cupuliferæ*. Of these, the *C. avellana* and *C. colurna* of Europe and Asia produce the FILBERT (*q. v.*), as well as some of the varieties of nut called cobnut and hazelnut, which are used not only as food, but for their oil. The hazel-bush is extensively planted for copses in Europe, and yields material for hoops, hurdles, gunpowder, etc. The *C. americana*, or wild hazel, and *C. rostrata*, or beaked hazel, yield nuts smaller and not so good as those of the European. There are still other foreign species. Witch hazel is the *Hamamelis virginica*. See HAMAMELIS.

**Hazen**, WILLIAM BABCOCK : soldier ; b. in Hartford, Windsor co., Vt., Sept. 27, 1830 ; graduated at the U. S. Military Academy July 1, 1855 ; served with distinction on frontier duty and during the civil war received all the brevets up to major-general. In 1866 he was made colonel of the Thirty-eighth Infantry, and in 1880 he became chief signal officer, with rank of brigadier-general. He published *The School and the Army in Germany and France, etc.* (1872) ; *Barren Lands of the Interior of the United States* (1874) ; and *Narrative of a Military Career* (1885). D. in Washington, D. C., Jan. 16, 1887. Revised by B. B. HOLMES.

**Hazleton**, hā'z'l-tŭn : city ; Luzerne co., Pa. (for location of county, see map of Pennsylvania, ref. 3–H) ; on the Penn. and the Lehigh Val. Railways ; 80 miles N. N. W. of Philadelphia. It has valuable anthracite coal-mining interests, is principally engaged in mining and hatting ; has 3 daily and 6 weekly newspapers, and from its elevated position has become a popular summer resort. Pop. (1880) 6,935 ; (1890) 11,872 ; (1900) 14,230. EDITOR OF "PLAIN SPEAKER."

**Haz'litt**, WILLIAM : literary critic ; b. at Maidstone, Kent, England, Apr. 10, 1778 ; the son of a Unitarian minister ; studied at Hackney College, and for a time labored as an artist, but without high success ; became noted as a contributor to journals, writing chiefly upon theatrical and literary topics. He was author of *Memoirs of Holcroft* (1809) ; *English Grammar* (1810) ; *The Round Table* (1817) ; *Characters of Shakspeare* (1817) ; *View of the English Stage* (1818) ; *Lectures on English Poets* (1818) ; *Lectures on English Comic Writers* (1819) ; *Lectures on the Literature of the Elizabethan Age* (1821) ; *Table Talk* (1824) ; *The Spirit of the Age* (1825) ; *Life of Napoleon* (1827) ; *Conversations with Northcote* (1830), etc. D. in London, Sept. 18, 1830.

**Hazlitt**, WILLIAM CAREW : English scholar ; grandson of William Hazlitt ; b. Aug. 22, 1834 ; educated at Merchant Taylors' School and the Inner Temple ; became a barrister 1861. He is author of *British Columbia* (1858) ; *History of the Venetian Republic* (2 vols., 1858 : enlarged to 4 vols. 1860) ; *Sophy Laurie* (1865) ; *Memoir of William Hazlitt* (1867) ; *Bibliography of Old English Literature* (1867) ; *English Proverbs* (1869) ; *Popular Antiquities of Great Britain* (1870), and has performed much editorial and other literary work.

**Head**, BARCLAY VINCENT, D. C. L., Ph. D. : numismatist ; b. at Ipswich, England, in 1844 : educated at Queen Elizabeth's School there ; is keeper of coins at the British Museum ; author of *History of the Coinage of Syracuse* (1874) ; *Coinage of Lydia and Persia* (1877) ; *History of the Coinage of Bœotia*. In 1887 appeared his masterpiece, entitled *Historia Nummorum*, an exhaustive historical survey of the science of Greek numismatics and the standard work on the subject. ALFRED GUDEMAN.

**Head**, Sir FRANCIS BOND, P. C., K. C. H., and knight of the Prussian military order of Merit : author, and Governor of Upper Canada ; b. near Rochester, England, Jan. 1, 1793 ; served with the Royal Engineers at Waterloo ; at Fleurus under the Prussian general Ziethen ; retired from the army and took charge of a gold and silver mining company in South America ; published in 1826 a narrative of his travels entitled *Rough Notes of a Journey Across the Pampas* ; in 1835 was appointed Lieutenant-Governor of Upper Canada, where he suppressed an insurrection, for which service he was created a baronet. The title of privy councilor was conferred on him in 1867. Among his many published works are *Bubbles from the Brunnen of Nassau* (1833) ; *Life of Bruce* (1844) ; *The Defenseless State of Great Britain* (1850) ; *The Horse and his Rider* (1860) ; *The Royal Engineer* (1870). He wore the Waterloo medal, and was a major (retired list). D. in England, July 20, 1875.

**Head**, Sir GEORGE : b. near Rochester, England, 1782 ; went to Portugal as commissariat clerk 1809 ; became assistant commissary-general 1811 ; was sent to Canada 1814, to Nova Scotia 1816 ; knighted 1831. Author of *Forest Scenes and Incidents in the Wilds of North America* (1829) ; *A Home Tour* (1836–37) ; *Rome* (1849) ; a translation of Cardinal Pacca's *Memoirs* (1850) ; a good translation of *The Golden Ass* of Apuleius (1851), etc. D. in London, May 2, 1855.

**Headache**, or **Cephalal'gia** : a symptom of very many widely differing conditions, but not, as was once believed, a disease of itself. The various forms of neuralgic pains about the face, eyes, or ears may be referred to the head, and simulate headaches in the stricter sense. They are generally easily distinguished by careful examination. As might be supposed, diseases of the brain are frequently attended by this symptom, but particularly when the membranous envelopes of the brain are diseased, or when they are implicated in more deep-seated brain diseases. The violent headaches of meningitis or brain fever are prominent in the symptomatology of this disease. Tumors of the brain, abscesses, etc., sometimes, though not always, cause headaches limited to the area of disease. In the onset of various fevers, such as typhoid fever, and during their course, headache is a frequent occurrence. So, too, in the course of more protracted illnesses, generally accompanied by the presence of poisonous matters in the blood, such as in Bright's disease, in malaria, and in syphilis. But these cases are far less frequent than headaches in persons otherwise well or but little disturbed in health. Certain persons are notoriously subject to recurring attacks of severe or trivial headaches, and a hereditary element not rarely enters into the causation. Especially is this true of the peculiar form of unilateral headache called MIGRAINE (*q. v.*), a form attended also with scintillations before the eyes, disturbances of the stomach, ringing of the ears, and other symptoms. Periodical headaches may also be the expression of the general nervous disorder or weakness called neurasthenia, they may be accounted for by impoverishment of the blood, or diseases of various organs, especially the uterus and ovaries in women. Headache as an expression of disordered stomach or bowels is well recognized. Indiscretion in diet or drinking is very apt to be followed by head-pains, not rarely confined to the region of the forehead. Much attention has been directed to the influence of disorders of vision in the production of headache, and the frequent cures afforded by application of suitable glasses is sufficient proof of the truth of this view. Further causes might be recorded almost without number, and still a small number of cases would remain in which no adequate explanation could be found. There are cases in which, as far as our present knowledge allows us to judge, the headache is the primary disease, rather than a symptom. In seeking to alleviate a condition having so many diverse causes, the strictest investigation into the entire bodily health must be made. In many cases the cause soon becomes evident, in some it may evade the most experienced physician. The treatment prescribed is similarly diverse. It may in one case be directed to a disordered stomach or torpid bowels, in another to proper action of the kidneys or other excretory channels, and in another and larger group of cases to the quieting of pure nervous excitation. Recurrent and unusually severe headaches must always be looked upon as occurrences of gravity.
WILLIAM PEPPER.

**Head-dress** : the protection or ornamentation of the human head by the adjustment of the hair, the use of a covering of any sort worn upon the head itself, and the addition of jewels, chains, flowers, or the like ; or any of these. The variety of head-coverings, although perhaps roughly divisible into hoods, caps, and hats, is indefinitely great, and the different styles of decoration are perhaps as numerous. No more can be done here than to speak of those fashions which are the most nearly associated with our civilization, as the origins of modern styles or as most often found in our literature and art.

The Egyptians in antiquity, as is proved by the numerous reliefs and paintings on the walls of tombs and temples, wore thick and elaborate head-dresses, as the sunny climate and low latitude of the country would make necessary, but not hats with brims. In default of these they used hoods fitting somewhat closely to the head ; perukes or wigs, probably of horsehair or tow, for the monstrous constructions represented can not be supposed mere dressings of the hair,

and indeed some of these wigs have been discovered; and large, high caps, the material of which is often doubtful. The largest and highest are cupola-shaped, and are associated with the royal authority; when colored yellow they are generally considered to have been of brass—a sort of helmet; but they are often of other colors. This round-topped cap, when very high and painted white, is taken to be the crown of Upper Egypt: a lower one of a different form, and red, is the crown of Lower Egypt, and the two are associated as the symbol of rule over the whole land. Lower and flat-topped caps are worn sometimes alone, sometimes upon the close-fitting hood. Often a strap under the chin holds the whole head-dress in place. It may be supposed that the huge wigs were worn upon the shaven head; and it is evident that clean shaving was as common in ancient Egypt as it is now in tropical countries of Asia. But elaborate dressings of the natural hair were also common among the ladies of the court. Hairdressing among the Greeks as well was often very elaborate, and in early times, as shown by the sculptures of the sixth century B. C., men as well as women wore their hair long and delicately braided. In some sculptured representations of athletes, heroes, or divinities the long braids are wound around the head horizontally; in others a great number of slender corkscrew-like curls emerge from a band passing round the head above the ears; again in others two or three long curls hang down upon the shoulder, or a braid hangs down the back. A later style was the massing of the hair above the forehead in a dense skein or knot of curls, while it hung free and rather long behind the head. The fashions followed by young girls were generally more simple, and nets and small bag-like hoods were often worn to protect and cover the hair. Under the Macedonian rule it became common to wear a crown-like frontlet, or a band made broader above the forehead so as to give apparent height to the head at that point, while at the same time the hair was so massed as to make the forehead appear low. Crowns in the modern sense had not become known to the Greeks of antiquity; the usual badge of royalty among Asiatic nations was the simple fillet tied around the head, the *diadema*; and a similar badge was employed in Greece.

Among the Greeks caps of cloth, leather, and felt, close-fitting, conical, and shaped like the modern *tarboosh*, were worn, both alone and under the helmet. The vase-paintings show them as worn by seamen, mechanics, and soldiers. A hat with a brim, probably always of felt, and called *pétasos*, is given to hunters; this is also an especial attribute of the god Hermes, and is shown as worn by the young men (*epheboi*), and this perhaps with some allusion to their especial connection with the worship of Hermes. The pétasos is shown sometimes with a brim wider in some places than in others, and even turned up like the cocked hats of the eighteenth century. The *kausia* was a modification of the pétasos, worn especially among the Macedonians as a sign of royal rank, the diadem or fillet tied around it, with long ends hanging behind. It was, however, the general custom in the towns, and especially with the wealthier classes, to go bareheaded, and it seems to have been thought a sign of imperfect physical condition to need a hat when going about the streets. The higher types of art among the Greeks, being generally based upon the nude or nearly nude body, do not include the use of any headdress.

Among the Romans nearly the same customs prevailed. The peculiar Roman dress, the toga, was worn with the head bare. But the priests wore a skull-cap, and this, with a pointed addition like a spear-head, was their peculiar badge; a soft conical cap was worn by artisans, and the putting of this *pileus* upon a slave's head was one ceremony of his manumission. This *cap of liberty* was used as such an emblem in classical Roman times, but it had not then the special shape, with the pointed top bent or drooping forward, like the "Phrygian cap" of modern usage. In general it was assumed that in the city a Roman would go bareheaded, but on all necessary occasions he wore hat or cap as might be more convenient. No elaborate ornamentation was given to either in the Græco-Roman world, nor was it a custom among men of the Roman world at any time to dress the hair elaborately. On the other hand, the *coiffures* of the ladies of imperial times are of amazing elaboration and variety. It seems as if the essential simplicity of dress, consisting of so few and so nearly invariable garments, even among the elegant and extravagant, left hairdressing as the only field except jewelry for the display of fancy and for the pursuit of novelty.

In antiquity, as in modern times, the badge of royalty was generally something worn upon the head. Instances have been named in the *pschent*, or double crown of Egypt, and the *diadema* or fillet. In their capacity as true haters of kings the Romans gave the fillet to their priests alone; the *corona*, or headdress of honor, was given to the successful soldier or the respected citizen as a special reward. (See CROWN.) During the Græco-Roman epoch the Persians and the neighboring nations used a tall cap, called by the Western nations *mitra*, and one form of this is the "Phrygian cap" of modern times. The form generally worn by persons of dignity has not the nodding, almost volute-like peak of our "Phrygian cap." It ends in an ornament, sometimes like our conventional crown. Its general shape is conical, and this shape continues in Western Asia from the time of the Assyrian empire to the time of the Parthian wars against Rome. It is commonly said that the *miter* of European bishops and the *tiara* of the pope are derived from this headdress, as the word *miter* evidently is from its Greek name μίτρας; but it is difficult to establish such origins.

A remarkable chapter in the history of costume is to be found in the use of the *hood*, so common throughout the Middle Ages and so little known since the fifteenth century. The hood of cloth was not unknown to the Romans, and this and a similar garment of skin or leather was very common among the Gauls and Scandinavians, if not throughout Northern Europe, previous to the Roman conquest of Gaul and Britain. It was sometimes made fast to a cape or cloak, and perhaps as often independent, serving to tie over whatever skull-cap or defensive head-piece might be worn. Throughout the Middle Ages it was the commonest garment of the mechanics, field-laborers, and toiling men generally; sometimes small and light, a mere cap, sometimes ample and of heavy material. The latter is perhaps the hood proper, the *chaperon*, which in the thirteenth and fourteenth centuries had attached to it a cape long enough to reach to the elbows and closed in front, so that the face looks out through a slit prepared for it. This garment was worn in different ways; sometimes the cape of it was folded or twisted into a long tippet, and then wound around the head, upon which the face-opening had been adjusted previously. When the cape was smaller the face-opening was put on like a hat, and the whole cape thrown loosely backward over the head. At a later time the hood was made with a long tubular prolongation of its crown, a fashion comparable to the hanging sleeves of a time not much later. A tight-fitting cap tied under the chin had to be worn under these strange hoods to keep the hair tolerably smooth.

One reason for the great use of the hood was evidently the facility with which it was made in the cottage, whereas a hat would require a more skilled kind of labor. Indeed, throughout the Middle Ages the hat is rather the sign of a person of some condition who can mount on horseback and travel. The most remarkable shape is that known as the *bycocket*, a modification of which is the *cap of maintenance* of English heraldry. But it is not in hats and caps that the peculiarities of mediæval head-dress are found. The hair was worn hanging down in some form by all women except the poorest until the twelfth century, and one style was to divide it into thick locks, two or more on each side, and to twine a ribbon around these, in and out, so as to hold them separate and yet together. In the twelfth century a veil was often worn, gathered so closely about the neck and shoulders as to resemble the *wimple* of later times, and to conceal the hair. Then this was re-enforced by a cap or headband passing under the chin, and the veil, and later a linen cap, was worn upon this. The wimple appears early in the fourteenth century—a piece of fine linen covering the throat and chin and the sides of the face, and covered in its turn by the veil; so that for about eighty years it was fashionable to show only the face from the eyebrows to the mouth. Then followed in the fifteenth century the tall or spreading headpieces, *hennins* and *cornets*, made of some colored stuff, probably stiffened with wire or perhaps with starched buckram or with paper. These were divided into two or even three horns at one epoch; then they were conical, from 20 to 30 inches high, and tilted back from the crown of the head; then, toward the close of the century, they were short and nearly cylindrical; but always there were worn with them the most delicate veils, of fine and semi-transparent linen, sometimes embroidered, as the miniatures of the time show clearly. Meantime for the men, as they almost lived in armor, it is only on occasions of state

that the court nobles and their attendants are shown to us as especially adorned by the hairdresser's art, with curled and massed hair and a jewel, an aigrette, or a plume set above the forehead.

This same taste for dainty hairdressing prevailed throughout the sixteenth century. Even after the close of that century, in the last years of Henry IV. of France and the early years of James of Scotland and England, these kings and their grave ministers appear in their trustworthy portraits as carefully combed and curled, the hair and beard alike arranged according to a careful design, and kept in their places by some pomade or cosmetic. Apart from this, the head-dress was simple; men and women alike were rational enough in the great sixteenth century; small and flat caps and hats of reasonable crown and brim were worn even by the courtiers, and the ladies affected small hoods of decorative shape, flat *toques* with small plumes, dainty caps of muslin, and the uncovered hair adorned with jewelry, all in due succession of fashion, but all in good taste and without extravagance of fancy.

The long hair worn in the early part of the seventeenth century is well known to us from the familiar portraits of Charles I. of England. This was varied sometimes by a shorter cut of all except the *love-lock*, falling in curls upon the shoulders and breast and tied with ribbon. The English Puritan's demand for greater strictness of life and manners was thought to be exemplified in his more closely cut hair, though even his locks were long as compared with nineteenth century fashions. The hats had broad and drooping brims, and the elegants wore plumes curled about the crown and lying half hidden in the hollow of the brim. The ladies of the same epoch had a charming fashion of wearing the hair in a mass on each side, sometimes of short curls allowed to flow freely, sometimes in more artificial-looking structures, obviously having a cushion or other support within. And these graceful and essentially simple styles prevailed until after the middle of the century. Then, with the English Restoration and the beginning of the independent reign of Louis XIV., at Mazarin's death, begins the reign of wigs. Their origin was not so very absurd; clearly it had grown to be a conviction that a man was not at his best without long and abundant hair. The abundant locks of the center of all fashion, the young King of France, tended to confirm this opinion. The early perukes, with their extravagant curls falling low on the breast and between the shoulders, were only a carrying to excess of King Louis's fashion of wearing his own hair. But once established, this fashion was to endure for a century of shaved heads, warm caps worn within doors, close-fitting wigs out of doors, and hats only for show, as is evident from the fashion prevalent at times of carrying these accessories under the arm. *Cocked hats* are of the later part of the wig period; they were originally nothing but broad-brimmed hats whose brims were fastened up to the crown, usually at three points; and the *cockade*, since employed in so many ways, was originally nothing but the tuft or other ornament put on where the brim was made fast. Meantime the head-dress of ladies of fashion took several contrasting shapes. The becoming styles of the seventeenth century above alluded to prevailed generally until about 1680; then came the tall fan-shaped structure of linen and lace above the forehead, forming part of the *fontange* head-dress; but there was a return to reason, and it was not until a century later that the extreme of recorded extravagance in style was reached. Then, in the first years of Louis XVI., when the taste in furniture and decoration generally had become much more severe (see Costume and Furniture), the ladies undertook to start a wholly opposite taste in head-gear. The mass of frizzled and powdered hair wound about with ribbons, stuck with plumes and flowers, and with jewels on occasion, reached a height of a foot or more above the head, and was even higher when the semblance of a cap of gauze was combined with it, or a little hat or a cluster of feathers was set upon it.

The French Revolution put an end to a world in fashion as well as in politics, and it is not necessary to describe here the hats and bonnets of our own epoch.

For bibliography, see that of Costume given under the head of Dress. Russell Sturgis.

**Head'ley**, Joel Tyler: historian; b. at Walton, Delaware co., N. Y., Dec. 30, 1813; graduated at Union College 1839; studied theology at Auburn; for two years held a pastorate at Stockbridge, Mass.; was assistant editor of *The New York Tribune* in 1846; and (1856–57) Secretary of State for New York. He published *Letters from Italy* (1845); *The Alps and the Rhine* (1845); *Napoleon and his Marshals* (1846); *Washington and his Generals* (1847); *The Adirondacks* (1849); *History of the Second War between England and the United States* (1853); *The Great Rebellion* (1864); and other works. D. at Newburg, N. Y., Jan. 16, 1897.

**Headley**, Phineas Camp: See the Appendix.

**Healdsburg**: city; Sonoma co., Cal. (for location of county, see map of California, ref. 6–B); on the Russian river, and the S. F. and N. Pac. Railway; 66 miles N. of San Francisco. It is the seat of Healdsburg College (Seventh-day Adventists), is principally engaged in agriculture, quicksilver mining, stock-raising, fruit-culture, and grape-growing, and manufactures and ships a large quantity of wine annually. Pop. (1880) 1,133; (1890) 1,485; (1900) 1,869.

**Health** [M. Eng. *helth* < O. Eng. *hālð*, deriv. of *hāl*, whole, hale > Eng. *whole*, and (dial.) *hale*]: physiologically, that condition of organized living bodies in which the blood and tissues are in the state of integrity and functional activity inherent in their normal constitution. All of the structures are incessantly undergoing change, owing to the waste and renewal of their ultimate elements, the cells. There is in the constitution of these elements a tendency to development and a tendency to decay or retrograde metamorphosis. Upon their development depend the growth and maintenance of the organism, while in their retrograde metamorphosis we have their destruction after they have performed their proper functions. This tendency to development and to retrograde metamorphosis of the elements of tissues is impressed upon the organism as a whole, but differs in intensity at different periods of life. In the young the tendency to development is greatest, and the result is growth; in the middle-aged these forces are balanced, and the structures are maintained in bulk and symmetry; in the later periods the tendency to retrograde metamorphosis predominates and the organism wastes, and at length falls into inevitable decay and death. At all periods in the life of any organized body, therefore, molecular changes are in active progress in every tissue, and yet while these changes are in exact accordance with the normal constitution of their elements a state of health is maintained. But, though this definition is strictly in accordance with the teachings of physiology, it is evident that such a condition of health can be affirmed only in the most general sense of any complex living organism like man. So infinitely numerous are the elementary parts, and so various and powerful the causes which impair their integrity and prevent their functions, that there must be abnormal conditions constantly occurring which do not sufficiently impair structure and function to enable us to appreciate the deviation from the natural standard. It is only when changes in structure and function are so great as to be detected by the means which we employ for investigation that we can decide that a condition of health does not exist. For the effect of climate, filth, etc., upon the health, see Climate, Filth Diseases, Hygiene, etc. Revised by William Pepper.

**Health Laws**: See the Appendix.

**Healy**, George Peter Alexander: portrait and historical painter; b. in Boston, Mass., July 15, 1808: pupil of Baron Gros and of Couture, Paris; received third-class medal, Paris Salon, 1840, and second-class, Paris Exposition, 1855. Among his pictures is *Webster's Reply to Hayne*, in Faneuil Hall, Boston. He painted portraits of many distinguished people in Europe and the U. S. His portraits of Buchanan and Lincoln are in the Corcoran Gallery in Washington. D. in Chicago, June 24, 1894. W. A. C.

**Healy**, Timothy Michael: See the Appendix.

**Heap**, Charles Swinnerton: pianist and composer; b. in Birmingham, England, in 1847; studied under Dr. E. G. Monk and at Leipzig; gained the degree of musical bachelor from Cambridge in 1870, and musical doctor the next year. He has composed much choral and orchestral music, including several cantatas and psalms, two overtures, chamber music, and shorter pieces for voices and instruments. D. E. H.

**Heap**, David Porter: See the Appendix.

**Heard Island**: an island in the Antarctic (South Indian) Ocean, lying S. E. of Kerguelen's Land, extending between 53° 2′ and 53° 14′ S. lat., and between 73° 30′ and 72° 30′ E. lon. It is about 24 nautical miles long and 9 broad, and its highest point (Kaiser Wilhelm Peak) is about 6,000 feet high. It was discovered by Capt. Heard Nov. 25, 1853. Vessels

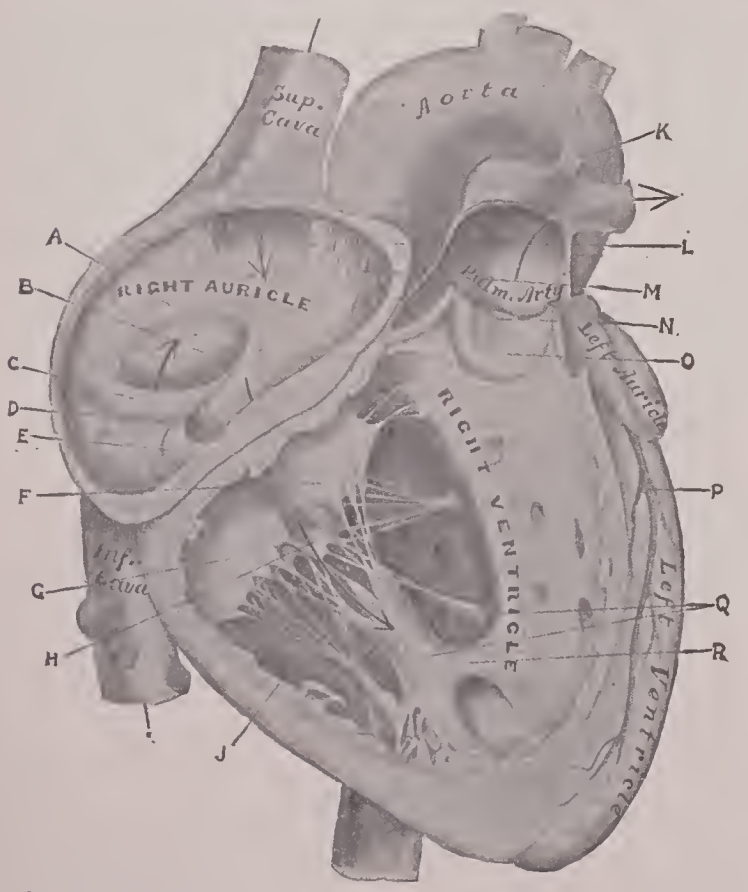
from the U. S. and other countries have here collected large amounts of the oil of sea-elephants and the smaller seals.

**Hearing**: See Acoustics and Sensation.

**Hearn**, Lafcadio: author; b. of an English father and a Greek mother, at Santa Maura, Ionian islands, June 27, 1850. He was educated in England and France, removed to the U. S.; now lecturer on English Literature in the Imperial University, Tokio, Japan. His writings, which are partly narrative and partly descriptive, include *Chita: a Memory of Last Island* (1889); *Two Years in the French West Indies* (1890); and *Ghostly Japan* (1899).

**Hearsay Evidence**: literally, evidence consisting of what one has been told by others. The term is used, however, in a wider sense to include any evidence not based upon facts with which the witness is personally cognizant, but upon what he has learned from the act or narration of another. With few exceptions, hearsay evidence is inadmissible. See Evidence.

**Heart** [M. Eng. *harte* < O. Eng. *heorte*: O. H. Germ. *herza* (> Mod. Germ. *herz*): Goth. *hairtō* < Teuton. *herton-*: Lat. *cor, cordis*; Gr. καρδία]: the great central power which regulates and compels the circulation of the blood. It may really be considered as two organs united in one; the one half governing circulation through the lungs, the other that through all the rest of the body. Thus constructed, the heart is divided by a median *septum* into two lateral halves, *left* and *right*; and each of these is again divided by a horizontal constriction into an upper and a lower portion. There are thus formed four cavities: two upper, *left* and *right*, auricles; and two lower, *left* and *right*, ventricles. The auricles receive the blood from the veins—the right from the body in general, the left from the pulmonary veins; and the ventricles propel the blood—the left to the body, the right to the lungs. The walls of these cavities consist of powerful muscular tissue of varying thickness, the left ventricle being twice as thick as the right, and not rarely reaching half an inch at the thickest part. The auricles are much thinner than the ventricles, as might be expected from their being receptacles of blood rather than active agents in its propulsion. The muscle fibers of the heart-walls are arranged in intricately interlacing bands, which have not as yet been satisfactorily described. In the auricular wall two sets of




The right auricle and ventricle laid open, the anterior wall of both being removed.

A, Annulus ovalis; B, Fossa ovalis; C, Eustachian valve; D, Coronary vein; E, Coronary valve; F, Infundibular segment of the tricuspid valve; G, Right segment; H, Posterior segment; J, Tendinous cords; K, Ductus arteriosus; L, Auricular appendage; M, Pectinate muscles; N, Nodule of Arantius; O, Aortic valve; P, Coronary artery; Q, Papillary eminences; R, Fleshy column.

fibers are found, one superficial and passing transversely from one auricle to the other, and a deep set, consisting of *looped fibers* attached by each end of the constriction between the auricle and ventricle, and *circular bands* passing around each auricle and continuous with the layer of muscular fibers in the walls of the great veins. The fibers in the walls of the ventricles have been divided into seven layers by Pettigrew, but it is only necessary to remember that they have one general arrangement. They pass downward from left to right, curve around the apex of the heart, and reascend from left to right, thus making a *figure-of-eight* curve around the apex of the heart. Microscopically the structure of the heart-muscle fiber is peculiar in being striated by cross-striations, such as are found in all voluntary muscles, but in only one or two other instances in involuntary muscle. Further, the fibers are branched, and have no sarcolemma or outer covering. See also Histology.

On examining the cavities of the heart it is found that the ventricles are of approximately equal capacity, and this is readily explainable, since each must propel a like quantity of blood. Were this not the case, and should the left ventricle force out a larger quantity at each contraction than the right, the blood would soon be gathered in the systemic circulation; and similarly if the right ventricle were more active than the left the lungs would soon be overfilled with blood. The auricular cavities are smaller than the ventricles, but this is compensated by the size of the great veins leading to the auricles.

The walls of the cavities, as seen within, are very uneven, especially in the ventricles. There are various ridges and eminences, called *fleshy columns* and *papillary eminences*. Some of the latter give origin to thin cords, which are attached at the other end to the valves, to whose action they will be seen to be important factors. In the auricles are seen certain remnants of the fœtal communication between the two sides of the heart (see below), and also openings of veins which bring back the venous blood from the walls of the organ. But the most striking feature of the heart's cavities are the openings into the various vessels leading into or from them. Into both auricles open large veins—into the right, the *superior vena cava* from above, the *inferior vena cava* from below; into the left, the four pulmonary veins, two of which not rarely unite before entering the heart. Below, each auricle opens into the corresponding ventricle by a large foramen. Examining the ventricles now, there are seen in each two large foramina—that leading into the auricle, and that into pulmonary artery and aorta, in the right and left ventricle respectively. Each of these orifices is guarded by a valvular mechanism which prevents reflux of blood through the orifice once this has been passed. The valves are formed by reduplication of the lining membrane of the heart, the *endocardium*, a smooth serous membrane which completely covers the inner surface of the cavities, and is continuous with the inner coat of the great vessels springing from the heart. The valves consist of a double fold of this endocardium, between the two sides of which is found a quantity of fibrous tissue, to give strength to the cusp. The valves guarding the auriculo-ventricular orifice are much larger than the aortic and pulmonary. They consist of, on the left side two, on the right side three, leaflets, springing from a fibrous ring which surrounds the orifice, and at the free margin they have attached to them tendinous cords which take origin from the papillary eminences in the ventricular wall. The two leaflets of the left auriculo-ventricular valve have some resemblance to a bishop's miter, hence the name *mitral* is applied to it. The three leaflets of the valve on the right side give to this valve the name *tricuspid*. When the blood is passing from the auricles to the ventricles the valves hang down and allow free passage to the blood. As soon as the ventricle becomes full, however, the backward pressure forces the valve leaflets upward, and eventually together. At the same time the tendinous cords attached to the valves serve to prevent bulging of the valves toward the auricles, and perhaps even maintain a convexity toward the ventricular cavity. The aortic and pulmonary valves consist each of three semilunar cusps whose formation is much the same as that of the mitral and tricuspid, excepting the absence of tendinous cords for support. The base of each cusp is attached to the vessel-wall, and the free edge may fall inward, meeting its fellows, and thus close the orifice; or it may fall outward toward the vessel-wall, and thus allow free passage to the blood. At the center of the free edge of each cusp is a small body (*corpus Aurantii*), semi-cartilaginous in structure, which is intended to close in a small gap which would otherwise be found at the point of junction of the three leaflets when they are closed. During contraction of the

ventrieles, when the blood is flowing out through the aorta and the pulmonary artery, the cusps of the valves are pushed toward the walls of the vessels. When the contraction has ceased, and the arteries have become distended, a reflux of blood occurs from contraction of the vessel-wall, and thus the valves are closed by pressure of the blood. The blood, being prevented from flowing back into the heart, is consequently caused to flow out into the distal arteries in a more or less steady stream.

The *shape of the heart* is that of an inverted cone, the position of the apex being indicated by the impulse against the chest-wall. The designation *left* and *right* applied to the cavities is not altogether exact, since the whole organ is somewhat twisted on its long axis, so that the right auricle and ventricle are placed anteriorly, the left being behind.

The *size of the heart* varies with advancing age and in different individuals. As a rough test the old saying that "the heart is as large as the individual's fist" does fairly well. The heart of an adult man is about 5 inches long, 3½ inches broad at the broadest part, and 2½ thick. The *weight* varies from 10 to 12 oz. in the male, and from 8 to 10 in the female; but compared to the body weight it is 1 : 149 in the female and but 1 : 169 in the male. The organ increases in size and weight (more markedly in men than women) up to about sixty years, when a certain degree of atrophy begins.

The *position of the heart in the chest* is easily described. It lies to the left of the middle line and between the two lungs. It is very much imbedded in the left lung. Portions of the lung are behind the left half, to the left of it and in front of it, except about 2 superficial inches. Its base lies under the third rib of the left side, extending 3 inches from the middle (median) line of the body; the right auricle, when filled, extends half an inch to the right of the right border of the breast-bone (sternum) in the second intercostal space, retreating under the sternum in its contraction. The apex is found in the fifth intercostal space, 3½ inches from the median line. Unite this point with the point 3 inches to the left of the median line on the third rib by a curve that will cross the fourth rib at a point 4 inches from the median line, and the left border of the heart is indicated. From the point indicating the apex carry a line to the right and a little upward, so that it will strike the right border of the sternum at the fourth rib, thence upward along this right border to the second intercostal space, and we have followed the external lines that represent the internal position of the heart. In very rare instances the heart is found on the right side of the chest, filling the space on that side which corresponds with its natural position on the left. In these cases the liver may be found on the left, the spleen on the right side of the body, and there may be a general "transposition of viscera"; or the heart alone may be misplaced.

The heart is inclosed in a membranous sac, the *pericardium*. This consists of two portions. First there is a large bag of fibrous tissue which is attached to the great vessels at the root of the heart and spreads out below into a sac of considerable size. This is the *parietal* layer of the pericardium, and incloses the heart, covered by a thin, smooth membrane, the *visceral* pericardium, which is reflected to the inner surface of the parietal pericardium, which it also lines. Thus there is formed a cavity, faced with a smooth serous membrane, which secretes a small quantity of clear fluid, and thus prevents friction in the action of the heart. The outer or parietal pericardium is in relation with the median surfaces of the lungs and below with the diaphragm, to which it is attached by a ligament.

The heart muscle is itself nourished by blood carried by the coronary arteries. They are the first vessels given off from the aorta. Their open mouths can be seen by depressing the membranes of the semilunar valves of the aorta. They descend on opposite sides of the organ, giving off numerous branches till they become capillary and countless. The venous blood of the heart is returned into the right auricle by several veins, which open into it through its outer wall.

The *nerves of the heart* have very little connection with those of the voluntary system, yet it is reported that men have lived who could stop the heart's action at will. The *par vagum*, the great nerve of the lungs and stomach, sends some of its fibers to the heart; so does the phrenic nerve, though chiefly distributed in the diaphragm. The sympathetic nervous system is also closely connected with the heart. But the hearts of many of the inferior animals will beat after they are removed from the body. That of the bullock can be made to beat after such removal by a little irritation. It has been suggested that the muscle of the heart possesses the peculiar power of contracting, in and of itself, without nervous excitation. But since the discovery of nerve-centers of the kind called ganglia about the base of the organ, in the midst of its other structures, it has become probable, if not certain, that an essential part of its nervous supply is centered in itself.

*Systole* and *diastole* are the contraction and dilatation of the several cavities. The two auricles act simultaneously, as do also the two ventricles. If an animal's thorax is opened and the heart observed *in situ*, it will be noticed that the cycle of the heart's action begins with a peristaltic wave of contraction, commencing in the great veins and spreading downward into the auricles. The latter contract in a similar worm-like manner, forcing the blood into the ventricles, which grow more and more turgid as the auricular systole advances. As soon as the latter ceases, without a pause ventricular contraction begins, and is seen to present a twisting of the ventricle from left to right and from behind forward. The blood is now forced into the aorta and pulmonary artery, which become distended and elongated. With completion of the ventricular systole the heart relaxes, and dilates when blood is again forced into the cavities. The exact duration of these phases can not readily be determined, but it is thought that the whole cycle requires about 0·8 second, of which the auricular systole consumes 0·1 second and the ventricular 0·3 second, leaving a period of pause or passive interval of 0·4 second.

The *impulse of the heart*, or *heart-beat*, is felt in the fifth intercostal space, an inch below and just within the nipple line. It is synchronous with ventricular contraction, and though much difference of opinion has existed as to the cause it seems determined that it is due to the peculiar anatomy of the ventricles. The *figure-of-eight* loop of muscle around the apex causes the heart to twist and move forward when contracting. In the flaccid state the anterior surface of the heart seems to lie in contact with the chest-wall, and when the organ, distended with blood, suddenly grows hard and moves forward by contraction of its fibers, an impulse is communicated to the chest-wall which is readily distinguished by the finger.

The *work of the heart* can not easily be calculated, because it is difficult to determine how much blood is discharged from the ventricle at each beat, and indeed it is likely that this varies largely with varying conditions of pressure, etc. The average of many calculations indicates that there are expelled from each ventricle about 6 oz. (180 grammes) of blood with each contraction. Taking this to be the amount of blood expelled and 250 mm. of mercury (equivalent to 3·21 meters of blood) as the pressure in the left ventricle, the work of the left ventricle done with each beat is 578 grammeters; or at 72 beats per minute, the day's work is 60,000 kilogrammeters. The right ventricle does about one-fourth as much, making a total of 75,000 kilogrammeters; or just about as much work as is done by a moderately heavy man making an ascent of Snowdon. Again, if the amount of blood in the body is one-thirteenth the body weight, or in a man of 75 kilos, 5,780 grammes, and 180 grammes of blood leave the ventricle at each beat, the whole quantity of blood must pass through the heart in 32 beats.

The *sounds* produced by the action of the heart are two, and are represented by the syllables *lub*, *dupp*. Anybody can hear them by placing the ear on another person's chest in the region of the heart; indeed, one may hear the sounds produced in his own heart if, in the stillness of the night, in bed, he turn on his side and place the palm of his hand over the ear and rest his head on the pillow. The first begins with the first of the ventricular contraction, and continues till it is ended; the second has no more duration than the sound produced by the snapping of a handkerchief. Half a dozen theories have been proposed to explain the first, but the opinion of most authorities now inclines to the view that it is a compound sound, due partly to the friction of muscular fibers on each other and partly to the closure of the auriculo-ventricular valves. Regarding the second, there is but little difference of opinion, for by experiment it has been proved to result from the collapse or striking together of the aortic and pulmonary valves at the close of the systole. The sound is one or single, because the closure on the two sides is simultaneous.

The *fœtal heart*, when it begins to show itself as a beating organ, suggests nothing of the elaborate organization it is

to become before independent breathing life can be possible. It is at first merely an enlargement of a beating blood-vessel. From this state it changes to such forms as are permanent in inferior types of animal life, passing from one to another, but always from a lower to a higher type, till it is completed. (See Circulation of the Blood.) It grows, and gets a single partition through it, with an opening in this partition. This is a single heart of two cavities, an auricle and a ventricle. After a time a partition is developed in the lower of these cavities. It is then a heart with one auricle and two ventricles. Still later, a partition is formed in the upper cavity, with, however, an opening which allows free communication from right to left. This is a heart of four cavities, which, after closing the opening in the auricular partition, prepares the individual for life in "this breathing world." So long, however, as the lungs have to perform no function, they receive but little blood through the arteries which are to be enlarged into the right and left pulmonary; but most of the blood propelled by the right ventricle, instead of turning to right and left, goes directly forward into the aorta at the concavity of its arch, through a channel that will disappear soon after birth, called the *ductus arteriosus*. At the same time the blood coming into the right auricle, or a part of it, passes freely into the left by the opening described above, which is called the *foramen ovale*. Thus, with the exception of the little blood sent for the nourishment of the lungs, this heart of four cavities acts as a single heart of two cavities. The first act of the newborn is to cry. This is the means appointed by nature to expand the chest and compel the opening of the lungs by the atmospheric pressure. No sooner are the lungs expanded than the blood of the right heart is literally drawn into the lungs, the right and left branches of the pulmonary artery expanding. The ductus arteriosus at the same time closes, and is soon to be obliterated. The blood in the right auricle is all directed into the right ventricle by the mechanical closing of a valve already provided on the left side of the foramen ovale. The valve soon grows into the septum, closing the foramen forever, leaving, however, a little scarlike depression, which is called the *fossa ovalis*.

William Pepper.

**Heartburn**: See Cardialgia.

**Heart Disease**: a general term under which are included a great variety of affections as diverse in nature and significance as are the various diseases of the liver, the kidneys, or other organs. The relatively greater frequency of one form has occasioned the erroneous popular belief that there is but one form of heart disease, and, in consequence of the serious nature of this one variety, that all cases are dangerous to life. The vital nature of the organ renders any disturbance of its action more or less serious, but it is by no means true that all such disturbances endanger life.

At the very outset we may distinguish two forms of heart trouble: the one, often called *functional*, in which no structural alteration may be found in any portion of the organ, and in the production of which the nervous system plays an important part; the other, termed *organic*, in which there is structural alteration in some part of the organ. As our knowledge of pathology has grown larger and methods of exact research more perfect, the number of functional diseases of this and other organs has steadily diminished, but there still remains a certain number of diseases of apparently purely functional nature. Organic heart disease may affect the envelopes of the heart or pericardium, the muscular structure or the endocardium, and especially the reflections of the latter which constitute the valves. Besides these acquired disorders a number of congenital malformations affecting various parts of the organ occasionally occur.

*Functional Heart Disease.*—These mainly affect the frequency of the contractions, and therefore of the pulse, or the regularity of the beats, and include also certain painful disorders. In a state of complete health one is not conscious of the beating of the heart except in strained positions. In certain conditions, however, there occurs great acceleration of the contractions, with forcible action, plainly perceptible to the individual. To this condition has been applied the term *palpitation*. Though not infrequently functional in nature, it is an indication, in a perhaps greater number of cases, of organic disease. Excitability of the nervous system, as a result of hysteria or of neurasthenia, or the depression consequent upon many diseases; emotional disturbances, like fright; disorders of digestion, and many other conditions, may lead to such functional palpitations. Overuse of certain substances like tea, coffee, tobacco, or alcohol, may also be the cause, or the palpitations may be symptomatic of various diseases, as exophthalmic goitre or Basedow's disease. In an attack of palpitation the heart-beats become more and more rapid, until a pulse of 150 or 160 is reached, and in exceptional cases a rate of 200 or 300 may be observed, a condition to which the name *tachycardia* (Mod. Lat., from Gr. ταχύς, quick + καρδία, heart) has been applied. During this period of overaction the patient is flushed, there is great anxiety and profuse perspiration; gradually the heart-beats become less frequent, and the patient may fall into a sleep of exhaustion. If the cause of the palpitation is organic disease, the attack is more apt to continue longer, but in some cases of functional disturbances also palpitation may be prolonged. At the same time there may or may not be present irregularity of the beats, and especially is this true of certain cases of organic disease, though in old and dyspeptic persons irregularity may occur without structural disease. Different forms of irregularity have been described, such as the intermittent form, in which an occasional beat is missed, a form in which every other beat is large or small, or in which every third or fourth beat is small, or in which two or three beats following in quick succession are separated by a more or less extensive pause. These forms of action are always to be regarded with great suspicion, as they most frequently indicate serious and advanced disease. Extreme slowness of the heart's action, or *brachycardia* (Mod. Lat., from Gr. βραχύς, slow + καρδία, heart), is a rare form of disturbance, in which the pulse may fall as low as twenty or less per minute. Like palpitation, it may be functional or organic, though more frequently the former.

Of painful diseases the most important is Angina Pectoris (*q. v.*), or "breast pang." In a number of such cases disease of the blood-vessels supplying the muscular structures of the heart itself have been found, but in many others no lesion could be demonstrated, and these must be considered at present as instances of neuralgic disturbance.

*Organic Diseases.*—In describing different forms it must not be supposed that each is met singly. On the contrary, it is the rule to find several of the structural disorders below described in combination, one usually the result of another. Moreover, it is not impossible that functional disturbance may aggravate an organic disease.

*Hypertrophy of the Heart.*—This is enlargement, and the term means nothing more, although there are usually other changes attending it. The heart naturally increases in size with advancing years, but the increase is not considerable, and is not regarded as a disease. The pathological anatomy of hypertrophy consists of an increase in the number of muscle fibers, and to a less extent in increase of the size of individual fibers. Cardiac hypertrophy is analogous to the enlargement of the blacksmith's arm or turner's leg; new demands made on its strength produce a multiplication of its muscular fibers. Generally the external cause of this hypertrophy is some obstacle to the circulation, requiring increased strength of muscle to overcome it, as a diseased valve, or a tumor pressing upon a large artery, or a large organ so diseased that the circulation through it is seriously obstructed. It is produced by the mental emotions, which increase the force and frequency of heart-beats, as frequent anger and the anxieties that excite the heart (some depress its action), and, it may be added, by causes that have not yet been discovered. Its subjective manifestations are a strong impulse of the heart-beats, which, however, may be very strong and never be noticed by the affected person, and shortness of breath on exertion, and very little else. The physician discovers it by many signs, the chief of which is the extension of dullness on percussion to the left of the line already given as the left boundary of the healthy heart. The heart, once enlarged, never returns again to its original size. Cardiac hypertrophy of itself does not cause death. The conditions which called forth the enlargement, or secondary disorders, as apoplexy or kidney disease, may lead to a fatal termination, or may await the intercurrence of other and entirely distinct diseases. Indeed, if hypertrophy is produced by obstruction to the circulation, within certain limits it is compensatory and conservative.

*Dilatation of the heart* is an enlargement of its cavities. The left ventricle may be so dilated that its capacity is considerably greater than would be sufficient to contain the whole of a healthy heart. The dilatation may be in all of the four cavities, or may be confined to one. The ventricles are far more liable to dilatation than the auricles, and the

left much more than the right. Dilatation and hypertrophy very commonly go together, so that hypertrophy with dilatation, associated with and caused by morbid changes in the shape and function of the valves, is the most common form of heart disease. The condition of the heart may be regarded as alternately active and passive—active in systole, passive in diastole. If in the passive state, while the blood is flowing naturally into a heart-cavity, there is at the same time a reflux of blood into the same cavity in consequence of a defective valve, dilatation of that cavity will be sure to occur. The extended wall of such a cavity may not be thicker than it is in health, yet as it bounds a greater space it will require more material, and is hypertrophied by multiplication of the muscular fibers. In this state the heart has been known to weigh 60 oz., or six times its natural weight. Hearts like these are called *enormitas cordis*, or *cor bovinum vel taurinum*. They are frequently found in persons who have had rheumatism and heart disease in childhood, and have grown to manhood with a damaged heart. It is noticeable that children bear these cardiac affections better than adults. The body, as it grows, seems to accept and tolerate an amount of such disease that would overwhelm a grown-up person. When it begins thus early, it is often carried to manhood, and sometimes to advanced manhood. It is the repetition of the attack which is fatal in childhood. Dilatation with hypertrophy is, after it reaches a certain stage of progress, attended by shortness of breath on exertion, sometimes palpitations, irregular heart-beating, and consequently irregular pulse. The chief danger consists in the progressive failure of cardiac power, and therefore of the circulation, the occurrence of dropsy of the legs and body, and finally complete loss of power in the heart. These extreme results are all the more prominent when the muscular structure becomes diseased by fatty degeneration, in which case thinning of the walls and dilatations of the cavities become most marked, and circulatory failure therefore most prominent. This condition of affairs, though not invariable, is common in all cases of advanced cardiac disease.

Simple *atrophy of the heart* (diminished size and weight) occurs with wasting diseases, in which the quantity of blood in the system is diminished also, and it should not be regarded as a disease. It is also found in the general wasting of extreme age.

*Diseases of the Valves of the Heart.—Endocarditis*, or inflammation of the lining membrane of the cavities of the heart, is a common attendant on acute rheumatic inflammation of the joints, but it may occur without rheumatism. This inflammation is one of the principal causes of derangement and imperfection in these essential appendages of the heart. Thus endocarditis expends its force principally on those duplications of the endocardium which constitute the valves. It deposits a new material between their folds, and at first increases their thickness. A portion of this new material is converted into fibrous structure, and finally the fibers contract. The result is that these valves become thick and unyielding, so that the semilunar can not be applied to the arterial wall when the blood is forced into the aorta or pulmonary artery. The mitral and tricuspid grow stiff and hard, and do not fully give place to the blood passing from the auricle into the ventricle. Again, this new fibrous structure contracts and shortens the valves, so that their parts can not meet properly and prevent the reflux of the blood. So blood from the ventricles sent into the great arteries will flow back again into the heart, to be forced out again by a new contraction. This is *insufficiency* or regurgitative disease of a valve. The stiff, unyielding state, when it obstructs the current, is called *obstructive disease of the valve* (*stenosis*). The valves are thickened also by the deposit between their folds of a yellowish substance, made up partly of small microscopic cells, and partly of fat-globules, called *atheroma*, one of the products of a slow or chronic inflammatory action. In time this atheromatous deposit is apt to be converted into, or rather is replaced by, a hard calcareous material. Such calcareous deposit is usually of limited extent and presents itself as plates or spicules, but the interference with the action of the valves may nevertheless be very great. The presence of calcareous matter, moreover, keeps up a constant irritation, which prolongs the inflammation and therefore leads to further damage. The term *ossification of the valves* was formerly used, but true bony formation is certainly very rare.

*Rupture of the valves* is possible. The aortic valve may yield in the bottom of one of its cups; or the marginal thread may separate from the deeper part of the cup; or the upper attachments of the cups to the aorta may give way; or the anterior leaf of the mitral valve may be perforated; or one or more of its tendinous cords may be broken. These accidents usually occur after the ruptured part has been weakened by the deposit in it of a plate of atheroma; yet they may yield without previous disease, but then always at the time of great exertion of muscular strength in lifting weights, running, jumping the rope, or the like. Sudden death during great exertion is sometimes produced in this way.

*Vegetations on the Valves.*—Besides the general thickening of the valves inflammation may occasion certain morbid deposits on them. They are minute hard warts that are formed on the free surface of the valve just below its thickened margin. These are chiefly important as being the occasion of the deposit of masses of the fibrin of the blood upon the valves, so producing large granular-looking warts, which obstruct the outflow from the ventricle. Any roughening of a valve-surface by inflammatory or other disease, or by rupture, may cause the deposit of these *fibrinous concretions*. When they occur they not only obstruct the flow of the blood, and partially disable the valves, but portions of them may be washed off into the arterial current and be carried into a distant organ, as the brain, spleen, or kidney; and one of these reaching an artery too small to receive it, it stops there and cuts off the arterial blood from all portions of the organ usually supplied by the obstructed vessel. This mode of plugging up the arteries is called *embolism*; the plug itself is an *embolus*.

In the advanced stages of these diseases of the valves and muscular structure it is not difficult to arrive at the opinion that there is heart disease. Shortness of breath, induced by exercise, the strong heart-beating, beating of the vessels in the neck, the dropsies, the distress produced by lying down, tell the truth but too certainly. But they do not designate the particular form or forms of disease. This can only be learned by listening to the sounds produced by the action of the heart, and by actual measurement by percussion. Thus, in addition to the two natural sounds, from one to four new ones may be produced, called *murmurs*. These murmurs vary in pitch and quality according to the morbid conditions causing them. They are due to the friction of the blood against roughened surfaces, or the mere passage of the blood through abnormally large or small orifices. The valve diseased and the nature of the disease are determined by the position in which murmurs are heard and their character. If there is a murmur heard most distinctly under the breast-bone, where the third ribs are joined to it, and while the ventricle is contracting (in systole), it is probable that there is obstructive valvular disease, either in the aorta or pulmonary artery, and the chances are thirty to one that it is in the former, for in this proportion at least is valvular disease found more frequently on the left than on the right side. Indeed, the grave valvular diseases of the right heart are almost always found to have occurred before birth. The aortic-valve murmurs are heard somewhat more distinctly at the right border of the breast-bone, and those of the pulmonary valve at the left border. If there is a murmur with and after the second sound heard most distinctly at the same place, it indicates insufficiency—that is, regurgitation, as already explained. It will be remembered that the two hearts contract simultaneously, and that the two second sounds are simultaneous. If, then, the second sound on one side is silenced by deformity of the valve, the valve on the other side is, in all probability, normal, and produces its own normal second sound strongly enough to be heard. A murmur heard most distinctly in the left and lower part of the heart-region (toward the apex) is referred to a diseased mitral valve. If it is in systole, the valve is insufficient, and there is regurgitation from the left ventricle into the left auricle. If it is in "the period of repose"—that is, the period between the second natural sound of the heart and the recurring first—it will indicate an obstruction, from the stiffness or other diseased change in the valve, to the flow from auricle to ventricle, for it is in this period that the auricle is emptying itself into the ventricle.

With two exceptions, these murmurs are positive indications of changes in the form, thickness, dimensions, or structure of these valves. There may be an *anæmic murmur* with the ventricular contraction at the pulmonary opening when the blood is thin, or does not contain its normal quantity of animalized elements—or, in other words, when it contains too much water (*hydræmia* and *chlorosis*)—and there may be actual regurgitation, and the corresponding murmur at the.

mitral valve, caused by muscular relaxation, as a result of which the orifice is abnormally large and the valves therefore insufficient to prevent regurgitation. The same rules are applicable to valvular diseases of the right heart, except that the murmurs of the tricuspid valve are heard at the junction of the sternum and fourth right rib.

These are the common forms of heart disease; and there will be in this article no better place than here to say that the popular opinion of their fatality is erroneous. Few persons can hear the announcement that they have disease of the heart, of whatever kind, without hearing it in the command, "Set thine house in order, for thou shalt surely die," and the general expectation is that the death will be sudden. It is true that there are sudden deaths from heart disease, even in persons who have not been ill enough to consult a physician. But these sudden deaths are exceptions. For one such, a quarter of a hundred live on till death comes through some disease which could not have been looked for, or the kidneys become involved in secondary Bright's disease. Every physician of experience can recall cases of heart disease which have persisted for years, giving no trouble beyond occasional shortness of breath after unusual exertion or indiscretions of other kinds. The hypertrophy of the organ which has been above described is here a conservative process tending to equalize the circulation by strengthening that portion of the heart which requires additional power, either because the blood is not permitted to flow out with the wonted ease, or because after expulsion part of the blood regurgitates. It will thus be seen that heart disease of itself is not often a cause of rapid death, but may persist until old age without inducing great discomfort. The mode of life must of course be regulated to avoid causes of increased strain to the heart, and intercurrent diseases must be treated with greater care, as a crippled heart makes them additionally dangerous. Death may finally occur from exhaustion of the heart or from other diseases supervening.

*Diseases of the Heart-muscles.*—Two important forms of such disease may be recognized: the *inflammatory* and the *degenerative*, the latter being such as are attended by retrograde changes in the structure of the heart without inflammation.

*Myocarditis*, or inflammation of the heart-muscle, may be an attendant of endocarditis or of pericarditis (inflammation of the investing membrane of the heart), or it may occur independently of such affections. This inflammation may take one of two forms, either *acute purulent* inflammation with formation of abscesses, or a slower chronic inflammation by which there occurs formation of fibrous connective tissue between the true muscular fibers. The latter form is much more common than the former. Purulent myocarditis may be localized, as stated, in the form of abscesses, or it may be present as a uniform infiltration of the muscle with pus. Abscesses usually occur as a result of deposition of septic matter, carried to the heart from some distant point of suppuration through the circulation. They may cause death by leading to rupture of the organ or by general *pyæmia*, or they may be healed. When the latter occurs the pus is gradually absorbed and a scar takes the place of the tissues which have been destroyed and removed. The scar tissue being inelastic, the constant distentions of the cavities lead to gradual stretching, and finally a localized, saccular dilatation, or *aneurism of the heart*, results. This may remain for a long time without giving marked symptoms, or may rupture and lead to rapid death. The more chronic myocarditis with formation of fibrous tissue is much less serious than the purulent form. It may give rise to few or no symptoms for a long time, or may not be recognized until after death, when the morbid changes may be seen at autopsy. It is frequently present in chronic valvular heart disease, and contributes to the gradual weakening of the walls which culminates in dilatation of the cavities. The presence of connective tissue between the muscle fibers gradually deprives the latter of their proper blood-supply, and degenerative changes are apt to ensue, so that fibroid change and fatty degeneration of the heart usually coexist.

*Degenerative changes* in the heart-muscle include several varieties, but the most frequent is *fatty degeneration*. This must be carefully distinguished from that form of fatty disease in which there is mere deposition of fat within the muscular structure and around the organ, and which is called *fatty infiltration*. In every person there is a certain amount of *adipose tissue* or fat in the layer of pericardium lining the outside of the heart, just as there is a deposit of fat in the subcutaneous connective tissues. In individuals who are very "fat" this adipose tissue grows more and more considerable, until finally the organ is imbedded in a thick layer of fat, and the latter may also push into the muscular structure between the fibers. This condition is called fatty infiltration. Fatty degeneration is quite another thing and of much greater gravity. In this case, as a result of malnutrition from anæmia and various organic diseases there is gradual retrograde change in muscle fibers themselves, causing transformation into fat, and as a result the muscle is greatly impaired, whereas in infiltration the impediment is mainly mechanical, the masses of fat interfering more or less with the muscle which is itself healthy. The appearance of fatty degeneration of the heart is readily recognized by the change of color from the dark red of healthy muscle to a more or less pronounced yellowish tinge, and by the greater softness of the walls. In advanced cases the cardiac power becomes much reduced, the pulse becomes intermittent and irregular, and the cavities widely dilated.

Other degenerations of the heart do not merit notice here. *Rupture of the heart* may occur, as above described, by yielding of the walls in the situation of an abscess or after the healing of such through the scar or aneurism there developed. More rarely rupture may occur in points of great weakness due to fatty degeneration, or deep ulceration from endocarditis. Great and sudden strain is the usual inciting cause. The blood flows out into the pericardial sac and impedes the heart's action. Death is usually very rapid, and there may be no definite indication of the cause. A few cases of slow death have been recorded, but a few hours is the usual limit.

*Heart-clot.*—At varying times after death the blood in the heart and large blood-vessels coagulates to form dark-red masses, sometimes called *currant-jelly clots*. If there has been time for a separation of the white and red corpuscles of the blood, the latter sinking by their greater weight, the clot formed has a lighter color and may be almost white. Clots may, however, be formed in the heart during life, and indeed they usually occur when death is slow. Under such circumstances the circulation through the heart is very much retarded, and clotting easily occurs. This is especially prominent in diseases of the lungs, in which there is a special impediment to the circulation, and the immediate cause of death in such diseases is usually failure of the heart. Thus in pneumonia or phthisis there are, after death, dense white clots, sometimes almost entirely filling the right ventricle and auricle, and extending far up into the pulmonary artery and its branches. The left heart is less involved in these cases. Occasionally a heart-clot may cause sudden death by becoming detached and obstructing one of the orifices, or, if smaller, the coronary artery. In all cases of heart-clot during life there is the danger that parts of the clot may be detached, carried into the general circulation, and obstruct small arteries in various organs, as the kidneys, spleen, or brain.

*Embolism and Thrombosis of the Coronary Arteries of the Heart.*—The first of these terms refers to the fact just described that clot or fibrinous concretion may form in the heart, and that a part or the whole of it may be detached and carried forward till it reaches an arterial division too small to receive it; it can not go back, but must remain there, preventing the circulation of arterial blood in the artery beyond it, till it is disintegrated and carried away. It is possible that a portion of a fibrinous concretion on the valves or wall of the left ventricle, so detached, may enter one of the coronary arteries, and so obstruct it. But a section of the aortic valve covers the mouth of each of these vessels during the contraction of the ventricle, and this protected condition must render such an accident very rare. What we are more familiar with is *thrombosis*, or the coagulation of blood in the artery. This cuts off half of the supply of blood to the heart; a pretty rapidly increasing feebleness of the heart-action follows, with a weak and slow pulse, great prostration of strength, extreme paleness of countenance, coldness of the feet and hands, and after these symptoms death occurs in ten to twenty hours in the majority of the cases.

*Pericarditis.*—As the lining membrane of the cavities is subject to inflammation, so is the external covering. This and the lining of the fibrous pericardium are alike liable. They are indeed but one membrane. Pericarditis and endocarditis often occur at the same time, being both produced by an extension or migration of articular rheumatism, or rather by that same state of the system which causes the articular disease. Either of these diseases may accompany

Bright's disease. Beyond the concurrence with these affections the causes of pericarditis are not well defined. The disease itself, as well as endocarditis, was not intelligently observed until the nineteenth century. The changes produced by pericarditis are: first, an increase in the quantity of blood in the vessels of the membrane; second, absorption of the fluid which in health diminishes the friction between the heart and pericardium; third, exudation of fibrinous material or serous fluid from the blood. Both of these products of this inflammation are commonly found, but the serum is usually much the most abundant and the most oppressive by impeding the action of the heart. When there is little serous fluid, the disease may run its course with but little general disturbance; but when the quantity is large, there is a rapid pulse, oppressed breathing, and a tendency to faint when sitting or standing. The pericardium is distended by its watery contents, sometimes even to tension; and the normal dilatation of the heart-cavities becomes difficult. If the disease runs a favorable course the serous fluid and the fibrinous exudate are gradually absorbed by the blood-vessels and a normal condition of affairs restored. In other cases, after the fluid has been absorbed, or in case of its entire absence from the first, fibrous adhesions may be formed and bind the two layers of the sac together, greatly to the impediment of the heart.

In the early stages of pericarditis there is pain from rubbing together of the dry and inflammed layers of pericardium, and for a like reason a to-and-fro rubbing sound or *friction* may be heard. When effusion of fluid has occurred, both these symptoms disappear, but disturbance of the heart's action now becomes pronounced, and the area of dullness to Percussion (*q. v.*) increases. The heart-sounds under these circumstances become a little less distinct as the heart is buried in water. This is the condition indicated by the phrase "water on the heart," popularly supposed to be a common malady, but it is not found to exist in one in twenty of the cases in which it is suspected. Pus is sometimes, but not often, found in the pericardium after inflammation. In *chronic pericarditis*, implying chronic distention of the heart-sac, the fluid causing the distention is partly pus (seropurulent). Chronic pericarditis is almost always fatal. Acute pericarditis is rarely fatal in the first attack; but in young persons subject to recurring rheumatism each return is more and more dangerous.

*Deformities and Defects.*—The growth of the heart may be arrested in any of the imperfect stages referred to under the head of *fœtal heart*. (See Heart.) It may have but two cavities, an auricle and ventricle, or two ventricles and one auricle, or two auricles and one ventricle; the pulmonary artery may be small or not developed; so also the aorta may be small or wholly obstructed at its origin; the foramen ovale may remain open after birth; there may be an opening in the septum of the ventricles which will permit free communication from one to the other; the ribs over the heart may be absent, so that the skin is its only chest-covering—indeed in certain rare instances the organ has been found beating and wholly outside the chest (*ectopia cordis*), suspended by its vessels, which were internal; in rare instances there is no heart; such a fœtus usually has no head or arms, but lumpy growths instead, and must always be one of twins, the circulation being produced by the twin heart through the placenta. The most common of these defects is an open foramen ovale, permitting venous blood from the right auricle to mingle with the arterial in the left. This is produced when the current through the pulmonary artery is obstructed. This state of the heart leads to the condition called *morbus cæruleus*. The name, however, applies equally to other congenital defects that permit venous blood to pass into the left heart or into the aorta to circulate in the arteries, producing blueness of the skin. This color is not constant, except in a few, but is produced by crying, a fit of coughing, excitement, or unusual physical exertion. It is not incompatible with a life of limited duration, but is likely to be attended by diminished growth of body, bodily and mental sluggishness, shortness of breath, palpitation at times, and occasional fainting. If the subject of any of these defects survive the first years of life, the defect alone will not probably be the immediate cause of death, but it will diminish the power of resisting a fever, a pneumonia, or any grave disease, and especially one that disturbs the balance of the two circulations. The heart of two cavities and obliteration of the pulmonary artery must be attended by an enlargement of the bronchial arteries if life can be maintained even for a short time. If there are two auricles and one ventricle, the foramen ovale must remain open; if there are two ventricles and one auricle, there is a permanent opening in the septum; if the aorta is obstructed, the ductus arteriosus remains, as well as the opening in the septum. In all these cases the action of the organ is practically the same as in a heart of one auricle and one ventricle.

In spite of this long list of diseases relatively very few deaths are caused by all these agencies put together; a very large proportion of the deaths so occurring are in persons of advanced age; and even when disease fastens on the heart it does not, as a rule, preclude the hope and expectation of "length of days." Counting from youth to age, not one in a hundred has any kind of disease or defect of the heart.

Revised by William Pepper.

**Heart's Content**: village; on the southeast side of Trinity Bay, Newfoundland; lat. 47° 50′ N., lon. 53° 20′ W. It is the landing-place of the Atlantic telegraph cables extending to Valentia, Ireland. Here is a fine telegraph building. The harbor is good; most of the inhabitants are fishermen. Pop. 880.

**Heartwood**: See Duramen.

**Heat** [M. Eng. *hete* < O. Eng. *hēto*, deriv. of *hāt*, hot: Germ. *heiss*]: a natural force the existence of which is realized through the sense of feeling. It is difficult to give a *scientific* definition of the term heat in any other way than by the enunciation of the "dynamic theory," upon which all its manifestations depend. In its most common acceptation it refers to the physical effects which bodies in nature, in certain conditions, produce upon others. A person exposed to the direct action of the sun or a fire experiences a feeling of comfort or discomfort, which is involuntarily attributed to some sort of emanation from these sources (see Sensation); and bodies in certain conditions are observed to produce effects on other bodies near them, or in contact with them, which are attributed to the same kind of influence. It was for a long time supposed that a material agent passed from one body to another. Under this hypothesis it was conceivable that a body might "contain" heat, and that this substance might exist in greater "quantity" at one time than another in the same body; and although the term *heat* and the expressions "quantity of heat," "transfer of heat," and others having significations which involve the idea of quantity, are still retained, even in scientific explanations, the quantities referred to are not those of matter, but of dynamic effects.

The dynamic theory of heat—a theory which has revolutionized the physical sciences—is founded on the assumption that all substances in nature are composed of indefinitely small material molecules, which are maintained by the forces which act upon them in a constant state of vibration or oscillation. When a body, whether solid, liquid, or gaseous, becomes hotter in the popular sense of this term, the scientific condition involved is that the vibrations of the molecules become more rapid; and a decrease in the velocity of vibration of the molecules accompanies or produces the effect called cooling. The forces which act upon the molecules, and which determine the velocity of vibration, are presumed to be their own mutual attractions and opposing centrifugal forces, to which is added the external pressure of the atmosphere or other medium which surrounds the body. Each molecule in motion possesses a certain *vis viva* (living force), or energy, corresponding to that which is manifested by *bodies* having visible or sensible motions; so that the *vis viva* due to the heat-vibrations may be said to represent generally the heat-condition of the body.

The dynamical process of heating or cooling may be effected in various ways. The most common and universal phenomena of this kind in nature take place through *radiation* of heat. If a heated body be placed near another which is cooler, a transfer takes place until an equilibrium is attained in their conditions. This equilibrium is assumed to be effected through the vibrations of an elastic medium which pervades all space, and which is composed of ponderable molecules so small that they penetrate the spaces between the molecules of other substances, and form, so to speak, an atmosphere around them. This medium, which is called the luminiferous ether, may be said to perform the same office in the transfer of heat that the common atmosphere performs in the phenomena of sound. The cooling of a body through radiation implies a loss of energy through the impact of its molecules with the atoms of the ether, waves or vibrations being communicated to the latter

which are propagated in all directions. Another body within the influence of these waves will receive heat by the impulsion communicated to its molecules; or, in other words, an increased rate of vibration will be communicated to its molecules, its energy will be increased, and it will become hotter. In any system of bodies or particles, if no chemical action takes place, and no mechanical or dynamic influence is exerted upon the system from without, any change of heat in one of the bodies of the system is accompanied by a corresponding change of the same kind in an inverse sense in one or all of the other bodies: when, however, any external force is applied to the system, such as friction, pressure, or a shock, the effect of such external energy exerted is manifested by a change of heat in the whole system; and, according to the principles of conservation of energy, these opposite effects must be equivalent. The variations of the heat of a body are thus known by common observation to be connected with the action of ordinary forms of dynamic energy.

The supposed motions of the separate molecules of bodies with which the phenomena of heat are connected can not be made evident to the senses, and hence the dynamic theory was the result of inductive reasoning, and not of observation. It had its origin in the fundamental principle of the science of dynamics, connected with that force in nature which arises from the inertia of matter. The well-known law of dynamics, that when the velocity of a material particle or of a body is changed by the action of a force the *work of the force* in a given time is equal to the *variation* of the *vis viva* of the particle or body, is a law which may be derived directly from the definition of the mass of a body and the principle of measuring forces by velocities. Applied to a system of bodies acted upon by a system of forces, this theorem of dynamics assumes the following general form of expression: *The aggregate work of the forces applied to a system in a given time is equal to the variation of the vis viva of the system in the same time.*

The discovery that this theorem of the transformation of energy, as applied to sensible finite velocities of bodies, is applicable to the insensible or indefinitely small vibrations of the molecules of a body which accompanies the changes of volume and the excitation of energy in the phenomena of heat was definitely demonstrated and received as a new theory about the year 1852. During many years previous to this the subject of the true theory of heat had been discussed, and the new theory was even announced in precise language by Lavoisier and Laplace as early as 1780, in the following language (Verdet, *Théorie Mécanique de la Chaleur*): "Other physicists think that heat is only the result of insensible vibrations of matter," . . . "In this system heat is the living force which results from the insensible movements of the molecules of a body"; "it is the sum of the products of the mass of each molecule by the square of its velocity." "We shall not decide between the two preceding hypotheses [referring to the material theory]. Many phenomena appear favorable to the latter. Such is, for example, that of the heat which is produced in the friction of two solid bodies; but there are others which are applied more simply in the first." "Perhaps they both have place at the same time." Laplace afterward, however, in his discussions on heat, defended the material theory. The experiments of Rumford and of Davy in 1798 and 1799 upon the heat produced by friction served to demonstrate the failure of the *material* theory, and gave a new impetus to investigation.

The discoveries which led to the foundation of the science of thermodynamics were made between the years 1842 and 1849, and were due to the independent and separate investigations of Dr. Robert Mayer, a German physician, Prof. von Helmholtz, Mr. Colding, an engineer of Copenhagen, and Mr. Joule, of Manchester, England. An approximate determination of the *dynamic equivalent* of a unit of heat was first published by Mayer; while Joule was the first to give by exact experiments the determinations which established the principle, and placed the value of the dynamic equivalent beyond doubt. The final development of the science into a definite form, immediately following the determinations of Mayer, Helmholtz, and Joule, was principally due to the labors of R. J. E. Clausius, M. Rankine, and Sir William Thomson, their most important researches having been published in the years 1849 to 1851. To these illustrious philosophers and mathematicians we are principally indebted for the establishment of the science of thermodynamics.

Heat being no longer regarded as a material substance, but its phenomena being those of force, motion, and work, it is proper to explain the meaning of the term "quantity of heat," which is retained even in scientific discussions. For this purpose it will be necessary first to explain the signification of the term *temperature*. Degrees of temperature, as exhibited when the thermometer is brought in contact with a body, indicate, as is well known, various conditions of the body in regard to heat, and under the material theory it was rational to suppose that the lowering of temperature indicated by the thermometer when in contact with a body would indicate the quantity of heat which passed out of the body; or, in other words, variations in the thermometer might be taken to represent variations of quantities of heat in a given mass. Under the dynamic theory, however, a change of heat in a body indicated by the thermometer involves three effects, an increase or decrease of the energy due to the heat-motions, the work of the force of attraction of the molecules, due to the change if the body expands or contracts; and also the work of the external pressure upon the bounding surfaces. The variation of heat in the body is the resultant of these effects. If the body heated or cooled retains its form and dimensions, then the only effect of an external modifying force is to produce a change of molecular movement, provided no visible or sensible motion is communicated to it; and this increment of living force, or "heat," will be indicated by the thermometer, or become *sensible* through the thermometer. The *dynamic equivalent* of a certain quantity of heat will in such a case be the work of the exterior force which produces it. One mode of finding such an equivalent may be mentioned, especially, as that followed by Joule. He found by experiment the quantity of work expended in producing friction among particles of water, corresponding to the heating of one unit of weight, or 1 lb., one degree of the thermometer. The water was taken at its maximum density, so that the only effect of friction was the heating effect, no part of the external force being expended in producing expansion or in overcoming the attraction of the particles and the force of external pressure; or at least these effects were insensible. It was found that 772 foot-pounds of work correspond to an elevation of temperature in 1 lb. of water one degree F. This quantity of heat being represented by 1, the dynamic equivalent of a unit of heat in English measures is said to be 772 foot-pounds. This operation being merely a transformation of the energy of a force exerted into another form of energy, the energy of motion in a mass is necessarily invariable. To find the equivalent *thermal* effect in any other substance, it is only necessary to find experimentally the mass of such substance that will have its temperature changed one degree by the quantity of heat thus represented by unity. It is obvious that any other quantity of water might be taken, as, for instance, a kilogramme, and any other thermometer, the centigrade, for instance. This would give a different unit of heat, which would correspond, however, to a different quantity of work of the modifying force, but the relations of the two units and the quantities of work would be invariable. Thus a French unit of heat, a "calorie," is such a unit; it corresponds, nearly, to four British units, the exact ratio being 3·968, the quantity of work equivalent to a calorie being 423·55 kilogrammeters.

Various modes of determining the dynamic equivalent have been adopted, and laborious experiments and investigations with this view have been made by eminent physicists. These experiments include those in which heat is generated by friction of water, mercury, and iron; experiments with steam and air; with dynamo-electric machinery; and the shock of bodies, all leading substantially to the same result, small differences only occurring in the determinations arising from causes of loss of heat or work which could not be always experimentally ascertained, the accepted result being that stated above.

The determinations by Joule in 1843–45, which first gave to the dynamic equivalent a value worthy of confidence, may be said to have been the starting-point of modern progress in the science of heat. We are thus led to the enunciation of the fundamental principle of the dynamic theory of heat, sometimes called the principle of equivalence of heat and work—viz., *heat and dynamic energy are mutually convertible*; the law of this equivalence, stated with reference to British measures, being that *1 unit of heat corresponds to 772 foot-pounds of dynamic energy exerted*. A quantity of heat expressed in British units of heat may therefore be expressed as work by multiplying the number of units of heat by 772, the result being work in foot-pounds.

The general conclusions to be deduced from what pre-

cedes are as follows: (1) The word *heat* implies a condition of bodies in nature which is a condition of energy, or capacity for producing changes. (2) This capacity is indicated by the thermometer; and one kind of change effected between two bodies in different conditions through the action of heat is the *transfer of heat*, by which bodies are brought to the same degree of temperature, as indicated by the thermometer, through radiation or actual contact. (3) The changes of heat in a body are accompanied by corresponding changes of the density and elasticity, or by changes in volume and in pressure, upon the medium which envelops the bounding surfaces of the body. (4) Among the changes produced by a change of heat also may be enumerated chemical, electric, and magnetic changes. (5) Heat, considered as a source of energy, is identical with the kind of energy called *vis viva*, and may be regarded as a quantity capable of being measured by its dynamic effects; and in this respect it is subject, like other forms of energy, to the law of conservation. This law, as applied to heat, gives rise to the principle of equivalence, and its proof is the determination experimentally of the *dynamic equivalent* of heat.

In a complete study of heat two very different systems of investigation are necessary. One consists in the determination of the quantities of heat which are absorbed or disengaged by bodies when they pass from one condition of heat to another through intermediate states, in which the relations between the temperatures, volumes, and external pressures are considered. In this system of investigation the equivalence of heat and work is to be taken into account, and also the principles which form the basis of the science of thermodynamics. The phenomena of greatest interest to be considered are the changes of volume and of states of aggregation of bodies which accompany changes of heat; the performance of external work through the elastic force in the expansion of bodies; the applications of heat to electricity, magnetism, and chemistry. The investigations are prosecuted partly by experiment and observation, and partly by analytical investigation, the experimental investigations furnishing usually the constants or coefficients of the mathematical formulas.

The other class of investigations relates to the phenomena of heat as exhibited between bodies in which the interchange of temperatures is effected without any modifying external cause, and embraces the laws of the *propagation or transfer* of heat; the study of radiant heat in its relation to the wave-motions of the ethereal medium; and the action of bodies in reference to radiation and absorption. In these investigations the phenomena of heat and light are regarded as identical in character, or as resulting from the same physical agencies.

The first system of investigation mentioned will be first discussed. Let it be supposed that the exterior forces which act on a body are uniform normal pressures, such, for instance, as the pressure of the atmosphere upon the surfaces of solids and liquids, or the pressure, equal and opposite to the elastic forces, of the sides of vessels upon the gases or vapors which the vessels contain, the temperatures of the bodies being uniform throughout their whole extent. Then the condition of any body will be completely determined by the relations which exist at any instant between the three quantities, $p$, the pressure, $v$, the volume, and $t$, the temperature—a relation usually expressed mathematically in the form of an equation, $f(p,v,t)=0$, the expression $f(p,v,t)=0$ being read *function* of $(p,v,t)=0$. It is a common algebraic principle that in such an expression, *when the relations are known*, if any two of the quantities are known the third can be determined. If the volume and temperature be taken as independent variables the relation may be expressed $p=f(v,t)$; and if the pressure and temperature be taken as independent variables the volume would be expressed $v=f(p,t)$. $t=f(p,v)$ is another form of the same expression.

It is a matter of common observation that bodies assume different forms and conditions or states, which depend on their conditions in regard to heat. These states give rise to a classification of bodies under three general states, known as solid, liquid, and gaseous. A solid substance is one the molecules of which, though in a state of incessant vibration, nevertheless are retained in such a state of equilibrium between the attraction of the molecules for each other and the elastic force due to heat, that the body, as a whole, retains persistence of form as well as of volume. In the liquid state the molecules of the body move freely among themselves, but are not permanently attached to each other. In other words, a single molecule may transfer its contact from one set of molecules to another set, subject to the condition that the particles or aggregated molecules remain in mutual contact, like so many minute spheres or globules, rolling freely upon each other, but still retained in mass by the attractive forces which act through their point of contact. The term *gas* refers to that condition of substances in which the particles are in a state of tension. See Gas and Liquefaction of Gases.

The effect of a transfer of heat to all substances is similar in all three states of aggregation. The transfer of heat to a solid not only causes an increase of molecular vibration, exhibited by an increase of temperature, but an expansion, which consists in the separation of the particles from each other, or an increase of volume; but this expansion involves the overcoming of the external pressure of the air or other enveloping medium. In the case of liquids a transfer of heat to the liquid produces precisely the same effects as in the case of a solid—increase of molecular vibration, disintegration, involving expansion of volume and overcoming of the external pressure. In the case of perfect gases, the molecules having already become entirely separated, the effect of a transfer of heat is exhibited simply in increase of vibration of the particles, or increase of sensible heat (temperature), and capacity for overcoming the external pressure. When heat is abstracted from a body the effects described above are all reversed. The molecular oscillation is diminished, the volume contracts, and the external pressure, acting through the volume passed over by the contracting envelope, will perform work which appears in the heat abstracted.

These general laws may be illustrated or explained in a very simple manner, according to the fundamental theory of heat which has been enunciated, by the use of algebraic symbols. Suppose a definite quantity of any body, solid, liquid, and gaseous, to receive heat from some external source. Let the quantity of heat received, expressed in units of heat, be denoted by $Q$. The body will undergo the following changes: (1) an increase of molecular movement involving an increase of actual energy, which may be represented by $W$; (2) a certain amount of expansion or change of position of the particles, which involves a certain amount of work in overcoming the attractive forces of the body, which may be represented by $R$; (3) the change of volume involves the work of overcoming the external pressure to an amount which may be represented by $S$; and since $Q$ is expressed in units of heat, and $W$, $R$, and $S$ are supposed to be expressed in units of work—foot-pounds—we shall have, for the total effect of the heat transferred, $Q.E=W+R+S$; $E$ representing the dynamic equivalent of a unit of heat. This expression is the enunciation, algebraically, of the principle of equivalence. The quantity $W$ in the general expression represents a quantity of work equivalent to the change of *vis viva* of the mass of the body from the change of heat-motions of the molecules; the quantity $R$, the *work* of the forces of attraction of the molecules due to their change of position in reference to the centers of attraction; and $S$, the work of the external pressure. The two former are often combined in discussions under the head of *internal work*, while the latter is called *external work*, and the expression of equivalence then assumes the form $E.Q=U+S$; $U$ designating the *internal* and $S$ the *external* work, their sum being equivalent to the change of heat $Q$ expressed in foot-pounds, or multiplied by $E$.

The principle of equivalence of heat and work is sometimes called the "first law of thermodynamics." Another law, called by some authors the "second law of thermodynamics," by others the "principle of Carnot," and by others, again, the principle of the "equivalence of transformations," depends upon the relation which exists between the quantity of work which a body can perform when undergoing an indefinitely small change of heat and the temperature of the body at the time of the change. The principle, as enunciated by Clausius, is that the capacity of a body for producing changes or performing such indefinitely small amount of work is proportional to the absolute temperature of the body, the *absolute temperature* being the temperature measured from a zero-point, at which any thermometer would stand if a substance to which it was applied were to be deprived of heat. This is a theoretical limit downward of all thermometers; and although it can not be realized in nature, yet its position on any scale may be determined. For Fahrenheit's scale it is at 459·4° below the ordinary zero, and for the centigrade scale 273°

below. It follows from the principle above enunciated that if an indefinitely small quantity of work, represented by a change in the pressure, volume, and temperature of a body, be represented by $dz$, expressed in thermal units, then $dQ$, or the corresponding change in the heat of the body, will be represented by $dQ = Tdz$; $T$ being the absolute temperature. From this we get $\frac{dQ}{T} = dz$, $\frac{dQ}{T}$ being the transformation value of the work $dz$ at the temperature $T$. When a body passes through a series of changes in regard to heat, and finally returns to its original state, the process is called a cycle, and if the operations are all reversible—that is, if the body undergoes expansions and contractions which with the pressures involved are reversible—the total work performed, both internal and external, will be zero, and we shall have $\int \frac{dQ}{T} = 0$. The expressions $f(t, v, p) = 0$, $EQ = W + R + S$, or $EdQ = dW + dR + dS$, and $\int \frac{dQ}{T} = 0$, are three expressions on which the mathematical theory of heat is based, and these, when developed and combined for all changes of a body, constitute the science of thermodynamics.

It will be impracticable in this very general account to do more than refer to some of the problems relating to the expansive action of heat in fluids as illustrations of such applications. The relations between the temperature, pressure, and volume of unit of weight of any particular substance being given, the principles of thermodynamics serve to *compute* the quantity of heat which will be absorbed or rejected by unit of weight of that substance under given circumstances—the computation, for instance, of the *real and apparent specific heat*, the *heating and cooling of gases and vapors by compression and expansion*, the *free expansion of gases*, the *flow of gases and vapors*, the *latent and total heat of evaporation*, the *latent heat of fusion*, and the *efficiency of heat-engines*. Most of these subjects have been treated also by experimental methods. It is by experiment alone that the relations between the pressure, volume, and temperature are first determined. The specific heats of substances, or the numbers which are found in tables of specific heats, represent the quantity of heat required to change the temperature of 1 lb. of the substance one degree of the thermometer under certain standard conditions as to pressure, volume, and temperature. The specific heat of water at the temperature of its maximum density, 39·1° F., is the *unit of heat*, represented in work by 772 foot-pounds. It will readily be observed that since the quantity of heat required to raise the temperature of 1 lb. of a substance one degree involves not only an increase of temperature, but a certain quantity of work if the body be allowed to expand, the specific heats will depend on the amount of expansion. The specific heats of solids and liquids, found in the ordinary tables of specific heats, are generally average values of the apparent specific heats, the true values increasing generally with the temperature.

It is difficult, if not quite impracticable in most cases, to determine the real specific heats of solids and liquids at constant volume experimentally, owing to the impossibility of retaining substances in these states at constant volume, except under very great pressures. For gases the specific heats are usually restricted to two particular cases—(1) those in which the volume is retained constant during a change of temperature, and (2) those in which the pressure maintained is constant. It is difficult also, in the case of gases and vapors, to determine the specific heat at constant volume, on account of the dissipation of heat through the sides of the vessel containing the substance. The specific heats at constant pressure are therefore determined experimentally, and the specific heat at constant volume computed. For a perfect gas the specific heat at constant pressure may be shown to be equal to the specific heat at constant volume, added to the thermal equivalent of the work performed by the gas in expanding, at constant pressure, an amount corresponding to one degree of temperature.

Numerous problems arise in physical and mechanical investigations in which the intermediate changes between the initial and final states are not the object of examination, but the initial and final states alone, and the total quantities of heat involved in the changes.

The specific heats of substances have been referred to as the quantities of heat in thermal units required to cause a change of temperature in one unit of weight of the substance one degree. To find the quantity of heat corresponding to any given change of temperature in a given quantity of any substance requires, then, three factors—the *number of pounds*, the *change of temperature in degrees*, and the *specific heat*; this last factor for water (at 39·1°, or maximum density) being unity, and for other substances the specific heats may be found from the tables. A quantity of heat represented by $Q$—that is, a change of heat equivalent to $Q$ expressed in heat-units—may be expressed by symbols thus: $Q = W \times c \times t$, $W$ being the weight of the body, $c$ the specific heat, $t$ the number of degrees of change of temperature. It is evident that if three of the above quantities are the known quantities in any problem, the fourth can be determined. This is a very simple but a very useful formula, which serves to solve a large class of problems which occur in every-day life, and requires only ordinary arithmetical or algebraic knowledge for its application. For instance, suppose we have a cubic foot of water, about 7½ gal., at the temperature 60° F., in a wooden vessel, and we wish to heat the water to the boiling-point by putting in heated stones; required the number of pounds of stones heated just to redness that will produce this effect. The water being at 60°, and being heated to 212°, the change of temperature of the water will be 152°, and the quantity of heat to be taken up by the water will be $Q = 62{\cdot}4$ lb. $\times 1 \times 152 = 9{,}484{\cdot}8$ units of heat. Suppose $W$ to be the weight of stones required; the specific heat of stones is about ·22, and at a red heat the temperature of the stones may be estimated at 1,000° F. The quantity of heat lost by the stones when immersed in the water, if both are brought to 212°, will be $Q = W \times, 22 \times (1{,}000° - 212°) = W173{\cdot}36$; and since this quantity of heat must be equal to that gained by the water, we have $W \times 173{\cdot}36 = 9{,}484{\cdot}8$.

$$W = \frac{9{,}484{\cdot}8}{173{\cdot}36} = 60{\cdot}5 \text{ lb.}$$

Similar applications might be made for liquids mixed with liquids, for the quantity of heat abstracted from gases by contact with solids, and for any change of heat of a substance when the weight, specific heat, and change of temperature are known.

*Coefficient of Expansion.*—The rate of expansion of a body is the increase of volume which takes place for equal increments of temperature, the volumes being referred in each case to the volume of the same body at a standard temperature. When a body exists in the form of a rod or bar, the length of which is to be determined under different degrees of heat, the increase of length is called the linear expansion. Very complete tables giving coefficients of expansion may be found in Landolt and Börnstein's *Physikalisch-chemische Tabellen* (ed. of 1893), and in many of the larger treatises on physics.

The following are the linear coefficients of some substances:

LINEAR COEFFICIENTS OF EXPANSION (MEAN COEFFICIENTS BETWEEN 0° AND 100° C., UNLESS OTHERWISE INDICATED).

| | | | |
|---|---|---|---|
| Aluminium (40°) | 0·00002313 | Rhodium (40°) | 0·00000858 |
| Bismuth | 1316 | Selenium | 6604 |
| Cadmium | 3159 | Silver (40°) | 1921 |
| Copper | 1718 | Sulphur | 0·00011800 |
| Cobalt (40°) | 1236 | Tellurium | 0·00003687 |
| Carbon (diamond) (40°) | 0118 | Thallium (40°) | 3021 |
| " (graphite) (40°) | 0786 | Tin (40°) | 2234 |
| " (anthracite) (40°) | 2078 | | |
| Gold | 1470 | Brass (71 Cu. + 29 Zn.) | 0·00001906 |
| Iron | 1182 | German silver | 1836 |
| Iridium (40°) | 4170 | Glass (white tubes) | 0883 |
| Magnesium (40°) | 2694 | Vulcanite (9°) | 6360 |
| Mercury (cubic) | 0·00018092 | Pine (lengthwise) (17°) | 0355 |
| Nickel (40°) | 0·00001279 | " (crosswise) (17°) | 5840 |
| Osmium (40°) | 0657 | Oak (lengthwise) (17°) | 0492 |
| Palladium (40°) | 1176 | " (crosswise) (17°) | 5440 |
| Phosphorus | 1104 | Ice (−10°) | 0·00011250 |
| " (50°) (liquid; cubic) | 0·00052000 | Calcite (55°) | 0·00005734 |
| Platinum | 0·00000884 | Quartz | 3530 |
| | | Paraffin (15°) | 0·00031985 |

*Liquefaction, Melting, or Fusion.*—The continuous transfer of heat to a solid, causing a continuous rise of temperature and an expansion of volume, produces ultimately a change of aggregation or change of state to the liquid form, called the fusion, melting, or liquefaction of the substance. This law is general for substances which do not change their composition in changing their state. For substances which do not change their composition the following phenomena occur: (1) "Each substance begins to melt at a certain temperature, which is constant for the same sub-

stance if the pressure be constant." (2) "The temperature of the solid remains at this constant point from the time when fusion commences till it is complete." (3) "If a substance expands in congelation, its melting-point is lowered by pressure; but if the substance contracts in congealing, its melting-point (or point of congelation) is raised by pressure." The laws which have been enunciated are subject to certain qualifications, such as slow process of cooling and variations of external pressure, which may lower the temperature of solidification, but under the same conditions they are invariable. The continuous application of heat to a solid at its melting-point does not raise its temperature as long as any portion remains solid; and, commonly, the abstraction of heat from a liquid at its point of solidification does not lower its temperature as long as any portion remains liquid. The change of state is also usually accompanied by a sudden change of volume. Some substances, however, pass from the solid to the liquid state without showing a definite melting-point, becoming plastic between these states. Glass and iron are examples, and instead of a definite melting-point a certain interval of temperature is required for the change.

*Latent Heat of Fusion.*—The increase of the specific heat of a solid as it approaches its melting-point appears to be connected with the increase of the coefficient of expansion, which also increases simultaneously. At the melting-point the whole of the heat applied to a body is apparently required to overcome those molecular attractions which keep the molecules in the state of proximity belonging to the solid condition. The *work* of the heat applied is thus absorbed or expended without producing increased molecular vibrations. Heat which would have become sensible heat in the pure solid or liquid disappears or is transformed into the work of overcoming these molecular attractions, and is said to become *latent*. The latent heats of fusion of a few substances, estimated in units of heat, have been determined experimentally.

The total change of volume from the lowest to the highest temperature consistent with the solid or liquid condition of any substance is very small compared with the actual volume of the body which undergoes such a change, and hence the influence of the external pressure upon the bounding surfaces is very slight during the change. In other words, the work performed by heat in expanding liquids and solids may be regarded as chiefly expended in producing change of temperature and change of aggregation, the external work in all ordinary cases, especially when the solid or liquid is exposed only to atmospheric pressure, being so small that it may be disregarded. In the case of bodies in the gaseous condition, however, this is different. Gaseous bodies can not exist in a fixed or determinate volume ordinarily, unless they are inclosed within bounding surfaces or envelopes. The force of cohesion among the particles of a gas no longer exists as in the solid and liquid states, and the heat condition of a perfect gas consists simply in the oscillation of the molecules (which is represented by the actual *temperature* of the gas), and the outward pressure or repellent action of these molecules, which must be resisted by the envelope. For a definite volume of a perfect gas thus confined there are thus but two conditions involved in changes of heat—the temperature and the pressure which it exerts against the bounding surfaces of the envelope. If such an envelope is perfectly elastic, and heat be transferred to the gas (the external pressure, such as the pressure of the atmosphere, remaining constant), the effect will be an expansion of volume. This expansion will be much greater than the expansion of liquids and solids for the same increase of heat.

The coefficient of expansion or increase of *volume* of the permanent gases in such circumstances, for an increase of temperature of one degree F., has been determined, through the well-known experiments of Regnault and others, to be 0·002035, or $\frac{1}{491{\cdot}4}$ of the volume of the gas at 32° F., and for one degree centigrade, 0·00366, or $\frac{1}{273}$ of the volume of the gas at 0° C. Thus one volume of a perfect gas at 0° C. or 32° F. will become $1 + 0{\cdot}00366$, or $1 + \frac{1}{273}$ volume at 1° C., or $1 + 0{\cdot}002035$, or $1 + \frac{1}{491.4}$ volume at 32° + 1° F. A slight difference in the coefficients was found by Regnault for the different gases, and also a slight difference at different external pressures, but for purposes of ordinary calculation the coefficients of all *permanent gases* may be regarded as the same.

We may conceive, however, that when heat is transferred to a gas inclosed within an envelope (for instance, within a cylinder which is closed at one end by a movable piston), the *volume* and the *external pressure* may change simultaneously, and thus the three quantities which determine the condition of the gas—viz., the volume, $v$, the pressure, $p$, and the temperature, $t$—may all be variable quantities. The relation between these quantities has been found, and is represented by what is well known as the law of Mariotte and Gay-Lussac. The following simple equation is the mathematical enunciation of this law: $PV = R(a + t)$ or $PV = RT$; $R$ representing a constant for any particular gas, and $T$ the absolute temperature; in which $P$ is the external pressure upon unit of surface, $V$ the volume of unit of weight, $R$ a constant which depends on the specific gravity or density of the gas (the weight of this unit of volume), $T$ the temperature, and $A$ the number 273, centigrade degrees being employed, and 459·4 if Fahrenheit degrees be employed. The quantity $P$, defined as the external pressure upon a unit of surface, is evidently also the outward pressure or elastic force of the gas.

It is well known, from common observation, that many liquids, such as water, alcohol, and ether, if not confined in close vessels, become transformed into a condition resembling the gaseous condition at ordinary temperatures, and disappear *as liquids*, being diffused in the atmosphere as vapors. This transformation takes place in nearly all liquids more or less rapidly at ordinary temperatures, though for some no such transformation takes place at very low temperatures. It is considered probable, however, that this quiet change takes place in all liquids above certain fixed temperatures. Many solids, also—e. g. ice and camphor—pass to the state of vapor without passing through the intermediate liquid state, under certain conditions. If a *closed* vessel be partly filled with a liquid, the space above the liquid will thus ordinarily become filled with the vapor of the liquid, and the *elastic force* of the vapor will depend on the nature or *kind* of liquid, the *volume* of the inclosed space, and the *temperature*. If heat be applied to the liquid in this condition, the formation of vapor will continue, the vapor exerting a certain additional elastic force depending on the *temperature alone*, as long as there remains any liquid. Evaporation will cease when the application of heat is suspended, and, if the liquid be cooled, *condensation* will occur; so that the relative quantities of liquid and vapor, and the elastic force of the latter in a given space and for a given liquid, are dependent on the condition of heat or *temperature* solely. Similar phenomena will follow if the extent of the inclosed space be enlarged or contracted, the *temperature remaining the same*. If the space be enlarged, an additional quantity of the liquid will pass into the state of vapor; and if the space be contracted, a certain amount of the vapor will be reconverted into liquid. For every liquid in an inclosed space there is thus a certain tension or elastic force depending on the temperature (whatever be the relative volumes of the liquid and the free space above it) which is the greatest elastic force that the vapor can have at each particular temperature. If the vapor be compressed, liquid is formed by condensation, and if the space be enlarged, or the external pressure which confines the vapor be diminished, additional vapor will be formed, and the elastic force will remain thus constant for each constant temperature. A vapor in this condition in presence of its liquid is said to be *saturated*.

This law of vapors—viz., that the elastic force in a given volume depends solely on the temperature—is approximately true whether the space in which the vapor is formed be vacuous, or whether it contain air or any other permanent gas, provided that the liquid exerts no solvent or chemical action on the gas. The combined elastic forces, or the resultant pressure on the sides of the vessel, when a permanent gas is present which is not acted upon by the liquid, is nearly the sum of the elastic force of the gas and the maximum tension of the vapor at the given temperature. It was found by Regnault, in experiments on this subject, that liquids do not give off vapor of quite so great a tension in a space occupied by a permanent gas as they do in a vacuum, and that the difference increases as the temperature rises; but for technical applications under ordinary temperatures the law may be considered true. The only difference between evaporation in a vacuum and in a space occupied by a gas is that the formation of vapor

takes place more slowly if a gas be present—a fact of great importance in the economy of nature connected with the evaporation of water from the surface of the earth.

When heat is continuously applied to a liquid in a closed vessel, the space inclosed remaining constant, the temperature of the liquid and vapor will continually increase if there be no dissipation of heat through the sides of the vessel: the quantity of the liquid will diminish and the pressure will increase, the vapor remaining saturated as long as any liquid remains. After the last element of liquid shall have passed to the state of vapor, if heat be still applied, the vapor begins to assume the properties of the permanent gases. Under this condition, if the temperature could be indefinitely raised, or the volume of the space indefinitely increased, under a constant temperature, the vapor would finally arrive at a state corresponding to that of perfect gas, and would then follow strictly the laws of Mariotte and Gay-Lussac; and hence it may be said that the physical properties of vapors, when sufficiently expanded or at sufficiently high temperatures, and when they are not in contact with their liquids, are identical with those of perfect gases.

*Complete Vaporization.*—The temperature at which the complete evaporization of a liquid in a given space will occur depends on the relative volumes of the liquid and the space above it. With alcohol, the empty space being about equal to that occupied by the liquid, complete vaporization takes place at about 400° F. In the case of water, if the space occupied by the water be about one-fourth of the whole internal volume of the vessel, the liquid will be wholly converted into vapor, if the vessel be strong enough to resist the pressure, at about 680° F. (*Cagniard de la Tour.*) The elastic force of the vapors of *mixed liquids*, as determined by Regnault, is the sum of the tensions of the two vapors taken separately if the liquids have no solvent action on each other. With water and ether the tension of the vapor of the mixture is less than that of the sum of the tensions of the two liquids taken separately, being hardly equal to that of ether alone. When two liquids dissolve each other in all proportions—e. g. water and alcohol—the resultant tension is intermediate between the tensions of the separate liquids.

*Boiling-points.*—The *boiling-point* of a liquid is an expression which usually refers to a fixed or standard pressure upon the exterior surface, the pressure of the atmosphere, and it indicates the temperature at which the elastic force of the vapor is equal to such standard pressure. *Ebullition* is a phenomenon which takes place when heat is applied to the lower part of the mass of a liquid which has been heated to the boiling-point, and arises from the formation of bubbles of vapor at the point at which the heat is applied, the bubbles rising through the liquid and escaping at the free surface. The formation of such bubbles may occur before the whole mass of the liquid has been heated to the boiling-point, but in this case the bubbles are usually condensed before they reach the surface.

"*Boiling-point due to the pressure*" is an expression sometimes employed to designate the *temperature* corresponding to the pressure, whether that temperature be above or below the standard temperature for which the boiling-points of the tables are determined. The boiling-point of a liquid under any pressure is, properly speaking, the lowest temperature at which ebullition *can* occur, since there may be circumstances under which ebullition, or the formation of vapor, does not take place until the liquid has been heated many degrees above its tabulated boiling-point. If the free surface of a liquid be covered or surrounded by another which has a higher boiling-point, the bubbles of vapor of the interior liquid having no escape, this liquid may attain a temperature higher than its ordinary boiling-point. The boiling-points of liquids are also influenced by the nature of the vessel. Water has generally a higher boiling-point by several degrees, under atmospheric pressure, in glass vessels than in iron vessels. Liquids holding solid bodies in solution generally boil at higher temperatures than when the liquid is pure.

*Nebulous* or *vesicular* vapor is that which arises from the condensation of particles of a vapor in the atmosphere or in its own vapor, constituting cloud or mist. If heat be applied to vesicular vapor, the condensed globules evaporate and the vapor becomes transparent, though still saturated. If heat be abstracted, new particles are condensed; the globules coalesce and fall in drops.

*Superheated Vapor.*—When a vapor at the point of saturation is removed from contact with its liquid and heated, it is said to be *superheated*. A saturated vapor not in contact with its liquid may become superheated by the enlargement of the space which contains it, for it will then admit of compression without condensation, and will have a pressure, at the same temperature, inferior to that of saturated vapor, and also a temperature more elevated than that due to saturation for the same pressure.

*Spheroidal State.*—It is a matter of common observation that when water is sprinkled upon the horizontal flat surface of a hot stove the drops are not immediately converted into steam, but roll about on the heated surface, and gradually evaporate, retaining all the time the spherical or spheroidal (flattened sphere) form. This condition is not peculiar to water, but may be experimentally demonstrated with all volatile liquids, and is usually described as the *spheroidal state*. It arises from the fact that the rapid formation of vapor makes a layer or bed of vapor on which the drop rests, and which prevents actual contact between the drop and the surface. The phenomenon may occur also whether the heated surface be liquid or metallic, the condition being that the surface shall be heated to a point considerably above the boiling-point of the liquid drop. Experiments by Boutigny showed that the *lowest* temperature at which a metallic vessel will cause the spheroidal state is 289° F. for water, 273° F. for alcohol, and 141° F. for ether. The spheroidal condition, sometimes called "Leidenfrost's phenomenon," illustrates an important fact in regard to the transfer of heat which will be treated of subsequently. It shows that for the rapid transfer of heat to a liquid there must be actual liquid contact with the heated surface—the interposition of a thin film of gas acting as an obstruction to the passage of heat.

*Humid Vapor.*—The vapor of water which is usually employed in industrial operations usually contains particles of water mechanically suspended in the vapor. The steam is then not only saturated, but *wet*. When in the simple condition of saturated vapor it is called *dry steam*. *Steam-gas* is a term employed by some writers to superheated steam, or steam in the condition of a perfect gas.

*Expansion of Dry Saturated Steam.*—If dry saturated steam be inclosed in a vessel, and the volume be enlarged by extending the space in such a manner that the elastic force of the steam performs no *work*, the steam will become superheated—i. e. its temperature will be, at the end of the expansion, higher than that due to the boiling-point corresponding to the pressure, and it will remain transparent. If, however, the expansion takes place against a pressure, so that there is work performed by the elastic force, condensation of a portion of the steam will take place, and the mass of steam will present a cloudy appearance. This fact was first determined theoretically by Rankine and by Clausius, and experimentally by Hirn. It is supposed that no heat is communicated to, or abstracted from, the vapor during the expansion. This condensation does not take place in steam sufficiently *superheated*. From the experiments of Fairbairn and Tate on superheated vapors it appears that for an interval of about 18° F. above the temperature due to the pressure the coefficient of expansion of a superheated vapor is greater than that of perfect gases, but above this temperature the relation between the volume and pressure follows closely the law of Mariotte and Gay-Lussac.

The elastic force of saturated vapors may be illustrated experimentally by taking several barometer-tubes, filling them with mercury, and inverting them in a trough of mercury. The surface of the mercury in each tube will drop about 6 inches, leaving a vacuous space at the top of the tube. If now a small quantity of liquid water be passed up into this vacuous space in one tube, alcohol into another, and ether into another, the quantity of liquid being more than can be evaporated in each space at ordinary temperatures, it will be found that a portion of each liquid will be instantly evaporated, and the mercurial column will be depressed in each tube, but by different amounts. If each tube be now heated by surrounding it with warm water, the elastic force of each vapor will be increased, the mercury will descend in the tubes, and will finally press the mercurial column down to the level of the reservoir. At this point it is evident that the elastic force of each vapor is equal to that of the atmosphere, or *1 atmosphere*. But the temperature of the liquid and vapor in each tube will be different from that in the others. The temperature of the watery vapor will be found to be 212° F., the temperature of the alcohol 173°, and the temperature of the ether 95°.

These are the temperatures at which the elastic forces of these vapors are equal, respectively, to 1 atmosphere. At these temperatures the liquids will *boil* under the atmospheric pressure. If the temperatures be reduced below these points, the pressure remaining the same, a portion of the vapor in each tube will be liquefied; and, the temperatures remaining the same, if the pressure be increased above 1 atmosphere, a portion of each vapor will become liquefied. The tension or elastic force of 1 atmosphere is thus the *maximum tension* which the saturated vapors can bear at the temperatures given above. If the three tubes and the basin of mercury were inclosed in a chamber in which, by compression of the air, different pressures could be obtained higher than 1 atmosphere, it would be found that, for each of the substances named, the temperatures at which the mercury would be forced down to the level of the reservoir under each additional atmosphere of pressure would be increased. The elastic force of saturated vapors is thus *independent of the volume and proportion of liquid mixed with the vapor, and depends only on the temperature.*

It has been found impossible to determine, *theoretically*, the relation which the temperatures bear to the pressures, and reliance is placed mainly on the celebrated experiments of Regnault. These tables show that no *simple* relation exists between the maximum tension and the temperature. Different empirical formulas have been proposed, however, to express this relation with certain degrees of approximation.

The effects which follow the transferring of heat to a body, solid, liquid, or gaseous, have been described by employing the simple algebraic expression, $QE = W + R + S$. The quantity $W$ represents a change which is exhibited by a change of sensible heat or change of *temperature*. That part of the whole heat transferred which produces the work $R$ and the work $S$ is expended in producing a change in the relative positions of the particles and in *external* work; and disappears as *sensible heat*—i. e. it is not afterward contained in the body or exhibited in the body as heat. These two quantities of heat, $R$ and $S$, become *latent*. The term *latent heat* is a technical expression, designating a quantity of heat which has apparently disappeared, but which really has been employed in producing changes in the body, in the form of work, other than the change of velocity of molecular motion or change of *temperature*. By reversing the process by which heat is thus made to disappear, this latent heat may be reproduced.

The total heat necessary to transform 1 lb. of water from the liquid condition at the melting-point of ice to the condition of saturated vapor or steam at the temperature $t$ is called the *total heat of vaporization*, and represents the sum of the heat which is required to heat the water from the temperature 32° to the temperature $t$, and the heat which disappears as latent heat. By algebraic symbols this sum is evidently expressed as follows: $Q = c\,(t-32°) + L = q + L$; $c$ being the mean specific heat of water between the limits of temperature, and $L$ the latent heat of vaporization at the higher temperature.

The results of Regnault's experiments, already referred to, led him to the discovery that *the total heat of the vapor of water from the temperature of melting ice increases at a uniform rate as the temperature rises.* Regnault's formula by which this law is expressed is as follows: $Q = 606{\cdot}5 + 0{\cdot}305\,t$, $Q$ being the total heat in calories, and $t$ being expressed in centigrade degrees. The equivalent English formula is $Q = 1{,}091{\cdot}7 + 0{\cdot}305\,(t-32°)$. The expression for the total heat of vaporization is $Q = q + L$, from which we have $L = Q - q$; that is, the latent heat of vaporization is equal to the total heat, diminished by the quantity of heat necessary to raise the temperature of the liquid from the melting-point of ice to the final temperature of evaporation.

*Density of Gases and Vapors.*—The term density refers to the degree of approximation of the particles of a body to each other. It is specific when it refers to the number of particles or quantity of matter in a unit of volume of a given substance, this unit being a standard for all bodies. In English measures, 1 cubic foot is the standard unit of volume, and the weight of a cubic foot of a substance in any condition is the *specific weight* of that substance in that condition. It is usual to express specific weights in terms of the weight of a unit of volume of a standard substance, the latter weight being taken as unity. Water is the general standard for specific weights, but for gases and vapors air is also taken as a standard, the weight of 1 cubic foot of air being unity. The following table shows the relative densities at 32° F. and 1 atmosphere pressure of some of the gases commonly met with:

*Relative Densities.*

| | | | |
|---|---|---|---|
| Air | 1·00000 | Water | 1·0000000 |
| Nitrogen | 0·97137 | Air | 0·0012932 |
| Hydrogen | 0·06926 | Nitrogen | 0·0012562 |
| Oxygen | 1·10563 | Hydrogen | 0·0000896 |
| Carbonic acid | 1·52901 | Oxygen | 0·0014298 |
| | | Carbonic acid | 0·0019774 |

The following are the *weights* of 1 cubic foot of each of the same substances in pounds avoirdupois under the same conditions—viz., at 32° F. and 1 atmosphere pressure—except for water, which is taken at 39·1° F.:

*Weight in Pounds Avoirdupois of 1 Cubic Foot.*

| | |
|---|---|
| Water | 62·425 |
| Air | 0·08073 |
| Nitrogen | 0·07860 |
| Hydrogen | 0·00559 |
| Oxygen | 0·08926 |
| Carbonic acid | 0·12344 |
| Steam | 0·502 |

The density of a perfect gas at any other pressure and temperature may be found from the law of Mariotte and Gay-Lussac, $PV = RT$, by substituting for $V$ the volume of 1 lb., $\frac{1}{D}$, and for $R$ its value for the gas under consideration. Fahrenheit's scale being used for $T$, the values of $R$ are:

| | |
|---|---|
| Air | $R = 53{\cdot}35$ |
| Nitrogen | $R = 54{\cdot}93$ |
| Oxygen | $R = 48{\cdot}26$ |
| Superheated steam | $R = 85{\cdot}77$ |

The *specific volume* of a gas is the volume of unit of weight. In English measures *1 lb. avoirdupois* is the unit of weight, and to obtain the specific volume we have $V = \frac{1}{D}$, the reciprocal of the *specific weight*. *Specific volumes*, or *volumes of 1 lb. of each* of the *substances named, are given below* in cubic feet, for 32° F. and 1 atmosphere:

| | |
|---|---|
| Air | 12·3870 |
| Nitrogen | 12·7226 |
| Hydrogen | 178·8909 |
| Oxygen | 11·2032 |
| Carbonic acid | 8·1011 |
| Steam, at 212° | 26·4216 |
| Steam theoretically, at 32° | 19·9203 |

Chemical action, when accompanied by the development of light and heat, is usually called *combustion*. *Inflammation* denotes that kind of combustion in which the products are gaseous and flame is produced. *Ignition* is simply the incandescence of a body unattended by chemical change. The phenomena of heat being those of rapid molecular motions, the heat and light developed by combustion must indicate an increased molecular movement in the particles of bodies, when combustion takes place, proportional to the amount or force of the chemical attractions. The heat of combustion may therefore be rationally explained by saying that intense and violent increase of motion in the particles of the compound is produced by the chemical attractions. Ordinary combustion consists in the combination of oxygen with various substances, the temperature required being different for different substances, and varying for the same substance with the rapidity of the combustion. Phosphorus combines slowly with oxygen at 77° F.; charcoal burns *slowly*, but does not ignite below a red heat; sulphur burns in air at 550°. But most elementary substances require to be heated to redness before combustion in oxygen or the air takes place. According to Peclet, solids emit light or become dull red at about 950° F. Kennelly and Fessenden, as the results of observations upon a copper wire placed within the bulb of an air-thermometer and brought to incandescence by the action of the electric current, found visible radiation to begin at 493° C., the range of difference for various observers not exceeding three degrees (*Physical Review*, vol. i.). Most substances burn with great rapidity when in a finely divided state. Fine dust of many substances burns in this manner with a rapidity which in a closed space may give rise to such a degree of pressure from the expansion of the gases as to produce phenomena like

explosions. A single spark may thus produce instantaneous combustion in a space filled with fine dust.

Porous substances often absorb and condense air within their pores; oxidation begins, accompanied by an elevation of temperature, which accelerates the oxidation until the process produces spontaneous combustion. Charcoal-powder, masses of tow, cotton, or rags, saturated with oil, sawdust mixed with oil, moist hay, and other substances in similar conditions, have thus been known to burst into flame. Wood does not take fire in oxygen gas, according to Thénard, at temperatures below about 600° F., but if it be long exposed to a high temperature in air, it may become partially charred, and rendered so inflammable as to favor the conditions of spontaneous combustion. Under such conditions a single spark or accidental exposure of the substance to a higher degree of heat may cause it to take fire.

*Ordinary combustion* is accompanied usually by *incandescence* and flame. If a solid burns without flame, the heat evolved at the surface of contact of the air and the solid causes an elevation of temperature of the residual solid particles, which gives rise to a *glow* or *incandescence*, the color and intensity of the light being dependent on the temperature. Dull red indicates the lowest temperature at which light appears, and dazzling white the highest degrees of heat; between these extremes the light passes from dull red or cherry red to bright red, dull white, then to yellowish, and finally to a full or dazzling white. If the combustible is gaseous, the combination with oxygen may be instantaneous, producing an explosion by the violent concussion of the air; or it may be gradual. In order that the phenomenon of explosion may take place, the combustible gas must be mixed uniformly with air or oxygen in the proper proportions, and then heated to the burning-point. A similar effect takes place when a solid combustible, such as sulphur or charcoal, is mixed with a *nitrate* or other solid which gives up its oxygen readily. In both cases it is only necessary that the temperature be raised to ignition at one point by friction, percussion, or the contact of a hot body, the action being then propagated instantaneously throughout the whole mass. When the combustion is gradual, the contact of the combustible gas with oxygen or the air takes place usually at the bounding surface of the gas; as, for instance, when a jet of gas issues from an orifice or when a column of gas rises from the wick of a candle. The inner mass of the combustible gas does not ignite at first, and the ignited surface assumes the form of a hollow cylinder or cone. The brightness and color of such a flame depend not only on the degree of temperature, but upon the presence of solid incandescent particles in the flame. These solid particles arise sometimes from the compound produced by the combination, but in ordinary forms of combustion of fuel they are particles of carbon. Hydrogen gas, carbonic oxide, alcohol, and sometimes coal-gas, burn thus with a dull flame. A bright flame is produced by compounds which contain carbon, from which a portion of the carbon becomes separated by the heat produced, the separated particles being first heated to incandescence, and afterward burned by contact with the air. If the quantity of air supplied be not sufficient, these solid particles may become cooled and form soot. The visible part of smoke is this soot cooled below red heat. Marsh-gas, olefiant gas, ether, volatile oils, resins, fats, etc., when burned, give off carbon in this manner, and may form bright flames, or produce, if the separated particles are not all burned, soot or smoke. *A purely gaseous substance does not become luminous at any degree of temperature, however high, luminosity being caused by particles of incandescent solids in the gas.*

The combustible ingredients of ordinary fuel, and of the liquids and gases usually employed for the generation of heat, are *carbon* and *hydrogen*. These substances combine readily with oxygen, the former producing by the combination carbonic acid or carbonic oxide, and the latter water. The oxygen required is usually supplied by the atmosphere, which contains about one-fifth of its weight of this substance.

As a general rule, all chemical *combinations* produce heat, while chemical *decompositions* cause a disappearance of heat. In the combination of two simple isolated elements heat is evolved only, but where the combination is effected through the simultaneous decomposition of compound substances, the heat evolved is the resultant of that which is produced by the combination of the combustible elements and that which *disappears* through the decompositions. In compounds containing oxygen and hydrogen in the proper proportions to form water, the surplus hydrogen only contributes to the development of heat when combustion takes place.

An important consequence of the dynamic law of heat, and one which has been experimentally verified, is that all chemical changes are accompanied by corresponding changes of heat. *Chemical action and heat are mutually convertible*; and although the quantity of *heat* evolved or annihilated in any chemical change can only be experimentally determined, yet it has been established that the *combination of any two bodies, chemically, is attended by the evolution of a quantity of heat equal to that which disappears in their separation.* The quantities of heat evolved or disengaged in chemical combinations are found experimentally by means of *calorimeters.* These measures of heat are employed in various forms, and operate generally in such a manner as to exhibit the effects of the heat evolved in acting on a given substance, such as the melting of ice or the raising of the temperature of a given quantity of water, the quantities of heat being thus indirectly measured by being transferred to some body in which these effects can be estimated in units of heat. In this manner the heat evolved in the combination of both simple and compound bodies has been determined by many observers, especial authority being given to those of Favre and Silberman. In the chemical changes which compound bodies undergo it may be stated as a general law that the heat which appears or disappears is the resultant of the action of the simple elements; and where a compound consists of *combustible* elements only, like *carbon* and hydrogen, *the heat disengaged is the sum of the quantities of heat disengaged by the combustion of the elements separately.* This law, though not indisputably established, is considered sufficiently exact for all ordinary purposes. The *temperature* at which bodies combine, although affecting the rapidity or energy of chemical action, does not affect the *total* quantities of heat involved in the change.

*The transfer of heat* from a heated body to one that is at a lower temperature consists, according to the dynamic theory of heat, in the loss of living force, due to heat-motion, in the hotter body, and an equivalent gain of living force in the colder body. When the two bodies are quite distinct, or separated, and do not form part of one and the same body, this transfer takes place generally, as has been stated, through the intervening ethereal medium by the process of radiation. Through this medium there is a tendency to equilibrium of temperature or of living force, the relative exchange of heat being inversely proportional to the masses of the bodies. It is probable that the transfer of heat between two bodies is always thus accomplished by *radiation*, although, technically, a distinction is made between the transfer at appreciable distances, or *radiation*, and the transfer by actual *contact* of the two bodies. Heat may be transferred practically also by the actual change of position of the body in which it exists. In this mode of transfer, which is called *convection* or carrying, the transfer is a mechanical one, and is not in any way connected with the change of heat in the body carried. Although this mode of transferring heat is of great importance in the arts, and especially in connection with the generation of steam, involving as it does the question of circulation of heated fluids, yet after the convection of heat by the transfer of the body in which it exists, whether that body be solid, liquid, or gaseous, there still must take place the transfer from the heated body to another, by the process of radiation or contact, before the heat can be utilized *as heat*. Thus a heated gas or liquid may be carried through pipes, or may be mingled mechanically with other gases or liquids for the purpose of conveying heat, but the final process by which that heat is actually transferred from the heated gas or liquid to another body, *as heat*, must depend on the dynamic laws of heat. In adopting, therefore, the usual designations of the modes by which heat is transferred—viz., radiation, contact, convection—it is to be understood that the latter is a mechanical mode, and need be discussed only in connection with the carrying of bodies to the places or points at which it is desirable or necessary for them to impart their heat to other bodies.

The experiments of Melloni are usually quoted as giving the first direct proofs that radiant heat like light consists in vibrations of the ethereal medium. It is now a matter of almost universal popular knowledge that the white light of the sun is composed of rays of various colors, which may be produced at will by means of a prism. The rays are deviated in the well-known order from red to violet, the number of vibrations for the red rays being 481 billions per second, and

for the violet 764 billions. The greatest intensity of light, according to Fraunhofer, is in the yellow, and the least in the violet. This spectrum is also a *heat spectrum*, the heat spectrum extending over about four times the space occupied by the visible spectrum. In the heat spectrum the maximum of heating effect lies beyond the red, on the obscure part of the spectrum. The greatest calorific effect is thus produced by rays for which the ethereal vibrations present waves of greater length and greater duration than those of the red rays of the light spectrum. The heat-rays beyond the violet, although not visible, are known to influence chemical action, in certain bodies, in a remarkable manner. While the light spectrum is thus only a part of the total spectrum, the invisible rays possess the same general properties as the light rays, and it appears that the ethereal vibrations affect the eye only between certain limits. A heated particle of a substance communicates vibrations to the ethereal medium whether the particle be surrounded by air or whether it be in a vacuum. In ordinary language, the particle sends *rays* of heat in every direction; these rays or waves proceed indefinitely, without change in strength or character, and with the same velocity as light, until they are intercepted by some body in the paths of the rays. If such a particle be a *molecule* on the surface of a body, it is evident that it will send off rays of heat in every direction not intercepted by the body itself.

It is a common error to suppose that the intensity of *a ray* of heat diminishes as the distance between the body emitting and the body receiving the heat increases—i. e. inversely as the square of the distance. The law of the inverse squares of the distance is rather a geometrical than a physical law, and refers to the action of *one* body on *another*, whether the question be one of heat or gravitation. A body or collection of molecules possessing a certain amount of living force, due to heat, imparts this energy to the ethereal medium in all directions, and the quantity of energy *intercepted* by another body will depend on the distance between the two bodies—the quantity thus intercepted by the *same body* at *different distances* being inversely proportional to the squares of the distances.

The inclination of the surface which intercepts radiant heat determines, for similar reasons, the quantity of radiant heat received. Even if the rays be supposed parallel, as in the case of the radiant heat of the sun, it is apparent that all the heat conveyed by a beam of rays may be represented by the section of the beam perpendicular to its direction. If the beam falls upon a surface inclined to its direction, the amount of surface over which the beam will be distributed will be greater as the inclination of the surface is greater. If the surface be plane when it becomes parallel to the axis of the beam it will receive no heat. Hence in estimating the intensity of radiant heat by units of surface, the inclination of the receiving and absorbing surfaces must be considered. The regions of the earth's surface near the poles, from their approach to parallelism with the direction of the sun's beams, receive less heat on each square mile of surface than is received by a square mile at the tropics.

Many attempts have been made to determine the quantity of heat in units of heat emitted by any given surface at a given temperature, supposing the temperature of the absorbing surfaces to remain at constant temperature. Dulong and Petit, whose researches in this and other branches of physics are universally known, made numerous experiments on this subject, which resulted in the determination of certain general laws. The experiments were made to determine the rate of cooling of bodies in an inclosed space, the space being filled with different gases, and the inclosure being maintained at constant temperature. The results were enunciated as follows: (1) "The cooling of a body results from radiation and from contact of the fluid or gas which surrounds it. (2) The rate of cooling, from radiation alone, is the same for all bodies at the same temperature, but its absolute value depends on the nature of the surfaces. It is represented by the following formula, $Q = Cat(a^{t'}-1)$, in which $Q$ represents the number of French units of heat emitted by one unit of surface in a unit of time; $C$, a constant depending on the nature of the surface of the radiant body; $a$, the number 1·0077; $t$, the temperature of the inclosure or absorbent; and $t'$ the *excess of temperature* of the radiating body over the absorbing body in degrees centigrade. (3) "The rate of cooling by *contact* of a fluid surrounding the heated body is also the same for all heated bodies, but its absolute value does not depend on the *nature of the surface*, and depends only on the form of the heated body."

For air under ordinary atmospheric pressure the law of cooling by contact is expressed by the formula $Q = C'.t^{1\cdot233}$, in which $Q$ represents the quantity of heat in calories abstracted from one unit of surface by the air in a unit of time; $C'$ a constant depending on the form of the surface; and $t$ the excess of temperature of the body over that of the air surrounding it.

The *relative* radiating powers of different surfaces at 180° F., as determined by Leslie, are represented approximately in the following table:*

| | | | |
|---|---|---|---|
| Lampblack | 100 | Mica | 80 |
| Paper | 98 | Graphite | 75 |
| Resin | 96 | Tarnished lead | 45 |
| Sealing-wax | 95 | Mercury | 20 |
| Crown-glass | 90 | Polished lead | 19 |
| India-ink | 88 | Polished iron | 15 |
| Ice | 85 | Tin plate | 12 |
| Red lead | 80 | Gold, silver, copper | 12 |

It is stated by Magnus that the greater or lesser density of the surface has no influence on radiation from the surface. Platinum which has been strongly hammered possesses the same emissive power as platinum carefully annealed. But the same surface roughened with emery-paper has its emissive power greatly increased. As far as quantities of heat are concerned, it is doubtful whether anything further than such *relative* determinations can, in the present state of knowledge, be depended on, the actual or absolute quantities for different temperatures being still uncertain. The radiating powers of different bodies or different surfaces represent also their absorptive powers, and, as has been already stated, radiant heat does not affect the eye, or solids do not become luminous, until the temperature reaches about 500° C.

The radiation and absorption of gases, according to Prof. Tyndall, present very peculiar laws, and our knowledge of the action of gaseous bodies on radiant heat is still very slight. It has been demonstrated experimentally by Prof. Tyndall that a ray or beam of heat is wholly or almost wholly transmitted through moderate distances in air, oxygen, hydrogen, and nitrogen; and, conversely, no radiation takes place from the heated particles of these gases. The only mode, therefore, by which heat can be imparted to these gases, or by which they can impart heat to other bodies, is by actual contact. Some other gases possess remarkable powers in absorbing or intercepting *dark* radiant heat. The absorption of radiant heat by vapor of water diffused in air, under circumstances of average humidity, was shown by Prof. Tyndall to be seventy times greater than the absorption by dry air. As the quantity of watery vapor was increased, the amount of heat absorbed was increased.

Conduction of heat refers to the transmission of heat from one part of a continuous and homogeneous body to another part of the same body. When a body is heated at one point, the heat is transmitted with greater or less rapidity throughout the whole mass, depending on the nature of the body and the differences of temperature of the heated part and other parts of the body. If the body is terminated by two parallel surfaces which are each kept at a constant temperature, there will be a flow of heat, so to speak, at a constant rate from the hotter surface to the other by conduction. The *law of conduction* under these circumstances is that the quantity transmitted for a unit of area perpendicular to the direction of transmission, and per unit of time, is directly proportional to the difference of temperatures of the parallel surfaces, and inversely proportional to the thickness or distance which separates the two surfaces. If $t_1$ and $t$ represent the temperatures of the two surfaces, and $e$ the distance separating them, the quantity of heat transmitted will be represented algebraically by the formula $Q = \frac{c(t_1 - t)}{e}$. The coefficient $c$ depends on the nature of the body. When the quantities of heat thus transmitted for different bodies across an interval 1 unit of length in thickness, and for 1 unit of area and time, are determined, these quantities of heat represent the *relative* conductibilities of the substances, and the numbers thus found, when referred to 1 as a standard, may be called the *conductivities* of the different substances.

The relative conductivities of metals, determined by experiments on bars of a given cross-section, the transmission of heat being determined by thermometers placed at different distances in holes drilled in the bars, have been determined by different investigators. The following table of

* Watts, *Dictionary of Chemistry*.

conductivities, from experiments made by Wiedemann and Franz, the temperatures along the bars being determined by a thermo-electric arrangement, is given by Balfour Stewart:

*Relative Conductivities.*

| Name of metal. | In air. | In vacuo. |
|---|---|---|
| Silver | 100·0 | 100·0 |
| Copper | 73·6 | 74·8 |
| Gold | 53·2 | 54·8 |
| Brass | 23·6 | 24·0 |
| Tin | 14·5 | 15·4 |
| Iron | 11·9 | 10·1 |
| Steel | 11·6 | 10·3 |
| Lead | 8·5 | 7·9 |
| Platinum | 8·4 | 7·4 |
| Palladium | 6·3 | 7·3 |
| Bismuth | 1·8 | |

The conducting power of liquids is greater at high temperatures than at low temperatures. And when there is no convection of heat in liquids by which heated particles are carried from one point to another, the conducting power of liquids is very small, the conducting power of water being, according to Depretz, only about $\frac{1}{100}$th that of copper.

*Conduction by Gases.*—Gases possess such a feeble power of conduction that they have been regarded as having no conducting power. Experiments by Magnus and theoretical deductions by Clausius, however, demonstrate that there is a slight power of conduction in perfect gases. Clausius estimates the conducting power of air to be about $\frac{1}{1400}$th that of lead.

The calorific *intensity* of combustion, or degree of temperature of the produets of combustion, and of the solid incandescent combustible, seems to depend on the rapidity of combustion rather than the quantity of heat evolved. Nearly all writers on the subject have given a method for finding what may be called the theoretical temperature of combustion, by supposing that all the heat evolved is contained in the gaseous products, and calculating the temperature by means of the specific heats and the weights of the products of combustion and the heat evolved. Making use of formulas corresponding to that which has already been given $Q = W.C.t$; $Q$ representing, in units of heat, the heat evolved; $W$ the weight; $C$ the specific heat of the gaseous products of combustion; and $t$ the number of degrees rise of temperature. From this formula we have $t = \frac{Q}{C \times W}$. Such determinations, however, have but little practical value for solid combustibles, because the residual incandescent solid gives off rapidly, by radiation, heat which does not pass off with the gases.

The quantity of heat radiated from an incandescent combustible depends not only on the temperature of the combustible, but also on that of the absorbent and the nature of the surfaces. On this account there does not appear to be sufficient ground for ascertaining the temperatures of furnaces or of the escaping gases by this process. It is well known from common observation that the temperature in ordinary furnaces is greatly increased by a more rapid supply of air; so that the quantity of heat evolved in a given time, and the temperature, are thus increased. Chemical action is promoted by high temperatures, and the conditions for increase of temperature, increase of heat evolved in a given time, and rapidity of chemical action, are coincident.

Among the most important of the applications of the dynamic theory of heat in the physical sciences may be mentioned its applications to the constitution of bodies, to electrical phenomena, to chemistry, to physiology, to astronomy, and to geology. All of these seiences have felt the influence of the science of thermodynamics in a remarkable degree, the investigations of the present day in regard to heat being largely devoted to the development of these applications. In the practical sciences its applications to the theory of *heat-engines* are perhaps the most important; and these applications will be given in the articles Steam-engine and Thermodynamics. Revised by E. L. Nichols.

**Heath**, William: soldier; b. at Roxbury, Mass., Mar. 2, 1737; became captain of the Suffolk regiment; commandant of the Ancient and Honorable Artillery of Boston 1770; afterward a provincial colonel; was often in the Legislature; was in the Provincial Congress 1774–75; a brigadier, and then major-general, 1775; brigadier-general of the Continental forces 1775; major-general 1776; State Senator 1791–92; became judge of probate for Norfolk co., Mass., 1793; was elected Lieutenant-Governor in 1806, but declined to serve. Published *Memoirs of Major-General William Heath* (Boston, 1798). D. at Roxbury, Jan. 24, 1814.

**Heath'cote**, Ralph, D. D.: clerical writer; b. at Barrow-upon-Soar, Leicestershire, England, Dec. 19, 1721; educated at Jesus College, Cambridge; became vicar of Barkby 1749; assistant preacher of Lincoln's Inn 1753; vicar of Sileby 1765; rector of Sawtry-all-Saints 1766; a prebendary of Southwell 1768; vicar-general of Southwell church 1788. D. in Southwell, May 28, 1795. Author of *Historia astronomiæ* (Cambridge, 1746–47); *The Use of Reason in Matters of Religion* (London, 1755); *Discourse on the Being of God* (1763, a portion of his twenty-four Boyle sermons), besides a number of other works. He also assisted in the preparation of the *General Biographical Dictionary*.

**Heath Family**: the *Ericaceæ*; shrubby plants or small trees with regular gamopetalous flowers, a free compound ovary with a single style, stamens mostly ten, and opening by terminal pores. They are closely related to the Huckleberry family (*Vacciniaceæ*), which is often united with them. The heaths as here restricted number about 1,000 species, which are found in all parts of the world, and are especially abundant in South Africa, where there are several hundred species of *Erica*, one of the genera to which the name heath or heather has been especially applied. In England the common heath of the waste lands is *Calluna vulgaris*, a low evergreen shrub with small crowded leaves and clusters of rosy flowers. It occurs in a very few scattered localities in the eastern part of North America (including Massachusetts), where probably it has been introduced. Many species of *Erica* are cultivated in greenhouses. Charles E. Bessey.

**Heath-fowl**: See Blackcock.

**Heaton**, Augustus George: See the Appendix.

**Heat-stroke**: See Sunstroke.

**Heaven** [M. Eng. *heven* > O. Eng. *heofon*, not connected with *heave*]: the blue vault apparently overarching the earth; also the subjacent region of clouds; also the unknown and idealized regions above the first. This natural division reappears in the later Jewish conception of *three* heavens, subtilized by the rabbis into *seven*.

Antiquity mostly conceived the azure vault as solid, not, as appears to us so obvious, as aërial, probably because the heavenly bodies were regarded as fastened in it and moved by it. The Hebrews shared this conception, but as their words for heaven signify elevated regions or expanse, and are thus elastic, they sometimes speak of it rather as a curtain, or tent, veiling the glory of Jehovah. When the conception of solidity prevails, the upper waters are viewed as massed above it, and poured out through windows or sluices occasionally opened and closed.

The undecaying identity and steadfast revolutions of the upper heavens, their brilliancy and purity, naturally suggested them to early mankind as peculiarly the divine habitation, especially as, by a natural instinct, physical elevation is the concomitant and symbol of eminent dignity and power, and as the great forces of fertility and destruction are so largely from above, the earth appearing rather passive than initially productive. Hence *Dyaus pater*, the Bright Father, contrasted with *Gē-* or *Dē-mētēr*, Earth-mother. The pagan fancy was wont to assist its conception of heaven as the abode of the gods by imagining some mountain as shooting up into the region above the clouds and sustaining the dwellings of the immortals. Hence the Homeric Olympus and the immeasurably high Mt. Meru of the Hindus. The Babylonians also, and Western Asiatics generally, conceived the earth as culminating at the north in a lofty mountain (Ezekiel xxviii. 14; Isaiah xvi. 13) on which the gods dwelt. The Israelites, on the other hand, coming to recognize the pure spirituality and incomparable power of God, have disengaged themselves from all such supports, and, while retaining the conception of heaven as especially God's dwelling-place, declare that "the heaven and the heaven of heavens can not contain him," thus recognizing his infinite transcendence, and his omnipresence alike in heaven, earth, and sheol. (See Psalm cxxxix.) In the later psalms and prophets these sublimer conceptions are peculiarly sustained and disengaged from the earlier crudeness. Thus the physical conception of heaven passes into that of the realm of existence, however viewed in its relations to space, in which God encounters nothing alien to the perfection of his own being, and within which all creature wills (whether by original creation, spiritual development, or redemption) are ab-

solutely at one with the Divine will. This is the foundation of the great address, "Our Father which art in heaven."

The Hebrews, apprehending heaven as created by God, and even in its purity as inadequate to his ideas ("The heavens are not clean in his sight, and his angels he charged with folly," Job xv. 15, with Job iv. 18), speak of them as destined to wax old and be folded up as an outworn garment, but only in order to give place to more exquisite divine creations, "new heavens and a new earth, wherein dwelleth righteousness."

Early mankind shrank from claiming a right, after death, of dwelling with the gods in heaven. Even the Old Testament believers, saving some bright flashes of anticipation in the later books, and the elevation of Enoch and Elijah without death into heaven, view the dead, bad and good alike, as descending rather to the center of the earth, into the joyless and strengthless realm of sheol. Very early, however, the Hindus began to believe that men, by virtue, asceticism, and ritual incantations, might merit long abodes in the myriad heavens of the gods, sometimes viewed as spiritual habitations, sometimes described with unspeakable grossness, all subject to the restless and endless round of elevation and depression, ever alternating, in incessant rebirths, between the heavens, the earth, and the hells. Exemption from this wheel of Ixion could be purchased, in Brahminism, only by surrendering individuality and sinking into the sleeping essence of Brahm; in Bûddhism by "being blown out" (Nirvana), as Bûddhism recognizes no God. In most tribes, especially the Greeks, certain heroes of divine descent, demigods, were supposed, after death, to have been raised to Olympus as full gods, but never the mass, even of heroes. Once in the *Odyssey* it is declared that Menelaus, as the son-in-law of Zeus, is to be transported, without death, to the Isles of the Blessed, a sort of "island-valley of Avilion" in the distant sea. The Elysian Fields, when developed in thought, are not usually placed in heaven, but are only a more favored region of Hades, appointed only for heroes and an occasional heroine, and, as we see in Vergil, subject to the remorseless doom of transmigration. The "happy hunting-grounds" of the North American Indians are the same thing in an aboriginal vesture. The Southern and Mexican tribes imagined the souls of heroes and heroines, and of those honored by being sacrificed to the gods, to accompany the sun in his course, or to become incarnate in the bodies of humming-birds. The doom of the multitudes seems to have received little or no attention. They were mostly supposed to become unhappy, tormenting ghosts or demons. The Assyrians also, though holding to a resurrection, were disposed to view it as occurring in the form of repulsive birds or beasts. Paganism generally is the state of those "who through fear of death are all their lifetime subject to bondage." The Persians, however, who can hardly be called pagans, cherished an animated hope of dwelling eternally in Ahura-mazda's bright kingdom of pure light. Persian influence is thought by many, with much reason, to have had an important share in developing the slumbering germs of a like faith among the Israelites.

The hope of immortality, gradually developing among the Jews, could not content itself with the joyless and shadowy existence of Sheol, but viewed the pious Israelites as to be recalled by Divine power in bodily subsistence, but glorified and undying, to dwell endlessly in the Messianic kingdom on the transfigured earth under the transfigured heaven.

Our Lord and the apostles freely clothe the faith and promise of eternal life in the conceptions of their people, thus emphasizing its substantial and embodied reality, and its citizenship in a kingdom of redeemed mankind, having its appropriate and eternal abode in a sphere of its own, which will thus be truly "a new earth." The relation of this to the planetary concretion on which we now dwell is not made a matter of curious detail, nor is the relation of transfigured, eternal being, to the present transient state, except that the disembodied spirit is declared to be not in its final condition, but to await a reinvestiture which, while substantial, shall be spiritual, serving, eternally, all the motions and impulses of the purified spirit. This final investiture is likened to a "house from heaven"; the reward of believers is declared to be "laid up in heaven"; the Saviour, in his glorified humanity, has ascended thither, and will come again to receive his people to himself; the souls of the martyrs and the spirits of just men made perfect are viewed in heaven; it is declared that Christ's people at his coming shall be caught up into the air to meet him. Our Lord himself declares that the state of the risen dead shall be eventually one with that of the angels. On the other hand, in the Revelation, and in that alone, the New Jerusalem, the eternal abode of the glorified, is described as coming down from heaven upon earth, here to abide, but pure, illustrious, incorruptible, heavenly.

The underlying doctrine of the New Testament appears thus to be that heaven, the realm of being in which God's will is perfectly done, and in which everything partakes of his eternity, shall ultimately extend its transfiguring power to this lower creation, and redeem it into essential identity with itself, the elements of caducity, corruptibleness, impurity, incongruity with eternal ends, inert grossness and heaviness, and above all of moral resistance to the Divine will and wisdom, being forever purged away, and the glorified and spiritualized, but truly substantial, not vaporous organism of redeemed mankind, while eternally maintaining its distinctiveness and its distinctive abodes in the Father's house, the consummate universe, nevertheless, by virtue of its spiritual perfection (*Spiritus omnis ales est*), shall, to use Frederick Robertson's admirable phrase, be "free of the universe." This is, in its perfect form, the kingdom of heaven, including alike, as the eternal home of redeemed man, the "new heavens and new earth, wherein dwelleth righteousness." CHARLES C. STARBUCK.

**Heaves**: same as BROKEN WIND (*q. v.*).

**Heavy Spar**: a popular name for the natural sulphate of baryta or barytes; has reference to the high specific gravity of that mineral. See BARYTA.

**Hebbel**, FRIEDRICH: dramatist; b. at Wesselburen, in Holstein, Mar. 18, 1813. He was a peasant-boy, and twenty-two years old before he acquired any systematic education. He studied for several years at the University of Munich, and in 1841 succeeded in attracting considerable attention by his tragedy of *Judith*. The King of Denmark gave him a stipend, and after traveling through France and Italy he settled at Vienna, where he married the actress Christine Engehausen. He was one of the most powerful dramatists of modern times, and not only showed perfect command of the technical requirements of the stage, but was also a deep thinker, and did not shrink from representing in his characters the utmost consequences of his thoughts. The most remarkable of his dramas are *Maria Magdalena* (1844); *Herodes und Mariamne* (1850); *Agnes Bernauer* (1855); and *Die Nibelungen* (1862). His complete works (12 vols.) were published at Hamburg in 1866–68, and his diaries (2 vols.) in Berlin, 1885–86. D. in Vienna, Dec. 13, 1863.
Revised by JULIUS GOEBEL.

**He'be** (in Gr. "Ηβη): in the Greek mythology, the goddess of youth and the cupbearer and attendant of the Olympian gods. She is usually represented as a tender maiden, lightly clad, with a cup in her hand. She was the daughter of Zeus and Hera, and became the wife of Hercules after the completion of his labors, his apotheosis, and the reconciliation of Hera. She bore Hercules two sons. After the rise of the myth of Ganymede she was also called Ganymede, and under this title and that of Dia she was worshiped in Phlius and Sicyon. In Rome, as Juventas, she personified not merely the young, but the perpetual youth of the state. The statue of Hebe by Canova is celebrated.
Revised by J. R. S. STERRETT.

**He'bel**, JOHANN PETER ("the German Burns"): b. at Basel, May 11, 1760; educated at Lörraeh, Carlsruhe, and at Erlangen; became subdeaeon and Professor of Ancient Languages in the Carlsruhe Gymnasium, and in 1798 Professor of Theology and Hebrew; church councilor 1805; director of the Lyceum 1808; in 1819 prelate of the Evangelical Church; was for some years editor of *Der Rheinländische Hausfreund*; author of *Biblische Geschichten* (1824), but is chiefly remembered for his *Allemannische Gedichte* (1803), which through Goethe's excellent review became justly celebrated. See also Längin, *Johann Peter Hebel* (in Lebensbild, 1874). D. at Schwetzingen, Sept. 22, 1826.
Revised by JULIUS GOEBEL.

**He'ber**, REGINALD: poet and second Bishop of Calcutta; b. of wealthy parents at Malpas, Cheshire, England, Apr. 21, 1783; was a half-brother of Richard Heber (1774–1833), noted as a collector of books. Reginald Heber was educated at Brasenose College, Oxford, and wrote the prize poem *Palestine* (1803; several times reprinted, e. g. London, 1865); became a fellow of All Souls' in 1805, and rec-

tor of Hodnet in 1807; was a prebendary of St. Asaph 1812; Bampton lecturer 1815 (his theme was *The Personality and Office of the Christian Comforter*, pub. 1816); in 1822 became preacher of Lincoln's Inn; and in 1823 was consecrated Bishop of Calcutta, and labored in India with zeal and wisdom until Apr. 3, 1826, when he was found dead in his bath at Trichinopoly. His works, besides those mentioned above, are *Narrative of a Journey through the Upper Provinces of India* [with] *an Account of a Journey to Madras and the Southern Provinces* (2 vols., 1828); a *Life*, etc., of Jeremy Taylor (1822), and some volumes of poetry; n. e. of his *Hymns* 1881. Heber was a man of saintly character, polished and dignified manners, and kindly and humble spirit. His hymn *From Greenland's Icy Mountains* (1819) is the most popular missionary hymn in the English language. See his *Life* by his widow, Amelia Heber (2 vols., 1830).

Revised by S. M. Jackson.

**Hébert**, ā'bār', Antoine Auguste Ernest: figure and portrait painter; b. at Grenoble, France, Nov. 3, 1817; pupil of Paul Delaroche and David d'Angers; Grand Prix de Rome 1839; first-class medals, Salon, 1851, and Paris Exposition, 1855; second-class, Paris Exposition, 1867; commander Legion of Honor 1874; member of the Institute 1874; medal of honor, Paris Exposition, 1889; director of the French Academy, Rome, 1866–73, and again in 1885; professor in the École des Beaux-Arts, Paris. His work is classical in its tendencies, and is not always exempt from the reproach of sentimentality, but he has considerable talent as a colorist. His celebrated pictures *La Malaria* (1850) and *The Kiss of Judas* (1853) are in the Luxembourg Gallery, Paris.

W. A. Coffin.

**Hébert**, Jacques René: revolutionist; b. at Alençon in 1755; nicknamed "Le Père Duchêne," from the ultra-radical paper published by him during the French Revolution. Previous to the Revolution, as he was uneducated, he led a miserable life as lackey and ticket-seller at the doors of the theaters. Immediately after the capture of the Bastile in 1789 he started his journal, *Le Père Duchêne*, the real patriotism, but also the extreme opinions, of which soon made Hébert extensively known, and caused him to be made attorney-general of the Paris Commune, and afterward a member of the National Convention. He was a member of the commission appointed to examine Marie Antoinette, whom he falsely accused of a scandalous offense. Hébert wielded a tremendous influence, especially among the worst elements of Parisian society, and was the chief promoter of public atheism; but Robespierre understood that the exaggerations of the Hébertist party discredited the cause of the Revolution, and the committee of public safety sent to the guillotine the "Père Duchêne" and his partisans.

**Hebert**, Louis Philippe: See the Appendix.

**Hebrew Language** [*Hebrew* < M. Eng., from O. Fr. *hébreu*: Ital. *ebreo* < Lat. *Hebræ'us* = Gr. *Ἑβραῖος*, from Aramaic *chebrāyā* < Heb. *chibrī* (plur. *chibrīm*), a Hebrew]: the language of the Old Testament; the tongue spoken by the Israelitish people from the earliest known period of their history up to a century or two before the beginning of the Christian era. It is a member of the Semitic family of languages (see Semitic Languages), and exhibits all the peculiarities of that family (triliterality of the stems, the "construct state," timeless verb, modification of meaning of verb-stems by prefixes and infixes, aversion to compounds in verbs and nouns, except in proper names, paucity of conjunctions, parataxis), being thus sharply divided from the Indo-European family on the one side and from the agglutinating tongues on the other. It belongs to the northern branch of the Semitic family, having greater resemblance to Babylonian-Assyrian and Aramaic than to Arabic and Ethiopic. Within this branch its place is in the Canaanitish group, it being almost identical with Moabite (and probably with Ammonite, Edomite, and Philistine), and slightly less near to Phœnician. This group seems to be characterized by the possession of a definite article, of the nominal plural-ending *īm*, of a certain set of derived verb-stems (which includes two proper passive forms), and of the construction known as "Waw consecutive," by which is meant that in ordinary prose in a series of past actions the verbs are imperfects introduced by the connective *wa*, while in a series of future actions the verbs are perfects introduced by *we* (a diminished form of *wa*). The vocabulary of Hebrew preserved in the Old Testament and the Talmud is relatively scanty, and especially lacking in abstract terms (a lack which was probably a feature of all ancient Semitic speech). The language is unfitted for the expression of philosophical thought (for which the people showed no inclination), but, on the other hand, it is an admirable vehicle for hortatory and denunciatory discourse, for simple narration, and for poetry. From the nature of the Semitic speech (each triconsonantal stem expressing a definite meaning) it was unnecessary to write the vowels, the special sense being sufficiently indicated by the connection of thought (the vowels are, however, expressed in the Babylonian-Assyrian syllabary). Vowel-signs were, in fact, not devised for Hebrew till long after it had ceased to be a living language (about the seventh century A. D.), whence it results that we are left in some uncertainty as to the ancient pronunciation. Except in the few proper names preserved in Assyrian inscriptions and the cases in which the Septuagint transliterates Hebrew words, we are dependent on the vocalization of the Masoretes (given in our printed Bibles), and no one knows what changes may have taken place between their time and that of the Old Testament writers. There were some differences of pronunciation within the limits of the Israelitish territory, as is indicated in Judges xii. 6 (whether there were real dialects is uncertain). The alphabet consists of twenty-two consonants, and is especially rich in sibilants, concerning the nature of one of which (the *sin*) we have not exact information. The character anciently used in writing was that which is known as the Phœnician, the origin of which is unknown. As early indeed as the fifteenth century B. C. the Babylonian cuneiform script was employed in Canaan by the Egyptian governors of the cities, the Babylonian language having been at that time the medium of intercourse between the Tigris-Euphrates valley, Canaan, and Egypt; but the Israelitish tribes were not then in Canaan, and were hardly in condition to use this script—they were uncultivated nomads. It can not be supposed that they acquired the art of writing before their arrival in Canaan, about the thirteenth century B. C., and they then no doubt found the Phœnician character in general use. When they began to employ it for literary purposes can not be determined with certainty; it was probably not long before the time of David, in whose reign for the first time there is mention of official writing (2 Sam. viii. 16, 17—the account in 2 Sam. x. 25 is probably a later addition to the narrative). The earliest known Canaanitish writing in the Phœnician script is the inscription of the Moabite king Mesha, about 900 B. C. (the stone is now in the Louvre). This character continued to be used by the Israelites till toward the second century B. C., when it was abandoned for an Aramaic script, the same that is now found in our Bibles. No ancient Hebrew inscription, except a scrawl by a workman in the Siloam aqueduct about 700 B. C., has yet been discovered, but excavation may bring such writing to light. As far as the present evidence goes, there is no reason to suppose that we have any written remains of the time of Moses.

Inasmuch as the Canaanitish language was spoken, with slight variations, by various peoples in Canaan, the assumption is a natural one that that land was its birthplace, that it was there that a section of the Semitic race developed those linguistic peculiarities which difference their language from those of their neighbors (Aramæans and Babylonians). If this be so, then it was in Canaan that the Israelites acquired their language (which is called in Isa. xix. 18, "the tongue of Canaan"). How this came about, whether they were originally of that land, or gave up their own language and adopted this, it is impossible to say with certainty; but it is contrary to all that we know of ancient linguistic history to suppose that they brought this Canaanitish tongue with them from a non-Canaanitish region, from the district of the Euphrates, for example. The movements of the Israelitish tribes prior to their settlement in Canaan are involved in obscurity. With our present knowledge it is impossible to say what historical significance is to be attached to the tradition of the migration of an Abrahamic clan from the Euphrates. Abraham is represented in one passage (Gen. xi. 28) as coming from a Chaldean land, in another (Gen. xxiv. 4, 10) as claiming Aram as his country; in neither of these regions, as it seems, could Hebrew have been the vernacular. The term "Hebrew" (*Ibri*) does not occur in the Old Testament as a designation of the language, which is called the "language of Canaan" (Isa. xix. 18) and the "language of Judah" (2 Kings. xviii. 26; Neh. xiii. 24). *Ibri* is a purely ethnic term, but its origin is uncertain. It may mean "the dweller on the other side" [of the river], but such a name would have been given by foreigners, and *Ibri* seems to be native. The ancestor

"Eber," to whom it is referred in Gen. x. 21, is a genealogical invention, and a comparison of the obviously geographical names in Gen. x. and xi. 10–26 suggests that this name also is geographical. We do not, however, know any place of that name, and the question of its origin must remain for the present unanswered.

Within the limits of the Old Testament the language shows no considerable internal phonetic, morphological, or syntactical changes. There are differences of style in individual writers, and variations in vocabulary according to subject-matter, but no marked development. At the moment when we first meet it (in the earliest narratives of the Pentateuch, about the ninth century B. C., and in the prophetic writings of the eighth century), Hebrew is already a well-developed language, exhibiting, moreover, great phonetic degradation as compared with classic Arabic (it is about at the same phonetic stage as Modern Arabic). The uniformity in the Old Testament is due perhaps in part to the comparative social isolation of the people, but largely, no doubt, also to the harmonizing procedure of the later scribes and editors, who permitted themselves to bring obsolete forms into agreement with their own usage; here and there words have survived which indicate that a steady process of change was going on. The present Hebrew text was fixed about three hundred years after the language had ceased to be spoken, and doubtless many old variations of form had then been expunged. In one direction, however, a definite modification of Old Testament Hebrew is discernible, namely, from the influence of the Aramaic or Syriac language. The Israelites were in contact with Aramaic-speaking peoples on the north and northeast from an early time, and Syriac appears to have been, even in the eighth century B. C., the medium of communication between the east and the west (2 Kings xviii. 26). After the exile Aramaic became more and more predominant in Western Asia (during the exile the Jews probably learned something of Babylonian), being the official tongue of the Persian government in that region (Ezra iv. 7), and finally expelled Hebrew entirely; from the third century B. C. the Jews largely spoke and wrote Aramaic, in which tongue considerable parts of the books of Ezra and Daniel now stand. Aramaic and Aramaizing words and expressions are found at first rarely (about the beginning of the exile), and grow more frequent in the later books, especially in Chronicles, Esther, and Ecclesiastes. On the later forms of Hebrew writing, see articles TALMUD and JEWISH LITERATURE.

The scientific study of Hebrew is of modern origin. The old Jewish biblical scholars were not interested in the subject, and of the early Christian writers only a few (especially Origen and Jerome) concerned themselves with Hebrew at all. It was under Arabian influence that the Jews began the investigation of their language, which was then carried on by a series of meritorious scholars, from the tenth to the sixteenth century; among the most famous of these are Saadia, Hayyug, Ibn Ganah, Aben Ezra, David Kimchi, and Elias Levita. The last named (1472–1549) was the chief agent in inducting Christian scholars into the knowledge of Hebrew, the scientific study of which then passed into Christian hands, and has since that time steadily advanced. In the latter part of the seventeenth century England was the center of Hebrew study, in the beginning of the eighteenth century Holland, and at the end of that century the leadership passed to Germany, where it has remained ever since, though the study is now pursued industriously all over the Christian world.

*Grammars.*—The best are: Gesenius, revised by Kautzsch (1878); Eng. transl. by Mitchell (Andover, 1880); Ewald, Eng. transl. of the *Syntax* by Kennedy (1879); Olshausen (Brunswick, 1861); Böttcher (Leipzig, 1866–68); Stade (Leipzig, 1879); König (Leipzig, 1881); Davidson (10th ed. Edinburgh, 1892); Driver, *Hebrew Tenses* (3d ed. Oxford, 1892). For comparison of Hebrew with other Semitic languages see Philippi, *Status constructus* (Weimar, 1871); Wright, *Comparative Grammar* (Cambridge, 1890); and also Land, Eng. transl. by Poole (London, 1876); and Bickell, Eng. transl. by Curtiss (Leipzig, 1877).

*Lexicons.*—Gesenius, *Thesaurus* (Leipzig, 1853), and *Handwörterbuch*, 11th ed. by Mühlau and Volck and D. H. Müller (Leipzig, 1892); Siegfried and Stade (Leipzig, 1893). A Hebrew-English dictionary by Driver, Briggs, and Brown is passing through the press (part i., Boston and New York, 1893). At present the lexicon of Siegfried and Stade is the most useful for general students. That of Fürst is not trustworthy.

*Concordances.*—Fürst (Leipzig, 1840); Wigram, *The Englishman's Hebrew and Chaldee Concordance* (3d ed. London, 1866); for the particles see Noldius (Jena, 1734).

*History of the Language.*—Gesenius, *Geschichte der hebräischen Sprache und Schrift* (Leipzig, 1815); Renan, *Histoire générale des langues sémitiques* (4th ed. Paris, 1863). On study of the language: L. Geiger, *Das Studium der hebräischen Sprache in Deutschland vom Ende der XV. bis zur Mitte des XVI. Jahrhunderts* (Breslau, 1870). C. H. TOY.

**Hebrew Laws**: See the Appendix.

**Hebrew Literature**: See JEWISH LITERATURE.

**Hebrews**: See JEWS.

**Hebrews, Epistle to the**: an anonymous epistle of the New Testament; written by St. Paul, or, what is more probable, by one of his disciples and companions under his inspiration (Luke, or Barnabas, or Apollos), and addressed to the Christians of Hebrew descent in the East. Its object is to show the infinite superiority of Christ over Moses, and of Christianity over Judaism, and to warn its readers against apostasy. The writer makes the Old Testament itself prove the New, to which it pointed as its fulfillment. He sets forth the eternal priesthood and sacrifice of Christ, of which the Levitical worship was a significant symbol and type. The ninth chapter furnishes the key to the understanding of the tabernacle and the temple. The doctrinal expositions are interwoven with solemn warnings and rich consolations in view of the heavy persecutions to which the readers were exposed from the unconverted Jews. The eleventh chapter contains a most eloquent sketch of the ancient heroes of faith for the encouragement of timid believers, and forms a parallel to the seraphic description of love in the thirteenth chapter of First Corinthians. The epistle belongs to the Pauline type of doctrine, and mediates between it and the Christology of St. John. It shows the influence of the Alexandrian philosophy of Philo. It was written before the destruction of Jerusalem, when the temple worship was still in existence, probably in Italy during the first imprisonment of Paul in Rome, A. D. 63 or 64. See commentaries on the *Hebrews* by Bleek, the most learned of all (in 3 vols.), Tholuck, Delitzsch, de Wette, Ebrard, Alford, Lünemann (in Meyer's *Com.*), Moll (in Lange's *Com.*, Am. ed., with valuable additions by Kendrick), Kay (in *Speaker's Com.*, 1880), Moulton (in Ellicott's *Com.*, 1881), Angus (in Schaff's *Popul. Com.*, vol. iv., 1883), T. C. Edwards (1888; 3d ed. 1889); B. F. Westcott (1889; 2d ed. 1892); C. J. Vaughan (1890); also the able work of Riehm on the *Lehrbegriff des Hebräerbriefs* (Basel, 1859, 2 vols.; 2d ed. 1867), and the relevant sections in introductions to the New Testament.

PHILIP SCHAFF.

**Heb'rides** [Lat. *He'budes*; Gr. Ἑβουδαι], or **Western Islands**: the common name given to the large group of islands stretching along the western coast of Scotland, numbering about 490, of which, however, only 120 are inhabited. The islands are divided into the Outer Hebrides, among which the most remarkable are St. Kilda, Lewis, Harris, North and South Uist, Benbecula, and Barra; and the Inner Hebrides, the principal of which are Skye, Eigg, Mull, Iona, Staffa, Ulva, Lismore, and Kerrera. Their area is estimated at 3,000 sq. miles. Most of these islands are rocky and unproductive, but their mild and moist climate, due to the presence of the Gulf Stream, produces excellent pastures, and cattle and sheep are reared in great numbers. The construction of good roads and the establishment of several steamship lines in connection with Glasgow have contributed very much to the full development of all the resources of the islands. The large tracts of moorland, which often cover considerable portions of the islands, are let out to sportsmen at high rents, and great numbers of tourists visit the islands every year for the sake of the wild beauty of their natural scenery. The islands are mentioned by Ptolemy and Pliny under the name of *Hebudes*, which by a misprint became *Hebredes*. The Norwegians called them *Sudreyjar*, or Southern islands, which name, Latinized into *Sodorenses*, is still retained in the title of the Bishop of Sodor and Man. In the ninth century these islands were colonized by emigrants from Norway, who largely replaced the original Celtic population, but the Gaelic language even now is in general use. The islands in the following centuries were alternately under Norwegian and Scottish authority, or under "Lords of the Isles," who were often virtually independent, until in 1510 they were finally annexed to the Scotch crown by James V. Pop. about 100,000.

**Hebron** (Heb. *Cheb'rōn*, *Chab'rā*): a place in Palestine; about 20 (17½ geographical) miles a little W. of S. from Jerusalem; one of the oldest existing cities in the world (see map of Palestine, ref. 11–D). Its original name (Gen. xiii. 18), displaced for a time by *Kirjath-arba*, city of Arba (Josh. xxi. 11), was restored by Caleb (Josh. xiv. 13–15). The Arabs now call it *El-Khalil*, the friend (i. e. of God, meaning Abraham, whose home it was for many years). It was one of the cities of refuge (Josh. xxi. 11). David reigned there seven and a half years before getting possession of the whole kingdom of Israel (2 Sam. v. 5). The Maccabees recovered it from the Edomites, who had taken it after the Captivity. It was burned by an officer of Vespasian just before the destruction of Jerusalem. It was taken by the Arabs in 637, by the crusaders about 1100; became the seat of a Latin bishopric in 1167; and ever since 1187 has been in the hands of the Mohammedans. It is in a valley, generally supposed to be the "Eshcol" of the Mosaic period, about 3,000 (Conder says 3,040) feet above the level of the sea. This valley is exceedingly fertile, abounding in grapes, olives, figs, pomegranates, and the like. The great mosque of Hebron, on rising ground, is over the cave of Machpelah, in which Abraham, Isaac, and Jacob, with their wives, are buried. The cave itself no one is permitted to enter; and until 1862, when the Prince of Wales was the guest of the Government, no Christian was permitted to enter even the area of the mosque. The population is some 8,000 or 10,000, of whom some 400 or 500 are Jews, and the rest Mohammedans, noted for their bigotry and fanaticism. See Appendix I. to *Sermons in the East*, by Dean Stanley.

Revised by S. M. Jackson.

**He'bron**: town (founded 1871); capital of Thayer co., Neb. (for location of county, see map of Nebraska, ref. 7–J); on the Little Blue river, and the Burl. and Mo. River and Chi., R. Is. and Pac. Railways; 65 miles S. W. of Lincoln. It is in a fertile and well-watered section, the center of an important agricultural and stock-raising region, and has fine school-buildings, churches, and other public buildings, and three weekly newspapers. Pop. (1880) 466; (1890) 1,502; (1900) 1,511. Editor of "Journal."

**Heb'rus** [Lat. = Gr. Ἕβρος, the modern *Maritza*]: the chief river of Thrace, now the Maritza. The river-god Hebrus is found on the coins of Thracian cities. The river rises in the mountains Scomius and Rhodope, and drains nearly all of Roumelia. Small boats ascend as far as Philippopolis, and vessels of 200 tons as far as Adrianople, except in low water, when they stop at Demotica, 25 miles below. The river is 240 miles long, and flows into the Ægean Sea. See Drexler's article in Roscher's *Ausführliches Lexicon* under *Hebros*. J. R. S. Sterrett.

**Hecatæ'us** (Gr. Ἑκαταῖος): of Miletus; one of the earliest and most important of the chroniclers (*logographi*); the son of Hegesander; lived about B. C. 549 to 479, and wrote in his native Ionic dialect. From the prominent part he took in the affairs of his native city it would seem that he was a man of noble birth and high position. He opposed at the outset the attempt of Aristagoras to arouse the Ionians of Asia to free themselves from the Persian dominion; was instrumental subsequently in procuring more lenient treatment for his countrymen from the Persian satrap; visited many countries, and published the results of his travels in a work entitled Περίοδος γῆς or Περιήγησις, in two books, of which the first was devoted to Europe, the second to Asia and Egypt; wrote also Γενεαλογίαι or Ἱστορίαι, containing the mythological histories of the Greeks, in four books. His geographical work is the more important, as he described what he himself saw. He is one of the authorities of Herodotus, who treats him with a singular mixture of levity and respect. Some fragments remain, and are collected in *Hecatæi Fragmenta*, ed. Klausen (Berlin, 1831); *Fragm. Hist. Græc.* (ed. Müller, vol. i., pp. 1–31; iv., pp. 623–628). See Mure's *Hist. of Greek Lit.* (vol. iv., p. 140). Revised by B. L. Gildersleeve.

**Hec'ate** [Gr. ἑκάτη, femin. of ἕκατος, clip-form of ἑκατηβόλος, far shooting, epithet of Apollo, brother of Artemis]: a mysterious Greek goddess, who was usually declared to be a daughter of the Titan Perses and Asteria, though her parentage is given in different ways. She was the only one of the Titans who fought with Zeus, and so she escaped the doom of Tartarus. She was a moon-goddess, and was figured with a triform body or with three bodies, corresponding to the new, full, and waning moon. Because of this triform character she was worshiped at the forks of roads (in Lat. under the name of Trivia; in Gr. of Trioditis), and each of her three faces watched over one of the three roads. Those who travel at night have need of the help of the moon-goddess when they come to the forks of roads. She is also the guardian of roads in general and also of doors and gates. In Hesiod she is a most powerful goddess, not only in heaven, but also on earth and in the sea. She confers riches, power, and honor upon men; she gives victory in the athletic games, in battle, in the assembly of the people, and in the law courts. Inasmuch as the moon influences the monthly sickness of women, Hecate presides over childbirth; for a similar reason she is a goddess of marriage. In common with all *light* divinities she was addressed in expiatory sacrifices. Annual mysteries were held in her honor in the early morning of a spring day when the new moon rose. She could cure madness as well as send it, for *lunacy* has always been the moon disease. In later times Hecate is the goddess of hobgoblins; she can send or expel ghosts and all other terrors of the night, and on occasion she herself appears as a most terrifying hobgoblin, accompanied by thunder and howling spook-dogs. In view of this it is easy to see that she should preside over the rites of magic, the magic ring, and exorcism of every kind; she is the very mother of witches like Circe, and the protectress of magicians like Medea. As goddess of the night, she is naturally akin to the gods of the lower world, and she is one of the keepers of the door of Hades and guardian of the hell-hound Cerberus. She is said to appear about sunrise, because the new moon comes, as it were, from the lower world. As goddess of the lower world she can send up the ghosts of the dead, both because she is the patron of magicians and because in ancient times the dead were buried along the sides of roads over which she held sway. Hecate is often confounded with Diana and Persephone, as well as with all the divinities in any way connected with the moon or the lower world.

In the most archaic art she appears with a single body. In her triform character she appears in two ways—either with three bodies, three heads, and six arms, or with one body, three heads, and six arms. The most beautiful representation of Hecate in this second form is that on the Pergamon frieze.

Literature.—First of all, the learned articles by Steuding and Roscher in Roscher's *Ausführliches Lexicon* under *Hekate*; then Preller-Robert, *Griechische Mythologie* (Berlin, 1886), i., pp. 321–327. J. R. S. Sterrett.

**Hec'atomb** [from Lat. *hecatom'be* = Gr. ἑκατόμβη, hecatomb, liter., a hundred oxen; ἑκατόν, hundred + βοῦς, ox]: strictly, the offering of a hundred bullocks in a sacrifice to the gods; but most commonly the term designates the slaughter of a considerable number of animals of any kind. It was essential that the animals, besides being healthy and perfect specimens of their kind, must never have been subjected to the service of man; for this reason oxen were not offered in sacrifice. Male or female animals were sacrificed to male or female deities respectively, white animals being offered to the gods of heaven and dark ones to those of the lower world and of the sea. Sometimes the whole hecatomb, but more often the thighs, legs, and hides, were burned as a part of the ceremony, the flesh of the beasts being eaten by the worshipers. Revised by J. R. S. Sterrett.

**Heck**, Barbara: "the foundress of American Methodism"; b. in Ballygarry, County Limerick, Ireland, in a settlement of German emigrants from the Palatinate on the Rhine. These people came early under the influence of Wesley and his Irish itinerants, and formed some of the strongest Methodist societies of the island. In 1760 Philip Embury, Paul Heck, and Barbara his wife, with others of the settlement, sailed for New York. There the little company lapsed from their faith, or at least from their Wesleyan usages; but in 1766 Barbara Heck recalled Embury to his duty as a Methodist local preacher (in which capacity he had labored in Ireland). She gathered a little congregation at his house, and rested not till she saw the famous "Old John Street chapel" completed. Methodism was thus effectively introduced into the U. S. When Wesley's preachers arrived to take charge of the John Street society she removed with her family and that of Embury to Northern New York, where they founded Methodist societies. They finally settled in Upper Canada, and became the founders of their denomination there. Barbara Heck died there at the residence of her son, Samuel Heck, near Augusta, in 1804, aged seventy.

**Heckeling**: See Flax.

**Heck'er**, Isaac Thomas: founder of the congregation of Paulists; b. in New York city, Dec. 18, 1819. In 1843 he joined in the Brook Farm experiment, and afterward lived in a socialistic community at Fruitlands, Worcester co., Mass., and also lived with H. D. Thoreau in his hermitage for a while. In 1845 he became a Roman Catholic; in 1847 joined the Redemptorists in Belgium; was ordained a priest in 1849; returned to the U. S. in 1851; was released from the order of Redemptorists by the pope in 1857, and founded the congregation of St. Paul the Apostle in 1858, in which "the members take no special vows, and any priest can leave the order when he chooses." In 1865 he established a periodical called *The Catholic World*; in 1869 was Bishop Rosecrans's procurator at the Vatican Council. Author of *Questions of the Soul* (New York, 1855); *Aspirations of Nature* (1857); *Catholicity in the United States* (1879); and *Catholics and Protestants Agreeing on the School Question* (1881), etc. D. in New York, Dec. 22, 1888.

**Hecker**, Johann Julius: See the Appendix.

**Heck'ewelder**, John Gottlieb Ernest: missionary; b. at Bedford, England, Mar. 12, 1743, of Moravian parents, with whom he came in 1754 to America; became in 1762 an Indian missionary, laboring in Ohio, Pennsylvania, and Michigan; became in 1788 missionary agent for the Moravians, serving at times as U. S. peace commissioner with the Indians; residing 1801–1810 at Gnadenhütten, O., and after that at Bethlehem, Pa., where he died Jan. 21, 1823. His chief works are *An Account of the History, etc., of the Indian Nations* (Philadelphia, 1818) and a *Narrative of the Mission of the United Brethren* (1820). Heckewelder's admiration for some traits of the Indian character exposed his books to severe criticism. See the *Life* by Edward Rondthaler (Philadelphia, 1847).

**Hec'la**, or **Hek'la**: a volcano of Iceland; situated in the southwestern part of the island, 20 miles from the coast. It is conical in shape, 5,110 feet high, covered with snow, and presents a dreary, desolate aspect. Fantastic groups of hills, craters, and lava, leading the eye to distant snow-covered jokuls, the mist rising from a waterfall, lakes encircled by bare, bleak mountains, an awful and profound stillness, and half-darkness produced by the lowering clouds, give to the whole region a character of desolation scarcely to be paralleled. Since 1104 A. D. eighteen eruptions of this volcano are on record. The last and most tremendous eruption was that of 1845–46, lasting seven months, pouring out a stream of lava a mile broad and 50 feet deep, and sending its clouds of dust 400 miles over the ocean, as far as the Orkney islands. The discharge of immense quantities of fine dust is a special feature of eruptions in Iceland, not only from Hecla, but from other parts of the island.

**Hectic Fever** [*hectic*, readapted from M. Eng. *etik*, from O. Fr. *etique* < Lat. *hecticus* (whence Germ. *hektisch*: Fr. *hectique*) = Gr. ἑκτικός, habitual, hectic, consumptive, deriv. of *ἕκτις, ἕξις, habit, deriv. of ἔχειν, hold, keep on]: a type of fever in which the temperature rises to a febrile point in the evening and sinks almost or quite to the normal in the morning. Patients having hectic fever usually present a bright flush of the cheeks and shiny eyes during the febrile period, and often sweat immoderately. Hectic fever indicates some infectious poison, usually that produced in suppurating areas, as, e. g., abscesses, cavities in the lungs in consumption, and the like. The occurrence of this type of fever is therefore of bad omen after surgical operations or in obscure cases in which a deep-seated trouble of doubtful nature is present.

William Pepper.

*Argonauta argo*, male, with the *Hectocotylus*-arm attached.

**Hec'tocotyle** [Gr. ἑκατόν, a hundred + κοτύλη, a small cup]: a name given to that "arm" of various Cephalopods (squid and cuttlefish) which becomes modified for reproductive purposes. At the time of reproduction one of the third pair of arms of the male becomes swollen and much larger than the rest, and this arm is charged with a packet of spermatozoa (spermatophore). During coitus this arm becomes separated from the male and attaches itself by means of its many suckers to the female, which then swims away. The spermatophore then discharges its contents, fertilizing the eggs. Before the return of the reproductive season the male grows a new arm to replace that which was lost. When first seen the hectocotyle was supposed to be a parasitic worm, and many years elapsed before the history was made out. Hectocotylization does not occur in all Cephalopods. Its extreme development is reached in the genera *Parasira* and *Argonauta* (the paper Nautilus). J. S. Kingsley.

**Hec'tor** (in Gr. Ἕκτωρ): the eldest son of Priam and Hecuba, the royal pair of Troy, the husband of Andromache and father of Astyanax or Scamandrios. For some reasons he may be considered the chief hero of the *Iliad*; he is the bravest, the wisest, and the best of the Trojans; he is an affectionate son and tender husband, whose farewell words to his loving wife will ever be famous. He knows that Troy must fall and that he himself must die; he knows even that his wife must be a slave, and yet at duty's call he boldly faces fate. He distinguishes himself in the defense of the wounded Sarpedon and in his fight with the Telamonian Ajax, after Achilles the best of all the Greeks. He forces the Greeks back to their ships and sets fire to the ships. At the urgent request of Patroclus, Achilles allows him at this juncture to don his arms and go out to oppose the man-slaying Hector. Patroclus is slain by Hector, and his death brings Achilles on the scene once more with his new and divine armor. The sight of Achilles strikes terror to the heart of Hector, who flees three times around the walls of Troy, pursued by Achilles mad for his blood. The sight saddens Zeus; the souls of Hector and Achilles are weighed, the scale of Hector sinks; Apollo abandons him and he is slain by Achilles, who casts the corpse in the dirt before the tomb of Patroclus, to be a prey to dogs and birds. But Aphrodite preserves the body from decay by anointing it with ambrosia. Achilles next drags the dead body behind his chariot three times around the tomb of Patroclus and thereafter three times around the walls of Troy, but during it all Apollo stands over the corpse and protects it from mutilation. The body is finally restored to Priam, at the command of Zeus, for a heavy ransom. Then, after lying in state in the court of the palace of Priam, it is finally burned, and thus ends the *Iliad*. J. R. S. Sterrett.

**Hector**, Annie (*French*): novelist; b. in Dublin about 1825; has written, under the pseudonym *Mrs. Alexander*, *The Wooing o't* (1873); *Ralph Wilton's Weird* (1875); *Her Dearest Foe* (1876); and many other popular novels.

H. A. B.

**Hec'uba** (in Gr. Ἑκάβη): daughter of the Phrygian Dymas, wife of Priam, the King of Troy, to whom she bore nineteen of his fifty sons. When pregnant with Paris she dreamed that she carried a torch in her womb, which meant, according to the interpreters, that the child would bring destruction to his family and fatherland. When born, Paris was exposed on Mt. Ida in order to forestall the threatened ill, though as the event proved the exposure was really the first step toward the fulfillment of the prophetic dream, and Paris, by the machinations of the gods, did ultimately become the cause of the destruction of Troy. Priam, foreseeing the fall of Troy, confided his youngest son and much treasure to the keeping of his guest-friend Polymestor, king in Thrace. After the fall of Troy, Hecuba became the slave of Ulysses and followed him to the Thracian Chersonese immediately after the sacrifice of her daughter Polyxena. By chance she found the dead body of Polydorus floating in the sea, into which it had been cast by Polymestor, who murdered Polydorus in order to get possession of the treasure of Priam. Hecuba put out the eyes of Polymestor after having killed his two children. She was then turned into a dog, which sprang into the sea and was drowned. The tomb of the dog marked the spot and served as a beacon for seafarers. J. R. S. Sterrett.

**Hedberg**, Frans Teodor: dramatist; b. in Stockholm, Sweden, Mar. 2, 1828. After entering upon a commercial career, Hedberg was later apprenticed to a wig-maker; then he tried his luck as an actor. Seeing that his success in that line did not come up to his expectations, he in 1854 left the stage in order to devote himself entirely to dramatic authorship. In 1861 he was appointed reader and teacher of recitation at the Royal theaters in Stockholm; in 1871 also intendant of the Grand theater; in 1881 director of the New theater, Gothenburg; and in 1883 he again took up his

residence in Stockholm, devoting his entire time to literary production. Hedberg is the author both of comedies and of historical plays. Most popular among them is the historical drama *Bröllloppet på Ulfåsa* (The Wedding at Ulfåsa, 1865). Among his other plays may be mentioned *Min vän löjtnanten* (My Friend the Lieutenant, 1853); *När man inte har pängar* (When You Have no Money, 1854). Hedberg's first production in the way of historical drama was *Kung Märta* (King M., 1860). which was kindly received by the public; others of same *genre* are *Lejonet vaknar* (The Lion Wakes Up, 1868); *Vasaarfvet* (The Vasa Inheritance, 1868), etc. He has also written the opera texts *Hertig Magnus och sjöjungfrun* (Duke Magnus and the Mermaid, 1867); *Vikingarne* (The Vikings, 1877), etc. Hedberg, who has also adapted foreign plays for the Swedish stage, has generally been one of the most fertile of Swedish dramatic writers. He has, besides, occupied himself with the history of the Swedish stage, in which line he has written *Karaktäristiker och Porträtter af Svenska Skådespelare* (Characters and Portraits of Swedish Actors, 1884) and *Karaktäristiker och Porträtter af Svenska Operasångare* (Characters and Portraits of Swedish Operatic Singers). P. Groth.

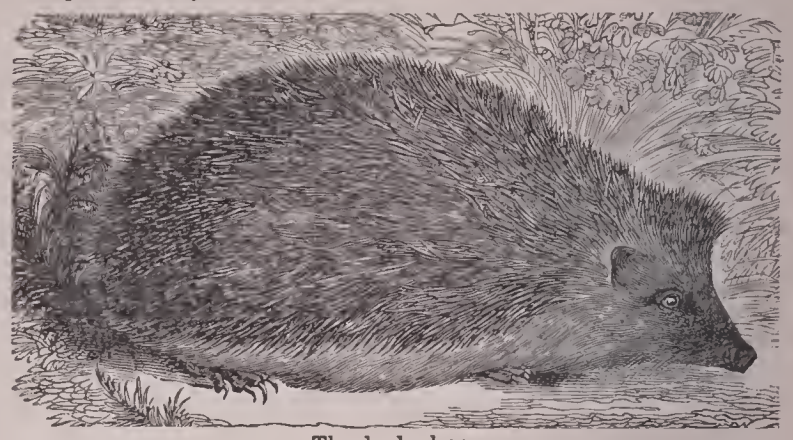
**Hed'dle**, or **Heald**: in weaving cloth, the vertical thread or wire which raises or depresses a certain part of the threads, or every alternate thread, of the warp preparatory to the passage of the shuttle. There is a heddle attached to each warp-thread, and in every loom there are at least two, often several, more sets of heddles, according to the kind of weaving. Many improved styles have been introduced for special kinds of looms.

**Hedge** [O. Eng. *hecg*: Germ. *hecke*, akin to O. Eng. *haga* > Eng. *haw*]: a fence of growing shrubs set closely together. The setting of hedges is a matter of great importance in regions where timber and stone are scarce or expensive, as in Great Britain and many parts of the U. S. The thorns (*Cratægus*) are extensively employed in England, but in the U. S. they are peculiarly liable to the attacks of borers, and are therefore not much used. Buckthorn, barberry, beech, hornbeam, Japan quince, privet, arborvitæ, holly, honey-locust, the Cherokee rose, and especially the Osage orange or bois d'arc (*Maclura aurantiaca*) are used successfully in the U. S. Much depends upon the proper setting of the hedge-plants, and still more upon subsequent care and proper clipping. The Osage orange is undoubtedly the most satisfactory hedge-plant for the U. S. The Russian mulberry is used for hedges in the prairie States. Small ornamental hedges and borders are usually made of privet or box. Revised by L. H. Bailey.

**Hedge**, Frederic Henry, D. D.: minister and scholar; b. in Cambridge, Mass., Dec. 12, 1805. At the age of thirteen he went to Germany for study; returned in 1823, and entered Harvard College in the class of 1825; studied theology at the Cambridge Divinity School; was settled over the Unitarian church in West Cambridge 1829; in Bangor, Me., 1835; spent the year 1847–48 in Europe; took charge on his return (1850) of the Westminster church in Providence, R. I.; accepted a call to Brookline, Mass., 1856, and in 1872 took the office of Professor of German at Harvard College, where previously he had lectured on Church History. His greatest work, *Prose-writers of Germany* (1 vol. 8vo, Philadelphia, 1848), is a standard. Other volumes are *Reason in Religion* (Boston, 1865); *The Primeval World of Hebrew Tradition* (1870); *Atheism in Philosophy and other Essays* (1884); *Hours with German Classics* (1886); *Martin Luther and other Essays* (1888); and *Sermons* (posthumous 1891). In 1888 he published a volume of *Metrical Translations and Poems* jointly with Mrs. Annie Lee Wister. From 1857 to 1860 he edited *The Christian Examiner*; he was compiler of a book of hymns with Dr. (afterward Bishop) F. D. Huntington; composed hymns; translated poems from the German: prepared a brief form of liturgy for the Unitarian Church, and was in 1857 president of the Unitarian Association. He was eminent outside of his sect as a preacher and writer, for the vigor of his thought, the dignity of his presence, and the noble purity of his English style. Dr. Hedge was a Christian rationalist, combining intellectual independence with fidelity to ecclesiastical tradition. D. in Cambridge, Mass., Aug. 21, 1890.

Revised by J. W. Chadwick.

**Hedgehog**: any small insectivorous mammal of the genus *Erinaceus*, a group containing about a score of species; found in Europe, Africa, and the greater part of Asia. Hedgehogs resemble one another very closely in general appearance, having pointed heads and the upper part of the body and head clothed with sharp spines. By means of a complicated system of muscles lying just beneath the skin



The hedgehog.

these little animals can, when attacked, curl into a ball of bristling points. The food of hedgehogs consists principally of insects, but they also eat small reptiles and, to some extent, fruit, eggs, and young birds. The most familiar species, the European hedgehog (*Erinaceus europæus*), is about 9 inches long. The term hedgehog is popularly used for various spine-clad mammals, and in the U. S. is a common name for the Canada porcupine (*Erethizon dorsatum*). F. A. L.

**Hedge Schools**: See the Appendix.

**Hedge-warbler**, called also **Hedge-sparrow**, or **Hedge-accentor**: See Accentor.

**Hedjaz, El**, el'hej-aaz' [Arab., land of pilgrimage]: a partly sandy, partly stony region of Arabia, extending along the coast of the Red Sea from Yemen to the Syrian desert. As both Mecca and Medina, the two holy cities of the Mohammedans, are situated in this region, it is annually traversed by thousands of pilgrims. It is divided into a lowland (Tehama) and a highland region (Nejd); constitutes with Yemen a vilayet of the Turkish empire. Area about 96,500 sq. miles. Pop. (1885) estimated, 3,500,000.

**Hedjirah**: See Hejira.

**Hed'onism** [from Gr. ἡδονή, pleasure]: the doctrine that we perform all acts of will with happiness in view. In ethics the name Hedonists is given to a class of thinkers who hold that all morality can be reduced to the pursuit of happiness, either individual or general. Hedonists are distinguished from Eudæmonists only in that the latter recognize the more refined and ideal forms of happiness in opposition to lower or physical pleasures and pains. The basis of Hedonism as well as of opposed doctrines of the end in view in acts of will is psychological. It is said that happiness is the natural object of pursuit of organized beings; that it is the spontaneous choice of every one; that it is the general index of healthy life and of all the functions both of the body and of the mind, including the will; that it is through gratification that the end and growth of an organism are realized; and that all social theories and institutions are based upon the necessity of securing general happiness.

These arguments are met on psychological grounds by the distinction between subjective and objective ends, between the ethical end and the *summum bonum* or "highest good." The subjective end is that which the individual desires and aims at in his acts of will; the objective teleological end, the highest good, is that which expresses the outcome of the organic or mental processes at the end of their development. Now happiness may be an element in the teleological end—the arguments from biology and philosophy favor it—but still not the subjective moral end of our action. Abundant psychological facts prove this. The mental functions, like the physical functions, give pleasure in the result only as each acts upon its own appropriate object, and it loses both its effectiveness and its hedonic quality as soon as the pleasure which accompanies its exercise is turned into the object. This is peculiarly so of the will. This anti-Hedonistic view seems to get support also from the moral consciousness which sometimes enjoins acts which appear to minister to nobody's happiness. See Moral Philosophy.

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(2 vols., London, 1892); Spencer, *Principles of Psychology* (2 vols., London and New York); against Hedonism, Martineau, *Types of Ethical Theory* (2 vols., Oxford and New York, 1886); Sidgwick, *Methods of Ethics* (3d ed. London and New York, 1890); James, *Principles of Psychology* (2 vols., London, 1890–91); Baldwin, *Handbook of Psychology* (2 vols.; 2d ed. New York and London, 1890–91).

J. Mark Baldwin.

**Heer**, hār, Oswald: Swiss phytopalæontologist; b. at Nieder-Utzwyl, Switzerland, Aug. 31, 1809; educated at the University of Halle; entered the ministry in 1831; privat docent in Botany in the University of Zurich (1834–52); afterward Professor of Botany in the university. Among his numerous publications are *Flora Tertiaria Helvetiæ* (1855–59); *Tertiary Climates in their Relation to Vegetation* (1860); *Flora Fossilis Helvetiæ* (1877); *Flora Fossilis Arctica* (1865–83). D. in Lausanne, Sept. 27, 1883.

Charles E. Bessey.

**Heeren**, hā'ren, Arnold Hermann Ludwig: historian and philologist; b. in Arbergen, near Bremen, Oct. 25, 1760; became Professor of History at Göttingen. Chiefly noted as the author of still valuable works entitled *Ideen über die Politik, den Verkehr und den Handel der vornehmsten Völker der alten Welt* (vol. x.–xv. of his collected historical writings), and *Handbuch der Geschichte der Staaten des Alterthums* (5th ed., 1828). His dissertations on the sources of Trogus Pompeius (Justinus), Plutarch's *Lives*, Strabo, and Ptolemæus are now superseded. He died at Göttingen, Mar. 6, 1842.

Alfred Gudeman.

**Hefele**, hā'fe-le, Karl Joseph, von, D. D.: Roman Catholic Bishop of Rottenburg, Würtemberg; b. at Unterkochen, Mar. 15, 1809; studied at Tübingen; was privat docent in 1836; professor extraordinary 1837, and in 1840 Ordinary Professor of Church History, Archæology, and Patrology in the Roman Catholic faculty of Tübingen. In 1869 he was made bishop. His edition of the *Apostolic Fathers* (1839); *Review of Wessenberg's Church Councils* (1841); *History of the Christian Councils* (1855–74, 7 vols.; 2d ed. 1873–90); *Pope Honorius, Cardinal Ximenes* (1851; trans. into English by Dalton, 1860); *Contributions to Church History*, etc., gave him wide fame as a profound scholar. He was a member of the Vatican Council, and voted with the minority against papal infallibility, but afterward submitted. D. in Rottenburg, June 5, 1893. Revised by J. J. Keane.

**Hegel**, hā'gel, Georg Wilhelm Friedrich: philosopher; b. at Stuttgart, Aug. 27, 1770. He was descended from an old Suabian family which had migrated into Würtemberg from Carinthia shortly after the Lutheran Reformation, in order to secure religious freedom. His father was an officer under the ducal government. He entered the University of Tübingen in 1788 as a student of theology. He received the degree of master of philosophy in 1790, and on the occasion wrote a dissertation, *De limite officiorum humanorum seposita animorum immortalitate*, evincing the fact that he had begun to ponder the question of the Kantian dualism. He had made some acquaintance with the Wolffian philosophy as early as his fifteenth year. In 1790 Schelling, then in his sixteenth year, entered the university, and his precocious intellect seems to have awakened in Hegel a new activity. Hegel had read Rousseau at an early age, and was influenced by him quite strongly, as, indeed, were Kant and most other German thinkers. The philosophy of Kant and his successors may be regarded as a speculative reaction against the tendencies that led to the French Revolution. Goethe's *Faust* portrays the same reaction in literature. In 1790 Young Germany looked for the social regeneration of Europe. "Liberty, equality, and fraternity" were the magic words of the time. Hegel took part in a political club formed for the dissemination of French ideas. In 1793 he left the university, and became a private tutor in a family in Berne. He passed this epoch of his life in a quiet and studious manner, gradually departing from the ideas he had received at Tübingen, and beginning seriously to grapple with the problem of human responsibility, and to feel distinctly the want of a fundamental principle that should subordinate both the theoretical and practical phases of life. He wrote a life of Christ; studied Kant more thoroughly; was charmed by the theories of Benjamin Constant; finally bent all his strength upon the mastery of Fichte's *Science of Knowledge*, which just then appeared. His correspondence with Schelling assisted him in gaining an insight into the subtle psychological analysis of Fichte. Schelling had been aroused by the *Science of Knowledge*, and he stormed, Titan-like, the subjective limits which Fichte in the spirit of Kant placed to the validity of his theoretical principles. The universal and necessary truths which, according to the critical system, demonstrated the subjectivity of all our knowledge, seemed to Schelling to establish its objectivity; for they are not universal and necessary unless they are the necessary conditions of the existence of objects in time and space. With this view he attempted to construe the world of nature *a priori* by means of transcendental ideas. Self-consciousness revealed the hidden laws and principles implicit in the ordinary knowing, and these laws and principles, drawn out of the unconscious activity of the mind, were identified with the moving forces of nature, and thus came to be attributed to an impersonal Reason, a Soul of the World. Schelling departed further and further in this direction during his first career, and developed a system in strong contrast to that of Fichte, which laid all stress on the conscious Ego and the free moral will. There was no necessary incongruity in the two systems, except what arose from one-sidedness, due to the intense emphasis given to the opposite poles of this philosophy; Fichte emphasizing the self-conscious Ego and the moral will, and subordinating all else as merely phenomenal and scarcely worthy of human investigation; while Schelling turned to nature and history as the unconscious realizations of spirit in time and space, and hence worthy of all study, as though charged with the fullness of divine incarnation. Fichte slighted time and space, and hence everything real and conventional—institutions, beliefs, systems; the world, in short. He was ascetic, subordinated the world to the soul, somewhat as did George Herbert or Thomas à Kempis. Schelling looked upon the world as the revelation of the Absolute, and held it sacred, while subjectivity became less and less important in his eyes, and as a consequence morality and practical aims and endeavors lost their interest for him.

Through the assistance of his friend Hölderlin, Hegel obtained a situation in 1797 as tutor in Frankfort, the birthplace of Goethe. His interest in philosophical studies increased. He studied Plato and Sextus Empiricus, and began to seize the objective dialectic into which he could translate the psychological process of Fichte. In 1799 his father died, leaving him some property, and in 1801 he removed to Jena, the center of literary activity at that time. Fichte had recently gone to Berlin, having been dismissed from Jena on account of complications arising from the charge of atheism made against him. Schelling was there as professor extraordinarius. Hegel lectured on logic and metaphysics, the philosophy of nature, and the philosophy of spirit. In 1805 he lectured on the history of philosophy, pure mathematics and natural rights; in 1806, on the unity of philosophical systems and the phenomenology of spirit. Up to this time he had been a follower of Schelling, with whom he had edited *The Critical Journal of Philosophy* four years before. His own system begins to reveal its outlines at this period: I. Logic or science of pure thought or Reason—universal ideas applying to nature and mind alike; II. Philosophy of nature, treating of the realization of Reason in time and space; III. Philosophy of man as finite spirit; rising through Religion to the Absolute or Pure Reason again, and thus completing the circle of philosophy. During this period his style evinced improvement, and his use of illustrations from Greek mythology gave to his abstractions a popular hold. He studied Goethe's philosophy of colors, and followed out the experiments indicated; reviewed Homer, and began to see the outlines of the process which includes the evolution of the world and as Providence guides human history. Schelling had removed to Würzburg in 1803. Hegel had for four years been clearing up in his mind the relation of his own results to the presuppositions of Schelling. The relation of Fichte, as subjective idealist, to Schelling, as objective idealist, he had already defined in *The Critical Journal of Philosophy*. He now was ready to define his own relation toward Schelling. In the *Phenomenology of Spirit*, published in 1807—a work which he called his "voyage of discovery"—he undertakes to trace the history of consciousness in its growth from the first stages of culture up to the theoretical and practical conviction which underlies modern civilization. In the preface to this work he attacks the "immediate intuition" of Schelling, and shows that thought or knowledge without mediation is entirely empty. He employs in this "voyage of discovery" a dialectic method as strict as that of Fichte, but used objectively—as the necessity of the object under consideration, rather than as a mere subjective necessity

of thought. Conseiousness in the stage of simple sensuous knowing is proved to know nothing immediately. Its first pereeption is shown to be a meditated one, depending upon inferenee, which is made implicitly or unawares. Further analysis reveals the presupposition upon which the inferenee involved in pereeption is based; this inference is found to be not subjeetive alone, but to correspond to an objective activity of mediation, which is seen to be the neeessity of the objeetive world, and is named *Force* by the consciousness. Herewith the reflective stage of consciousness begins, or the realm of understanding. The presupposition underlying Force is investigated; it is a unity in multiplicity, self-united in its utterance; force in expending itself manifests its unity in all its effects. This dualism ( force and manifestation) involves further the dualism of each of its sides, and thus we have the internal duality as Law on the one hand, and the external duality as Phenomena on the other hand, containing foree and manifestation. In natural law eonsciousness perceives an ideal type or form, which as internal and ideal measures and shapes the phenomenal world. Law is not abstract unity, but it includes in itself difference, multiplicity. The difference in the law is ideal and posited through the unity, which, again, is unity only as revealing itself in self-opposition—in other words, the ultimate presupposition of law is self-determination. Beyond self-determination analysis does not proceed, for no higher principle is presupposed; all its determinations (characteristics, properties, and attributes) are products of its own aetivity. Herein consciousness recognizes the image of itself; it has traced up the external world to its internal truth, self-determination (or "subject-objectivity," as Fichte named the Ego), an internal, essentially aetive, and self-opposed being; the Ego is such an aetivity as exists in self-opposition or as subject and object at the same time. Thus the objective has been traced back to an Ego, or spiritual personality (God) as its necessary essence, and in the contemplation of this essence of the world conseiousness finds itself eontemplating its own prototype, and beeomes self-consciousness. It mnst be understood that the mind makes all this experience in its prehistorie stages of culture, eontemporaneous with its formation of language, but in a naïve, uneonscious manner, having no philosophic knowledge of its method. It eomes to a seientific knowledge of the course it has trodden only after thousands of years. The result of human experience, wherein it arrives at self-conseiousness, is only a conviction, not a scientific idea. Hegel proceeds in the remaining part of the *Phenomenology* to trace out the neeessary stadia of history by which man realizes this conviction in institutions, beginning with the patriarchal one of slavery. In the subtlest manner he shows how the mind reflects upon an institution as soon as realized, and elevates itself to a new realization, making at each step its unconseious conviction more and more a conventional, universally recognized conscious principle, enunciated in its revealed religion, portrayed in its art and poetry, organized in its state, civil soeiety, and family, and finally generalized in its science. Hegel's philosophy is all contained *in nuce* in the *Phenomenology*, and in some respects this work is the best example of his method of dialectieal proeedure. His entire system may be regarded as the philosophy of civilization, or as the demonstration of the personality of the Absolute and an exhibition of His revelation in the world of time and spaee.

The *Philosophy of Nature* attempts to exhibit the return from pure empty externality—time and spaee, or the pure form of God's Not-me—through the meehanieal and dynamical phases of matter, up to organized life as a phenomenal appearance of self-determined being. The *Philosophy of Spirit* attempts to show the development from mere conseiousness (whieh is *real* self-determining being, instead of the phenomenal appearance of it in the animal, whieh is nature's highest being) up to the realization of this subjective conscionsness (which exists in the savage only as a mere possibility) in objective institutions, family, society, state, and church, with codes of laws and morals, ceremonials, and conventionalities, as well as in theoretical presentations in art, literature, and science.

To this vast undertaking he devoted the rest of his life. Closing his lectures at Jena, Sept. 18, 1806, on the occasion of the approach of the French, he repaired early in 1807 to Bamberg, where he edited a political newspaper until the autumn of 1808, when he took charge of a gymnasium at Nuremberg. Here he remained eight years; he was married Sept. 16, 1811, to Marie von Tucher. He elaborated and expounded his *Science of Logic* (1812–16) in three volumes, presenting in it the science of pure thought or the fundamental basis of his entire system. Its divisions are three: I. Being, or Immediateness; II. Essence, or Mediation; III. Idea, or Notion (*Begriff* and *Idee*), or Absolnte Mediation. It may be called a search for the true first principle by an examination of the content of abstract ideas, commencing with the simplest and most empty—to wit, pure being, which is so abstract and inadequate as to be the same as nothing—and proeeeding by the method of discovering presuppositions up to the highest idea, which he names *The Idea, par excellence*, as it is the thought of a self-subsistent personality, a self-object, a Creator who creates nature or the world as his Image. The outline of the philosophy of nature he presented in the *Encyclopædia of Philosophical Sciences* in 1817, at Heidelberg, whither he had gone in Oct., 1816, to assume a professorship in the university. The principle of evolution in nature is the inadeqnateness of externality to manifest personality. Each lower phase of nature presents us the phenomena of a struggle to reach the realization of the three constituent phases involved in personality. Each higher phase achieves what the next lower one was most deficient in. The vertebrate animal is the summit of nature. The generic appears in him *ideally* as instinct (but not as Ego), and *really* as the process of reproduction. But no individual animal, as such, is more than half a personality, so to speak, being either male or female, and becoming whole only in the generic act. With consciousness appears personality, as incarnated in the world, and a new world, that of spirit, begins. In the world of spirit each individual soul is a monad—the generic entering it as Ego, and thereby constituting an immortal individual. Where the generic is only instinct, as in the animal, there is born as yet no *self*. The species lives, but the individual dies. Human beings are, as animals, sexual and only half-persons, hence mortal. But as conscious Egos each is a totality and the possibility of the entire race. Henee the human being proeeeds to realize this possibility through the creation of symbols and language, scienee and institutions—family, society, state, and ehurch—in each of which he portrays for himself his generic nature, some phase or phases of the Absolute, so as to make it possible for the mere individual to participate in the life of the raee, of the generic, of the Absolute. Culture or education is the name of the process of initiation of the individual into this heritage. The whole raee is thus made to live vicariously for each man, and by theoretical participation each one avails himself of the life of the whole, without being obliged actually to suffer the penalties of living experience. This point is of the greatest importance as the transition from nature to spirit, and has been overlooked by countless students of Hegel, who have for this reason interpreted his doctrines pantheistieally as a genial naturalism.

The *Philosophy of Spirit*, which is the third part of Hegel's system, attempts to trace out in its details this self-emaneipation from nature and history, and is the labor of his Berlin period, whieh began Oet. 22, 1818. He was ealled to the chair of Fichte by the minister von Altenstein. In 1821 he published his *Philosophy of Rights*, containing the scienee of jurisprudence, morals, and politics. The eonstitutional monarchy is held by him to be the highest form of government. In the following years he wrote his *Æsthetics*, published after his death, in three volumes, treating of the three epochs of art—symbolic (Oriental), classic (Greek and Roman), and romantic (Christian)—as well as of the speeial arts, architecture, sculpture, painting, music, and poetry. The lectures on the philosophy of history were written in 1822–23, and delivered with modifieations five times. Aeeording to Hegel, the history of the world narrates the progress of humanity into a conseiousness of freedom. A series of lectures on the proof of the being of God were delivered by him in 1830. While engaged on a new edition of his complete *Logic*, having finished the revision of the first volume, he died of cholera, Nov. 14, 1831.

His complete works were edited, and in some cases compiled, from notes taken at his lectures, by his disciples Marheineke, Schulze, Gans, von Henning, Hotho, Michelet, Förster, and Boumann. They included the writings of the Schelling period (1 vol.), the *Phenomenology of Spirit* (1 vol.), *Science of Logic* (3 vols.), *Outlines of the Philosophy of Rights* (1 vol.), *Philosophy of History* (1 vol.), *Æsthetics* (3 vols.), *Philosophy of Religion* (2 vols.), *History of Philosophy* (3 vols.), miscellaneous writings (2 vols.). To these should be added the *Life* of Hegel by Rosenkranz. Access to Hegel's system through English translations and original

expositions is quite ample. A partial analysis and paraphrase of the first chapters of the third volume of the *Science of Logic* was published in London (1855), under the title of *The Subjective Logic of Hegel*, translated by H. Sloman, Dr., and J. Wallon; *Lectures on the Philosophy of History*, translated from the third Germ. ed. by J. Sibree (Bohn's Library, London, 1857); *The Logic of Hegel*, with prolegomena, by William Wallace (Oxford, 1874; containing vol. i. of the *Encyc. Phil. Sci.*); *The Secret of Hegel, being the Hegelian System in Origin, Principle, Form, and Matter*, by James Hutchison Stirling (2 vols., London, 1865; contains a translation of a portion of the first volume of the *Logic*, with full commentary); *General Principles of the Philosophy of Nature, with an Outline of some of its Recent Developments among the Germans, embracing the Philosophical Systems of Schelling and Hegel, and Oken's System of Nature*, by J. B. Stallo (Boston, 1848; contains a concise but genial exposition of Hegel's entire system); *The Science of Thought, a System of Logic*, by Charles Carroll Everett (Boston, 1869; contains an original exposition and justification of a system substantially identical with Hegel's *Logic*); *The Nation: the Foundations of Civil Order and Political Life in the United States*, by E. Mulford (New York, 1870; contains an original exposition and discussion of positions substantially agreeing with Hegel's *Philosophy of Rights*); *The Logic of Hegel, a Critical Exposition*, by W. T. Harris (Chicago, 1890), attempts to show the genesis of the categories of the mind according to Hegel; *The Philosophy of Religion*, by John Caird, is a valuable introduction to his thought; *Hegel*, by Edward Caird, expounds his doctrines and gives a sketch of his life. *The Ethics of Hegel*, by J. Macbride Sterrett, contains the *Philosophy of Rights*, partly translated, partly in analysis. In *The Journal of Speculative Philosophy* (St. Louis and New York, 1867–94) have appeared translations of Bénard's *Analysis of Hegel's Æsthetics*; of chapters from the *Phenomenology of Spirit*, with analysis and commentary; of the *Philosophical Propædeutic* (written at Nuremberg) *on Rights, Morals, and Religion*, the outlines of *Logic* and the *Phenomenology*; of the chapters in the *History of Philosophy* on Plato and Aristotle; of the chapter on *Chivalry* from the *Æsthetics*; of the greater part of Rosenkranz's *Hegel as the National Philosopher of Germany* (written in 1869 for the centennial anniversary of Hegel's birthday); of Trendelenburg *On the Logical Question in Hegel's System*; of Michelet and von Hartmann on *Hegel's Dialectic*; besides original articles on different phases of Hegel's system, and in particular an extended *Introduction to the Speculative Philosophy and Logic*, by A. Vera (an attempt at popular presentation of Hegel's point of view, of Hegel's *Philosophy of Religion*). The best history of the Hegelian school is to be found in Erdmann's *Grundriss der Geschichte der Philosophie*. See articles on PHILOSOPHY, FICHTE, SCHELLING, and KANT.

WM. T. HARRIS.

**Hegelund**, hā'ge-loond, PEDER JENSEN: dramatist; b. in Ribe, Jutland, Denmark, June 9, 1542. After studying at the University of Copenhagen, he spent several years in Germany, taking the master's degree at Wittenberg. In 1569 he became rector of the school at Ribe; 1580, lector in theology; 1588, dean of the cathedral; and 1595, bishop. While rector he undertook the translation of Latin dramas, to be performed by his scholars. In 1576 his translation of Xystus Betulejus's *Susanna* was acted in Ribe, and published the following year, together with an original poem entitled *Calumnia seu Diabola personata*, one of the earliest allegorical works in Danish literature. The translation contains a number of additions, mostly humorous, by Hegelund. His other dramas are lost. D. Feb. 18, 1614.

D. K. DODGE.

**Hege'sias** (Gr. Ἡγησίας): Greek orator; b. at Magnesia, Mt. Sipylus; flourished about 280 B.C. Hegesias was the founder of the Asiatic school of oratory, characterized by short sentences without periodic structure, by unnatural position of words, and by far-fetched and high-flown phraseology. Boeckh thinks that PAUSANIAS THE PERIEGETE (*q. v.*) represents this school. B. L. GILDERSLEEVE.

**Hegesip'pus**: a name sometimes given as that of the author of a Latin revision of Josephus's *History of the Jews*, but it is probably only a manuscript corruption of the name Josephus itself ("Ex-Josippo" misread Egesippus), and the version is probably the work of Ambrose, Bishop of Milan, in the latter half of the fourth century. See Weber and Cæsar, *Hegesippus qui dicitur de bello Judaico* (Marburg, 1864), and Rönsch, *Die lexicalischen Eigenthümlichkeiten der Latinität des sogen. Hegesippus* (1882). M. WARREN.

**Hegesippus**: "father of Church history"; ecclesiastical writer, second century; probably a Palestinian Jewish convert. Only fragments of his works are preserved (trans. in vol. viii. of the *Ante-Nicene Fathers*).

**Hegira**: See HEJIRA.

**Hegius**, ALEXANDER: See the Appendix.

**Heiberg**, hī'bārch, JOHAN LUDVIG: writer; son of Peter Andreas Heiberg; b. at Copenhagen, Dec. 14, 1791. After his mother's second marriage he lived with her till her death. On graduating he studied medicine for two years, but abandoned it for *belles-lettres*, and in 1817 took the degree of doctor of philosophy; was uncertain what profession to follow until in 1819 he received a traveling stipend, and spent over two years in Paris with his father, studying literature, especially the French drama, and music. In 1822 was appointed Professor of the Danish Language and Literature at the University of Kiel, where, in spite of his dislike of the place, he remained till 1825, when he settled in Copenhagen. During this period he became acquainted with Hegel's philosophy, which he vainly attempted to popularize in Denmark. He was the author of the first work on the subject published in Danish, *Om den menneskelige Frihed* (Concerning Human Freedom, 1824). His greatest service to Danish literature, however, was the introduction of the French vaudeville. His first attempt, *Kong Salomon og Jörgen Hattemager* (King Solomon and Jörgen the Hatter, 1825), was enormously successful, and this was followed by a number of others, of which *Aprilsnarrene* (April Fools, 1826) is still one of the most popular plays in Denmark. In 1828 Heiberg wrote *Elverhöi* (The Elves' Hill), the music by Kuhlau, a national romantic drama. The following year he was appointed poet and translator at the Royal theater, and in 1849 sole director. In 1831 he married the actress Johanne Louise Pætges, whose memoirs, published in 1892, shortly after her death, give much valuable information about Heiberg's private life. In addition to his plays and poems, Heiberg wrote many critical essays, of which the most important is *Om Vaudevillen som dramatisk Digtart* (Concerning the Vaudeville as a Branch of Dramatic Art, 1827). He also engaged in the Oehlenschläger-Baggesen discussion. (See OEHLENSCHLÄGER.) From 1827, when he established *Köbenhavns flyvende Post* (Copenhagen's Flying Post), he exercised a great influence on Danish literary taste. As a critic his judgment is keen, his style finished, his wit refined and piercing. As a poet he is as original and national, though not as rugged, as Holbay himself. D. near Ringsted, Seeland, Aug. 25, 1860.

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**Heiberg**, PETER ANDREAS: political writer and dramatist; b. at Vordingborg, island of Seeland, Denmark, Nov. 16, 1758; studied at the University of Copenhagen, in which city he afterward lived as a translator. He played a very conspicuous part in literary, social, and political life, but his liberal ideas were blended with a kind of revolutionary passion, and the scourging satire with which he attacked any kind of abuse was often mixed with scandal. In 1799 he was exiled, and went to Paris; received a position in the ministry of foreign affairs, and frequently was employed by Talleyrand in diplomatic negotiations. In 1817 he was pensioned, and spent the last years of his life in retirement; he was blind, and his beautiful and accomplished wife (afterward the Baroness Gyllembourg-Ehrensvärd) had not followed him in his banishment. His comedies, of which one, *Heckingborn*, has been translated into English, were much admired. Some of his songs and prose-writings, as, for instance, *The Life of a Dollar-bill*, are still interesting. D. in Paris, Apr. 30, 1841.

**Heidelberg**, hī'del-bārch: town; in the grand duchy of Baden, on the Neckar; 54 miles S. of Frankfort-on-the-Main (see map of German Empire, ref. 6–D); has one of the oldest and most celebrated universities of Germany (founded 1356; 1898, 1,462 students; library, 500,000 volumes; zoölogical museum, botanical garden, observatory). The old castle, built in the twelfth century, enlarged in the fourteenth and fifteenth, much injured by the French in 1688, and nearly destroyed by fire in 1764, forms a very interesting and picturesque ruin. In the cellar is the famous "Heidelberg cask," which holds 236,000 bottles. The manufactures of Heidel-

berg are very varied, comprising tobacco, madder, ultramarine, and other dyestuffs, optical, surgical, and musical instruments, paper, Portland cement, and leather; and its trade, especially in wine, is extensive. At an early period the city was a fief of the Bishop of Worms, till Count Otho of Wittelsbach (1228–53) made it the capital of the Palatinate, which it continued to be for nearly five centuries. It was in 1720 that Charles Philip removed his court to Mannheim. Pop. (1895) 35,195. The location of the city is most beautiful. Revised by C. H. Thurber.

**Heidenhain**, hī'den-hīn, Rudolf Peter Heinrich, M. D.: physiologist; b. in Marienwerder, Prussia, Jan. 29, 1834; educated at Universities of Königsberg, Halle, and Berlin; professor in Breslau since 1859. He has published *Physiologie der Absonderungsvorgänge* (1880); *Der sogen. tierische Magnetismus* (1880); *Vivisection* (2d ed. 1884); *Histologie und Physiologie der Dünndarmschleimhaut* (1888); and other works. C. H. T.

**Heights, Measurement of**: See Hypsometry.

**Heilbronn**, hīl-brōn': town of Würtemberg, Germany; on the Neckar; 33 miles by rail N. of Stuttgart (see map of German Empire, ref. 7–D). It is a curious old place, with narrow and crooked streets, and high, quaintly ornamented houses. Among its public buildings the Church of St. Kilian (built 1013–1529), the city-hall, and the tower in which Götz von Berlichingen was imprisoned in 1529, are the most remarkable. Its trade is brisk, and it has manufactures of chemicals, woolen cloth, gold and silver ware, cutlery, and musical and scientific instruments. Pop. (1890) 29,941.

**Heilbuth**, hīl'boot, Ferdinand: genre-painter; b. in Hamburg, Germany; naturalized in France; awarded second-class medals, Salons of 1857, 1859, and 1861; became officer Legion of Honor 1881. His pictures, both in oil and water color, are delightful in color, and those of his later years depict generally scenes in modern society in France, the background for the personages being usually landscape motives. One of his earlier pictures, *Mont-de-Piété* (1861), is in the Luxembourg Gallery, Paris; *On Monte Pincio* is in the Corcoran Gallery, Washington. D. in Paris in 1889. W. A. C.

**Heilprin**, Angelo: See the Appendix.

**Heim**, *hăn*, François Joseph: historical painter; b. at Belfort, France, Jan. 15, 1787; pupil of Vincent; awarded Grand Prix de Rome 1807; first-class medal, Salon, 1812; became member of the Institute 1829; officer Legion of Honor 1855; awarded medal of honor, Paris Exposition, 1855. He was prominent among the Classicists in their struggle with the Romantic school of 1830. Examples of his works are ceilings in the Louvre; *Charles X. Distributing Recompenses at the Salon of 1824*, in the Louvre; and several important paintings in the Versailles Museum. D. in Paris, Oct. 20, 1865. W. A. C.

**Heim'dall**, or **Heimdallr**: the watchman of the Asas, or Scandinavian gods; son of Odin by a mother of the Jotun race. He has golden teeth, rides a horse with a golden mane, can see by night as well as by day, and beholds everything within a hundred leagues. He can hear the growing of the grass, and even that of the wool on sheep. He dwells in the bright Himinbjorg, at the place where the rainbow-bridge enters heaven. When danger approaches he blows the great trumpet Gjallar-horn so loudly that the whole universe can hear. See Scandinavian Mythology.

**Hei'ne**, Heinrich: poet and wit; b. at Düsseldorf, of Jewish parentage, Dec. 12, 1799; was early sent to Hamburg to his uncle, the banker, Salomon Heine, to prepare himself for commercial pursuits; but as he utterly disliked business, he went in 1819, with his uncle's consent and support, to Bonn to study law. After a short stay in that city, during which he became quite intimately acquainted with A. W. Schlegel, he proceeded to Berlin, where Schlegel's letters introduced him to the celebrated literary circle which gathered around Rahel Levin, and which was frequented by Hegel, Chamisso, Grabbe, and others. Here he studied literature and philosophy, and published his first book, a volume of poems, in 1822. The poems were hardly noticed, however, and the young poet, disappointed and disgusted, left Berlin for Göttingen, where, after two years' unwearied study, he took his degree in law in 1825. Once more he returned to Berlin, and published his two tragedies, *Almanzor* and *Radcliff*, but this second attempt was still more unsuccessful than the first had been, though his peculiar talent can already be detected in these early attempts. It was his *Reisebilder*, published in Hamburg in four volumes, from 1826 to 1831, which first attracted public attention. They made quite a sensation at their first appearance. The audacity with which the author ridiculed the weaknesses of the social, political, and literary life of his time, the malice, wickedness, and deviltry of the book, amazed people, at the same time that they were charmed by its vivacity, sprightliness, elegance, and brilliant wit. But while the contents of the book were rather sensational at the time, its literary form was only a continuation of the type of Sterne's *Sentimental Journey*, and it certainly can not be classed among the works of art. As a clever bit of journalism it has, however, not failed to exert a great influence upon journalistic literature in Germany. Next year he published *Das Buch der Lieder*, in which he inserted the greatest part of his earlier poems from 1822; and this book made him at once the most widely read author in Germany. There was a new sense of beauty in these poems, and in consequence people became almost intoxicated, and seemed to forget how much of his success Heine owed to a studied and most clever imitation of popular songs, such as he found in *Des Knaben Wunderhorn*. From 1827 to 1831 Heine resided partly in Munich, where he edited *Politische Annalen* with Lindner; partly in Berlin, where he fell out with Platen and enriched the German literature with a piece of polemics to which no other literature has an equal, either in scandal or in wit; and partly in Hamburg. The revolution of July put him in a sort of democratic frenzy; and as it perhaps was not very safe for him to live in Germany after the publication of *Kahldorf über den Adel, in Briefen an den Grafen M. von Moltke* (Hamburg, 1831), he removed in that year to Paris, where he resided with some short interruptions for the rest of his life; he died there Feb. 17, 1856. From 1836 to the fall of the cabinet of Guizot in 1848 he received an annual pension from the French Government of 4,000 francs. In Paris he also married or rather bought his "common-law" wife, Mathilde, for 3,000 francs. From 1847 he was for the most time bedridden, suffering from a disease of the spine, which also affected his eyes. During the first part of his residence in Paris he developed a great literary activity. But all that he wrote was only a repetition of the two original types with which he began—*Buch der Lieder* and *Reisebilder*—and he who knows those two books knows Heine. The principal books written in Paris were *Neue Gedichte* (1844); *Atta Troll* (1847); *Romanzero* (1854); *Beiträge zur Geschichte der neuern schönen Litteratur in Deutschland* (1833); *Französische Zustände* (1833); *Der Salon* (1834–40); *Die Romantische Schule* (1835); *Ueber Börne* (1840); *Vermischte Schriften* (1854). While Heine was certainly a writer of remarkable talent, his poetical genius has frequently been overestimated. As a satirist without an equal in German literature, the German nation doubtless owes him very much as a fearless and merciless fighter for freedom in a mentally narrow and politically oppressed time. His influence on German poetry, however, must be considered anything but wholesome. Though he is able to express the most tender feelings of the human heart, he more frequently mocks in a frivolous manner at the most sacred of our emotions, and displays a want of and disregard for moral and artistic convictions.

See Strodtmann, *H. Heines Leben und Werke* (1884); Proelss, *H. Heine* (1886); Brandes, *H. Heine in Litteratur des 19. Jahrh.* (Band vi.); Matthew Arnold, *Essays in Criticism.* Revised by Julius Goebel.

**Hein'sius**, Antonius: grand pensionary of the Netherlands; member of an old family of Leyden, Holland; b. in that city Dec. 22, 1641. When William of Orange ascended the English throne, Heinsius became the real governor of Holland, and he acted in this position with great success and in perfect harmony with his royal master. He was, if not the creator, a most energetic promoter, of the grand alliance between Great Britain, Holland, Hanover, Denmark, Prussia, Austria, and Savoy against Louis XIV., and it was to him, as the real soul of the alliance, that Louis XIV. made overtures of peace in 1708, 1709, and 1710. But the negotiations were every time broken off on account of the enormous and humiliating sacrifices which Heinsius demanded of France, and to which he clung most doggedly. A caprice of Queen Anne, however, changed the whole situation, and as at the same time the French became successful once more in the field, the Peace of Utrecht was concluded Apr. 11, 1713. Heinsius signed it, but he was the last to do it. D. at The Hague, Aug. 3, 1720. See *Het Archief van den raad-pensionaris Antonius Heinsius* (Haag, 1867).

**Heinsius**, Daniel: classical scholar; the favorite disciple of Joseph Scaliger; b. at Ghent, June 9, 1580; became professor at Leyden 1605. Himself a Latin poet of distinction, he edited a great number of the classic poets, e. g. Hesiod, Theocritos, Horace, Vergil, Terence, and Ovid, which are distinguished by a profound knowledge of poetic diction and the critical acumen therein displayed. D. Feb. 25, 1655.—His son, Niklaas (b. July 20, 1620; d. Oct. 7, 1681), inherited his father's critical talent, and edited Ovid (his best work), Claudianus, Silius Italicus, Valerius Flaccus, Prudentius, Petronius, Vellcius, Curtius, and Tacitus. He never occupied any academic chair, but spent most of his life as a diplomat, being for many years in the service of Christine of Sweden. See L. Müller, *Geschichte der class. Philologie in den Niederlanden*, p. 38 f., 51–54.

Alfred Gudeman.

**Heint'zelman**, Samuel Peter: soldier; b. in Manheim, Lancaster co., Pa., Sept. 30, 1805; graduated at West Point, and became second lieutenant of infantry July, 1826. For twenty years he served principally on the northern frontier and in the Florida war. In 1847–48, a captain, he served in the Mexican war, and was breveted a major Oct. 9, 1847, for gallantry at Huamantla. He attained a majority in 1855, and as brigadier-general of volunteers commanded the forces which captured Alexandria, Va., May 24, and took part in the first battle of Bull Run, July 21, 1861, where he was wounded. In the Virginia Peninsular campaign of 1862 he commanded the Third Army-corps before Yorktown, April–May, and at the battle of Williamsburg May 5. Promoted to be major-general of volunteers from the date of the latter battle, he commanded the Third Corps at Fair Oaks May 31, June 1, and in the "Seven Days'" fight. At the second battle of Bull Run (Aug., 1862) he was engaged; also present at Chantilly Sept. 1. From Sept. 9, 1862, to Feb. 2, 1863, he was in command of the defenses of Washington, and the Twenty-second Army-corps Feb. 2 to Oct. 13, 1863; and from Jan. to Oct., 1864, commanded the northern department, embracing the States of Ohio, Michigan, Indiana, and Illinois; subsequently on court-martial duty till Aug., 1865, when he was mustered out. Brevet brigadier-general and major-general U. S. army for gallant conduct in battle. In Feb., 1869, he was retired from active service with the full rank of major-general. D. in Washington, D. C., May 1, 1880.

Revised by James Mercur.

**Heir** [M. Eng. *heire*, from O. Fr. *heir*, *hoir* > Fr. *hoir*: Ital. *erede* < Lat. *hēres*, heir]: at the common law, one who is entitled by law to succeed to the real estate of a deceased person who dies without a will, or who leaves property undisposed of by his will. The name is only strictly applicable after the ancestor's death; still, it is sometimes used in a secondary sense, to designate specified persons, during the ancestor's life. Personal estate does not pass primarily to an heir, but is received by the administrator, to be distributed among the next of kin, according to definite rules of apportionment, after the satisfaction of debts and other proper charges. (See Administration.) But the rights of heirs appertain to all forms of real estate, tangible or intangible, in possession or in expectancy, and are vested in them immediately upon the occurrence of death, without any formality of transfer or acceptance. Hence it is a legal principle that no man can make another his heir, since heirship exists independently of any individual creation, and depends solely upon the ties of nature and established rules of law. Property passing to an heir is said to be acquired by descent, while all other modes of obtaining title to land are denominated, in law, acquisitions by purchase. An ancestor is under no obligation to refrain from disposing of his real estate in order that his heir may not be deprived of his prospective interest therein, but may, if he desires, devise it entirely to third persons in his will. This rule, however, is sometimes modified by statute. When the heir is vested with the real estate, he does not take it absolutely, discharged of all the claims of creditors, but subject to their right to levy upon it, as if the ancestor were living, in case the avails of the personal property are not sufficient for the payment of debts. The question as to what relatives shall constitute the heirs of an intestate is determined upon different principles in England and the U. S. It is the policy of the law of Great Britain to keep landed estates undivided, and inheritance is therefore governed by the law of Primogeniture (*q. v.*). The eldest son and his descendants have the superior claim to the property, and in default of these the second son and his descendants receive the title, and so on with the other sons if there be any in the family. If there be only daughters, they all inherit equally by virtue of the doctrine of coparcenary. In the U. S. no preferential claim is given to any one of the children above the others, and all share the inheritance equally, being generally considered tenants in common. If there be no children living or their descendants, the other blood-relatives who are nearest in degree inherit the property according to rules prescribed by statute. (See Descent.) When there are no heirs of the deceased the property escheats to the State.

An *heir-apparent* is one whose right of succession is indefeasible in case he survive his ancestor; as, for example, the eldest son under the English law of inheritance. An *heir-presumptive* is one who would succeed if the ancestor were to die immediately, but whose right may be displaced, if the ancestor live, by the coming into existence of another as heir. Thus in England an only daughter would be heir-presumptive until a son were born. So a brother would be an heir-presumptive until the birth of a child.

The necessity of using the word "heirs" in conveyances of land is considered under the topic Fee. In Scottish law the term *heir* includes those who succeed to the personalty as well as those who succeed to the realty. For the difference between *heir* at common law and *hæres* or *heir* in works on the Roman and civil law, see Hæres.

Revised by F. Sturges Allen.

**Heir'looms** [liter., instruments or implements handed down to an heir; *heir* + *loom* < M. Eng. *lome* < O. Eng. *gelōma*, implement, tool]: personal chattels which go, by force of a special custom, to the heir, along with the inheritance, and not to the executor or administrator of the former owner, as the usual laws for the disposition of personal property would require, such as charters and deeds evidencing the title to the land, together with the receptacles in which they are deposited. The term "heirloom" is frequently employed in English law as applying to pictures, plate, or other articles of property which have been directed by deed of settlement or conveyance in trust to pass, subject to the same limitations as some mansion-house or estate thereby conveyed. These, however, are not heirlooms in the strict sense of that term, for they belong absolutely to the first person who takes a vested estate of inheritance in the real estate with which they pass, and if he dies intestate pass to his personal representatives and not to his heirs. Heirlooms proper and these quasi heirlooms (so long as they remain subject to the limitations) are governed by the same rules of descent as the land to which they are attached. The law concerning heirlooms is confined to English jurisprudence.

Revised by F. Sturges Allen.

**Hej'ira, Hedjirah**, or, less properly, **Hegirah** [from Turk. *hejra*, from Arab. *hejira*, separation, departure; deriv. of *hajara*, quit, leave]: the term applied to the prophet Mohammed's secret escape from Mecca to Yatreb. Yatreb zealously adopted his faith (Islam), and changed its name to Medinet-el-nabi (city of the prophet). In 635 A. D., under the Caliph Omar, an assembly of the principal companions of Mohammed determined to adopt the year in which the Hejira occurred as year 1 of Mussulman chronology. They did not, however, begin the year from the day of the flight (Sept. 13, 622), but from Moharrem 1 (July 15, 622), the first day of the old Arabic year. The pagan Arabs had employed a lunar year of 354 days 8 hours 48 seconds, divided into 12 months of alternate 29 and 30 days, but with the addition every third year of a supplemental month (*naci*, delay, arrears), so that their time might somewhat agree with that of the Greeks and Syrians. Mohammed had suppressed this *naci*, though he retained the ancient names of the months. There is now consequently an annual difference of about 10 days 21 hours 48 minutes between the Christian and Mussulman years, and exact reduction of Christian to Mussulman dates, or *vice versa*, is a complicated matter. Where absolute exactness is not required, thirty-three Christian may be considered equivalent to thirty-four Mussulman years.

Edwin A. Grosvenor.

**Hel** [Icel., the abode of the dead, hell, hence, by personification, the goddess of the lower world. See Hell]: the Norse goddess of the dead; the daughter of Loke and Angerboda. She dwelt in Niflheim, under one of the roots of Ygdrasil, the mystic ash-tree. She rules over nine worlds in Niflheim. Her home is called Helheim, and the way thither, Hel-way, is long. Hermod traveled it in nine days and nine nights. Its course is always downward and northward. Odin visited Hel's domain when he rode down to

consult the vala in regard to the fate of Balder. See Scandinavian Mythology. Revised by Rasmus B. Anderson.

**Hel'amys** [Mod. Lat.; Gr. ἔλλός, fawn + μῦς, mouse]: a name sometimes given to *Pedetes capensis*, a South African rodent of the family *Pedetidæ*, also called jumping hare and grand jerboa. It is over a foot long, and can leap like a kangaroo—over 30 feet. It is nocturnal, can rapidly hide itself in the ground, and is exceedingly timid.

**Helbig**, hel'bich, Wolfgang: archæologist; b. in Dresden, Germany, Feb. 2, 1839; studied philology and archæology at Dresden, Göttingen, Bonn, and Berlin, and was secretary of the Institute for Arehæological Correspondence from 1866 till 1887. His published works are *Wandgemälde der vom Vesuv Verschütteten Städte Kampaniens* (Leipzig, 1868); *Untersuchungen uber die Kampanische Wandmalerei* (*ibid.*, 1873); *Die Italiker in der Po-ebene* (*ibid.*, 1879); *Das homerische Epos, aus den Denkmälern erläutert* (*ibid.*, 1884; 2d ed. 1887); *Führer durch die öffentlichen Sammlungen klassischer Alterthümer in Rom* (*ibid.*, 1891); *La Collection Barracco, etc.* (Munich, 1893).

**Hel'der, The**: a fortified town of the Netherlands; in the province of North Holland, on the Mars-Diep, which separates the mainland from the island of Texel, and at the northern terminus of the North Holland Canal; 51 miles by rail N. N. W. of Amsterdam (see map of Holland and Belgium, ref. 3–E). The great dike of the Helder, built of Norwegian granite and Belgian limestone, forms for 5 miles an artificial coast-barrier. The Helder, previously little more than a fishing-village, was strongly fortified in 1811, and made a naval station by Napoleon I., who called it his northern Gibraltar. The Government of Holland maintains here a naval establishment, with dry docks, etc. The difficulties of navigation of the Zuyder Zee caused the construction in 1820 of the North Holland Canal, from the Y at Amsterdam to the Helder. The naval victory of the Dutch under de Ruyter over the English was won here Aug. 21, 1673. Pop. (1890) 22,737.

**Hel'en** (in Gr. Ἑλένη): a daughter of Leda, who, being pregnant by her husband, Tyndareos, King of Sparta, was visited by Zeus in the shape of a swan. Leda laid two eggs, from one of which came Helen and Pollux (the children of Zeus), and from the other Castor (the son of Tyndareos). Helen was the most beautiful woman in all Greece. While still young her reputed parents took her with them to Delphi to consult the oracle as to whom she should marry. While there Theseus chanced to see her dancing and kidnaped and carried her to Athens, where he consigned her to the keeping of Æthra, his mother. Afterward she was rescued by Castor and Pollux while Theseus was in Hades, but, according to some, not before she had borne to him a daughter (Iphigenia or Hermione; accounts vary). Upon her return to Sparta she was sought in marriage by all the young men of rank in Greece, but Tyndareos finally gave her to Menelaus, who thus became King of Sparta. She bore to Menelaus a daughter, Hermione, and, according to some, also a son, Nicostratus. In pursuance of a decree of the gods, Paris went to Greece to get the wife promised him by Aphrodite in return for the apple of discord. Arrived in Sparta, Paris was introduced to Helen by Menelaus himself, who then went away on urgent business, leaving Paris in his palace as a friendly and trusted guest. But during his absence Paris seduced Helen, and sailed away to Troy with her and much treasure. This brought about the Trojan war, because all the suitors of Helen had entered into an agreement to defend Menelaus against any one who should injure him in his marital relations. Helen was in Troy throughout the war as the wife of Paris, and after his death she became the wife of Deiphobus, his brother. She assisted the Greeks in the capture of Troy, and returned with Menelaus as his wife to Sparta, which they reached only after eight years of wandering. According to one story it was only the phantom of Helen that Paris took with him to Troy, for the ship of Paris was driven by winds and waves to Egypt, where King Proteus, upon learning the facts of the case, detained both Helen and her treasure, and restored them both to Menelaus after the Trojan war. After the death of Menelaus Helen was banished from Sparta by her stepsons (although the throne and kingdom belonged to her and not to Menelaus), and fled to Rhodes, where she was hanged by her former friend Polyxo, because in causing the Trojan war Helen had brought about the death of Tlepolemus, Polyxo's husband. After her death Helen was married to Achilles in the island of Leuce and bore to him a son, Euphorion. Helen was always beautiful and young in spite of time and years, and inspired passion in the breasts of all without feeling it herself, and though possessed by many men she always retained fresh and unsullied her mysterious virginity. Throughout antiquity it was dangerous to attack the character of Helen, for beauty redeemed and sanctified her, because among the Greeks "beauty was a holy thing." In the Middle Ages Helen reappears in the myth of Dr. Faustus, who raises her from the dead and possesses her. In modern poetry she is the ideal beauty of the ancient Greeks.

Literature.—A. Lang, *Helen of Troy*; Landor, *Menelaus and Helen*; Marlowe, *Faustus*; J. A. Symonds's chapter on the *Women of Homer* in his *Greek Poets*, vol. i., chap. iv.; the learned article by R. Engelmann in Roscher's *Lexicon* under *Helena*. J. R. S. Sterrett.

**Hel'ena**: city (founded 1833); capital of Phillips co., Ark. (for location of county, see map of Arkansas, ref. 4–E); on the Mississippi river, and the Ark., Mid., the St. L., Iron Mt. and So., and the Yazoo and Miss. Val. Railways; 90 miles S. by W. of Memphis. It contains 9 churches, 2 public and 2 private schools, U. S. post-office and court-house (cost $75,000), and 5 periodicals, and has 3 sawmills, 2 cotton-compressers, 2 cottonseed-oil mills, 2 foundries, gas and electric lights, and street railways. Pop. (1880) 3,652; (1890) 5,189; (1900) 5,550. Editor of "World."

**Helena**: city (settled as a mining-camp in 1864); capital of the State of Montana and of Lewis and Clarke County (for location of county, see map of Montana, ref. 5–E); in Prickly Pear valley, 15 miles W. of the Missouri river, and on the Gt. Nor. and the Nor. Pac. railways; 1,133 miles W. of Duluth. It is surrounded by rich agricultural valleys, and productive mines of gold, silver, iron, lead, copper,

State Capitol, Helena, Mont.

and zinc, and of sapphires and rubies. It has 2 national, 1 savings, and 2 private banks, with an aggregate capital of $1,000,000; 15 churches; 1 high school, and 7 public and 2 private schools; and 4 libraries, containing 56,000 volumes. There are 2 planing mills, 4 machine-shops, a foundry, a brewery, carriage, harness, and other factories, a large smelter, and 10 periodicals. Helena is the site of the famous Last Chance Gulch placer mines. Pop. (1880) 3,624; (1890) 13,834; (1900) 10,770. C. J. Hedges.

**Helena**, Saint: mother of Constantine the Great; said to have been the daughter of an innkeeper; b. according to some accounts in Bithynia, according to others in Britain, about 248. She was married to the Emperor Constantius Chlorus, who for reasons of state divorced her in 292; but her son, Constantine the Great, on succeeding to the throne in 306, treated her with great honor, and conferred upon her the title of Augusta. After her conversion to the Christian faith she made a pilgrimage to Jerusalem, where, with almost miraculous success, if the legend is credible, she succeeded in identifying all the remarkable objects and places connected with our Saviour's history; more especially his sepulcher and the real wood of the cross on which he suffered. She also discovered the burial-place of the Magi.

D. about 328. For her many virtues and charities she was subsequently canonized by the Church. Her festival is observed on Aug. 18.

**Hel'enus** (in Gr. Ἕλενος): (1) a son of Priam and Hecuba, twin-brother of Cassandra, and like her endowed with prophetic powers. After the death of Paris, Helenus and Deiphobus both sought the hand of Helen. Deiphobus won her and Helenus deserted to the Greeks, being enraged because Deiphobus was chosen before him. Another story has it that he retired to Mt. Ida, where, by Calchas's advice, he was captured. He was of great service to the Greeks, as he told them that Troy could not be taken without Neoptolemus and the arrows of Hercules, which were in the possession of Philoctetes, on the island of Lemnos. He suggested that the Palladium be stolen, and that the wooden horse be built. After the fall of Troy, Helenus became the slave of Neoptolemus, to whom he rendered invaluable services as seer; he prevented Neoptolemus from sailing with the rest of the Greeks, and induced him to settle in Epirus. After Neoptolemus had been killed by Orestes, Helenus became king of a portion of Epirus, which he called Chaonia after his brother Chaon, whom he had accidentally killed. He married Andromache, Hector's widow, and begat Cestrinus. He left his kingdom, which was patterned after Troy, to Molossus, the son of Neoptolemus by Andromache. Olympias, the mother of Alexander the Great, claimed descent from Helenus. (2) A son of Pyrrhus, King of Epirus, accompanied his father on his expedition to Italy in 280 B. C. After the defeat at Beneventum, in 275 B. C., and the return of Pyrrhus to Epirus, Helenus was left in Tarentum with a small garrison of Epirotes. He was soon recalled, however, and took part in the attack on Argos, in which Pyrrhus was killed. He was taken prisoner himself, but Antigonus Gonatas treated him with great regard, and allowed him to return to Epirus with the remains of his father.

J. R. S. Sterrett.

**Héliade**, Jean (or, more properly, **Eliade Rădulescu**, Ioan): Roumanian writer; b. in 1802 at Tergovist in Wallachia; d. in May, 1872. He was educated at Bucharest, in a college or school established by Lazăr, and at the age of twenty became one of its professors. In 1828 appeared his *Gramatica românească*, the first systematic work on Roumanian grammar published in Wallachia, in which he paved the way for the introduction of the Latin alphabet by omitting a considerable number of superfluous letters from the Cyrillic alphabet then in use. In 1829 he began *Curierul românesc* (*The Roumanian Courier*), the earliest of the Roumanian literary periodicals. He showed great activity as a translator, especially from Italian, making versions from Dante, Ariosto, Tasso, besides others from Molière, Lamartine, Byron, etc. After 1840, indeed, his writings show an excessive influence of Italian. In 1848 he mingled in political affairs, becoming a member of the revolutionary government, and, as a consequence, he was obliged to go into exile in September of that year. He went to Paris, then to the island of Chio; but in 1854 he was able to return to Bucharest. During his exile he had written in French *Mémoires sur l'histoire de la régénération roumaine* (Paris, 1851) and also *Souvenirs et impressions d'un proscrit* (Paris, 1850). Among other forms of literary activity, Eliade tried his hand at poetry, and his poem on Michael the Brave, the national hero of Wallachia, has some repute. In 1868 began to appear his *Curs de poesie generală* (3 vols.). Mention should also be made of his *Nuvele istorice* (3d ed. 1867). In conclusion, it may be said that in spite of his activity, Eliade's importance in Roumanian literary history lies rather in the incentive he gave to the literary development of his race than in the merit of his own works. E. S. Sheldon.

**Helian'thus**: See Sunflower.

**Hel'icoid** [from Gr. ἑλικοειδής, spiral-shaped; ἕλιξ, ἕλικος, a spiral + εἶδος, shape, form]: a warped surface that may be generated by a straight line moving so that each of its points shall advance uniformly in the direction of a given straight line, and at the same time have a uniform angular motion around it. The fixed line is called the *axis* of the surface, the moving line is called the *directrix*, and any position of the directrix is called an *element*. The conditions imposed require that the same point of the generatrix shall remain continually on the axis, and that the angle between the directrix and axis shall be constant. When this angle is a right angle, the helicoid is *right*; otherwise it is *oblique*. The curve generated by any point of the directrix is called a *helix*. Revised by S. Newcomb.

**Hel'icon, Mount** (in Gr. Ἑλικών): a mountain of Greece, in Bœotia; between the Gulf of Corinth and Lake Copais. It is strictly a range of mountains, a continuation eastward of Parnassus. Its highest point is a cone 5,000 feet high. Its eastern side is fertile and abounds in springs. Helicon was sacred to Apollo and the Muses, probably because Hesiod the poet lived at Ascra, near its eastern foot. Near Ascra was Aganippe, the fountain of the Muses. Higher up was the grove of the Muses. Still higher up was the well Hippocrene and the fountain of Narcissus. These points are identified. Revised by J. R. S. Sterrett.

**Hel'igoland**, or **Hel'goland** [Germ.; cf. O. H. Germ. *heiligo*, saint + land, i. e. saint's land or island]: a small island in the North Sea; opposite to and about 40 miles from the mouth of the Elbe, in lat. 54° 11′ N. and lon. 7° 53′ E. It is about a mile long from north to south, one-third of a mile wide, and about 3 miles in circumference. The island is divided into two parts—the low ground and the rock; the latter, a red sandstone, rises to a height of 200 feet above the sea. There are several excellent roadsteads. Although much has been said of the gradual washing away of the island by the sea, the probable rate is very small. The village is built on the low ground and the portion of the rock adjacent to it; the two parts are connected by a flight of 190 steps. The inhabitants are mainly of Frisian descent, engaged in fishing and piloting, though many have turned their attention to accommodating visitors who resort here for the fine sea-bathing. They are remarkably free from poverty, disease, and crime. The island is fortified, and has a lighthouse. In ancient times it was inhabited by Frisii, and it is said that on this island the temple of the Frisic god Fosete stood, before the introduction of Christianity in the eighth century, when it was destroyed. Heligoland was captured from Denmark by Great Britain in 1807, and was ceded to Germany in 1890. Pop. about 2,000.

**Heliodo'rus** (in Gr. Ἡλιόδωρος): Greek writer of romance; b. at Emesa in Syria; flourished toward the end of the fourth century A. D.; wrote *Æthiopica* in ten books, describing the loves of Theagenes, a Thessalian youth, and Chariclea, daughter of a king of Æthiopia. This was for centuries an exceedingly popular romance, vivid in details, interesting in narrative. The situation of the leading characters is strained, and the style exotic and hyperrhetorical, but the *Æthiopica* is the greatest work of the *Scriptores Erotici Græci*. Heliodorus calls himself a priest of the sun, and the identification with Heliodorus, Bishop of Tricca, is disputed by Rohde, *Der griechische Roman* (p. 432). Editions by Mitscherlich in the *Scriptores Erotici Græci* (1798), by Coraës (1805), and by Hirschig (Paris, 1856). Translated into English by R. Smith, in the Bohn Classical Library.

B. L. Gildersleeve.

**Heliogabalus**: See Elagabalus.

**Heliography**: a method of signaling between distant points by means of a movable mirror. See Heliotrope and Signal Service.

**Heliom'eter** [from Gr. ἥλιος, sun + μέτρον, a measure]: an instrument first invented to measure the diameter of the sun in seconds and parts of seconds, but now employed to measure small arcs generally upon the celestial sphere. It consists of an ordinary telescope equatorially mounted, the object glass of which is cut into two equal semicircles, which slide along the diameter of section by the revolutions of a very fine screw. Each half of the objective forms a separate image of any object at which the telescope is pointed. If there are two objects the screw and telescope may be turned until one image of one object coincides with the opposite image of the other. The amount of motion to produce the coincidence determines the angle between the objects. S. Newcomb.

**Heliopolis** (of Syria): See Baalbec.

**Heliop'olis** [Gr.; ἥλιος, sun + πόλις, city; in Egyptian *An*, Hebrew *On*, now *Matariyeh*]: a sacred city of Egypt, located near the apex of the Delta region, 5 miles N. E. of Cairo. According to Manetho it existed in the second dynasty. In the period previous to the twelfth dynasty it is seldom mentioned, but at that time Usertasen I. signified the completion of a temple of Ra by erecting obelisks before it. Only one of these is still *in situ*, the sole remaining memorial (cf. Jer. xliii. 13). Other Pharaohs, especially Thothmes III., Seti I., Ramses II., III., Psammetichus, and Nectanebo, added new buildings or restored old. Four obe-

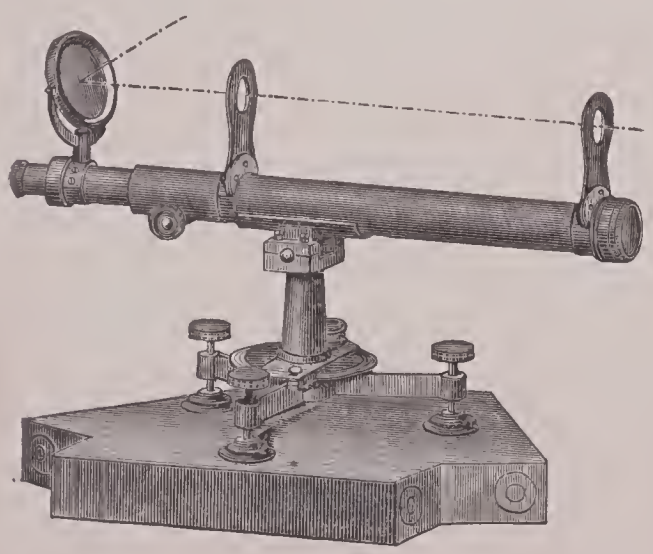
disks erected by Thothmes III. are now in Constantinople, Rome, London, and New York. The city was most flourishing under Ramses III., when the temple is said to have had 12,913 attendants. Herodotus recalls the reputed wisdom of the priests, while Strabo found it practically deserted. The final destruction came in the Arabian period, and late excavations have brought little to light. The site is covered with cultivated fields, the temple area being 6 feet below the level of the surrounding country, and 11½ feet below high Nile. Heliopolis was one of the holiest of Egyptian cities, and the oldest chapters of the RITUAL OF THE DEAD (*q. v.*) are said to have been written there. The earliest records indicate that it was at first the seat of the worship of the Mnevis bull (second dynasty). Previous to the twelfth dynasty it was sacred to Tum, and afterward it was the special seat of the sun-worship—i. e. of Ra under various forms and names: *Ra*, the sun in general; *Ra-Harmachis*, the rising sun; *Tum*, the setting sun; and *Aten*, the sun-disk.

CHARLES R. GILLETT.

**Helios**: See HELIUS.

**He'liostat** [from Gr. ἥλιος, sun + στατός, placed, deriv. of ἱστάναι, set up]: a mirror carried by a clockwork mechanism, so contrived as to reflect a beam of solar light in an unvarying direction, notwithstanding the apparent change of place of the sun in its diurnal motion. The heliostat has long been in use in physical investigations and experiments, without possessing a high degree of precision. More recently it has been employed in aid of astronomical observation, for which purpose it has been greatly improved. The expeditions sent out from the U. S. to observe the transit of Venus of 1874 (and also the French) made use of the heliostat in photographing the successive aspects of that phenomenon by means of telescopes of long focus (40 feet), instruments which without it could not have been employed at all. A nearly or quite perfect form of heliostatic apparatus, as it respects precision of movement, was one of the latest inventions of the ingenious Foucault, and was called by him the *siderostat* (Lat. *sidus*, a star or constellation + Gr. στατός, fixed), being designed for use in all the ordinary observations of astronomy, for the purpose of enabling the observer to occupy constantly the same and the most convenient position.

**He'liotrope** [Gr. ἥλιος, the sun + τροπός, turning]: an instrument employed in geodesy to reflect the sun's rays from one signal-station to another in order to facilitate observation; the reflecting surface presenting to the distant observer the appearance of a brilliantly luminous point or star. There are several varieties, the most common being that represented in the figure, where a mirror, movable



in any direction, is seen mounted near the eye-end of a telescope. The telescope, being first pointed at the distant station, the mirror is turned so as to reflect the sun's light through the two openings in the sights, which will occur when the shadow of the rear one is seen on the front one. An attendant turns the mirror constantly so as to maintain the proper direction of the rays. As the sun subtends an angle of about half a degree, the reflected rays, in passing off the mirror, are contained within a cone having the same angle at the vertex. Hence it is only necessary to point the instrument within a quarter of a degree of an object in order that the light may reach it. The heliotrope was invented in 1821 by Gauss, who used it as a signal upon which to observe in the measurement of angles. Its use for this purpose is now universal on long lines. For lines as short as 20 miles it is used when the atmosphere is hazy, so that poles and targets can not be seen. The longest line of a geodetic triangle thus far observed is one in California of 192 miles in length; for this line a mirror having 77 sq. inches area was used. The common heliotropes, used on lines less than 50 miles long, have mirrors about 2 sq. inches in area, and the effective area is often made smaller by the holes in the sights. The heliotrope requires clear weather, and its light is often unsteady, owing to disturbances in the atmosphere. The best time for measuring angles between heliotropic signals, or indeed between any kind of signals, is during the hour preceding sunset. By interposing and removing an object in front of the mirror, long and short flashes of light are made by which telegraphic messages can be sent from one station to another.

MANSFIELD MERRIMAN.

**Heliotrope** [from Lat. *heliotro'pium* = Gr. ἡλιοτρόπιον, dimin. of ἡλιοτρόπος, heliotrope; ἥλιος, sun + -τροπός, turning, deriv. of τρέπειν, turn; the flowers were once believed to turn with the sun]: a genus (*Heliotropium*) of herbs and shrubs of the family *Boraginaceæ*. The *H. peruvianum* and its hybrids are greenhouse shrubs, having flowers of delightful fragrance. The flowers are extensively used by perfumers. *H. curassavicum*, *H. convolvulaceum*, and several others are natives of the U. S., where also the common heliotrope (*H. europæum*) is naturalized.

**Heliotrope**, or **Bloodstone**: a variety of JASPER (*q. v.*); much used for seals and seal rings; presenting bright-red spots upon a deep-green ground.

**Heliotropism**: See PHYSIOLOGY (*Vegetable*).

**He'liotype** [liter., sun-print; Gr. ἥλιος, sun + τῦπος, blow, impression]: generally any process of reproducing pictures obtained by the actinic power of the sun's rays on a prepared surface, by printing in fatty inks, but more especially the process invented by Poitevin in 1855, and afterward developed and completed by Edwards. Poitevin discovered that on a plate covered with bichromated gelatin, and exposed to light under a negative, some pores of the gelatin would become completely, others only partially, closed, while others, again, would remain entirely unchanged. If, now, this plate be steeped in water and rubbed over with grease, the grease will speedily attach itself to those places of the gelatin sheet where the light has closed the pores, while it will not touch those places where the pores have remained open, and consequently become filled with water. Thus if the grease employed be lithographic ink, which is simply grease to which coloring-matter has been added, the light-produced image will at once be revealed. The development which this process received from Edwards consisted principally in the production of a movable film. He discovered that gelatin, without losing its property of being acted upon by light in presence of a bichromate, and of receiving and refusing greasy ink, might be converted into a tough, insoluble substance, like leather or parchment, by the addition of alum or chrome alum. The gelatin, with a sufficient quantity of bichromate of potash to make it sensitive to light, and of alum to make it hard and durable, is poured on a level plate, and dried in the dark by means of heat. When dry or required for use, the sheet of gelatin is stripped from the plate and printed under a photographic negative, which should be reversed as regards right and left.

**Heliozo'a** [Mod. Lat. pl., fr. Gr. ἥλιος, the sun + ζῷον, animal]: the sun animalcules, the name being given in allusion to the rays extending from the central mass. They form a sub-class of the Rhizopod PROTOZOA (*q. v.*); characterized by having radiating pseudopodia (the rays referred to), and frequently a chitinous capsule into which all may be retracted. *Actinophrys* and *Actinosphærium* are the best known. All forms occur in fresh water.

J. S. K.

**Helium**: See the Appendix.

**He'lius** (in Gr. Ἥλιος): the charioteer of the sun; son of Hyperion (the Titan deity of light) by his sister Theia, who also bore him the moon (Selene) and the dawn (Eos). Both the root of the word *Zeus* (διF) and tradition prove that Zeus, the bright and shining one, included in his many-sided nature the functions of the sun-god, functions which were afterward delegated to Apollo; but when Apollo began to represent the spiritual, healing, creative, and death-dealing manifestations of the sun, the physical functions of the sun were assumed by Helius. Helius was originally re-

garded as a ball of fire, or as a wheel, or disk, then as an eye (the eye of heaven), as a winged being of light because of his rapid journey across the vault of heaven, while the conception of the horses and chariot of the sun arose from the same rapid journey. The power of Helius was evinced by the heat which was produced by his piercing rays, those same rays which, in the hands of Apollo, became death-dealing arrows. These arrows made Helius an invincible hero who wars victoriously against the powers of darkness. Homer dwells upon the fiery splendor of Helius; owing to this splendor he is portrayed in art and literature as in the full vigor of early and beautiful manhood, with large, open eyes and rich, wavy, golden or auburn hair, which stood for the rays of the sun. In art he wears a rayed crown to which is sometimes added a nimbus or halo; his long flowing robes flutter in the wind behind him as his fiery, snow-white horses cause his chariot to spin along athwart the heavens. The chariot is golden, and in early vase-paintings the horses are winged. The moment of time usually chosen to represent Helius in works of art is sunrise; Aurora (Ἠώς) precedes him in her chariot and scatters roses in his way. The different stages in the daily course of Helius are well defined in Homer; he rises in the farthest east out of the gently flowing, deep stream of Oceanus, Thetis herself removing the bars that restrained the horses during the night. He ascends the heavens, reaching at noon the center of the vault, when he descends, and about the time for unyoking oxen again reaches the stream of Oceanus in the far distant west, thus producing night. He bathes his own "immortal body and his tired horses in a warm bath of soft water." The resting-place of Helius and Aurora is in Ethiopia; there is his palace or his cave; the Nereides and the Hours take from him the reins and his rayed crown, unhitch the horses, and conduct them to pasture. His rest is short; he is pursued by the darkness of night, from which he must escape, and he drives his chariot into a golden bowl, the handiwork of Hephæstus, and in it both chariot and driver are borne, while they sleep, upon the stream of Oceanus, past Red island (Erytheia), to the point of rising in the farthest east. His wife Perse (the Shining One), a daughter of Oceanus, bore him Circe and Æetes, sorcerers both (cf. Medea). Homer knows only of his children by Neæra, viz., Phæthusa and Lampetia, who guarded the herds of Helius on the island of Thrinacia (Sicily), Phæthusa herding the sheep and Lampetia the cattle. Helius sees all the actions of gods and men; he was consequently invoked as a witness to all compacts, oaths, and treaties; he is the revealer of all things both good and bad. He is the cause of life and growth in the vegetable world; death-dealing qualities are rarely ascribed to him as to Apollo. He gives health to the body; he restores sight to the blind (Orion); he is the measurer of time, the originator of the year and the seasons; in the Roman period he is even the father of time and the ruler of the universe. Lysippus fashioned in bronze a group representing Helius with his chariot and four, and Chares executed in bronze the celebrated Colossus of Rhodes (280 feet high, one of the Seven Wonders of the world), which was overturned by an earthquake in 222 B. C.

LITERATURE.—Rapp's learned article in Roscher's *Ausführliches Lexicon*; Roscher, *Die Gorgonen* (Leipzig, 1879) and *Nektar und Ambrosia* (Leipzig, 1883); Sonne, in Kuhn's *Zeitschrift*, 10, 166. J. R. S. STERRETT.

**Helix**: See PULMONATA.

**Helix** [= Gr. ἕλιξ, a spiral, anything of a spiral shape, deriv. of ἑλίσσειν, turn around, roll]: a curve having the form of a cork-screw, generated by the motion of a point which moves uniformly around a cylinder and at the same time moves along its axis. S. N.

**Hell** [from M. Eng. *helle* < O. Eng. *hell*; O. H. Germ. *hella* (> Mod. Germ. *hölle*, properly *helle*, the Teutonic goddess of the dead); Goth. *halja*: Icel. *hel*]: originally, the state of the dead, viewed without distinction of character or destiny; called *Sheol* by the Hebrews, and *Hades* by the Greeks. The body being regarded as that which gave strength and energy to existence, while there was yet a consciousness of something in man distinct from it, and capable of surviving it, this immaterial residuum was, among the Greeks and Hebrews, and many other peoples of antiquity, regarded as a shadowy, half-conscious somewhat, which, even if like Achilles it enjoyed a form of royal honor below, would gladly exchange this for the lot of a hireling laborer on earth. The associations of burial, the sinking sensation accompanying the failure of strength, and the ideas of gloom connected with the state of the dead, combined to suggest the interior of the earth as their dwelling-place. Hence the Romans call the dead *Inferi*, the subterranean ones. From this joyless region only a few favored spirits (mostly children or grandchildren of Zeus) were exempted by deification, and even to them, as to Hercules in the *Odyssey*, there was sometimes assigned a visionary *idolon* in the shades. The Germanic tribes in the north of Europe held similar views, except that the realm of Hela was even more dismal than Hades, a region both of darkness and frost. In the north, however (though with some waverings of idea), the whole body of heroes and heroines were exempted from this, and gathered to the feastings and tournaments of Walhalla. From Hades it was supposed possible, by powerful incantations, to evoke temporarily the departed shades, who, notwithstanding the general unsubstantiality of their being, seem to have been viewed as knowing the future. Against this practice of necromancy (illustrated in the evocation of Samuel) the Old Testament directs the severest prohibitions, as futile, diverting the mind from the substantial interests of life, and from trust in the living God. In Homer the shades thus evoked are described as gaining a temporary renewal of life by drinking the blood of the necromantic sacrifices.

In the Old Testament there appears no distinct conception of an award of good or ill in Hades or Sheol, according to character. For all the dead it is a land of confusion, emptiness, darkness, and dreamy inactivity. (See Job x. 21, 22.) Negatively, to the oppressed it is a relief. (Job iii. 17–19.) An approach to the idea of retribution finds place in Isaiah xiv. 9, 10, where the haughty King of Babylon is described as received in Sheol with scornful jeers. Among the Greeks, as early as Homer, peculiarly flagrant offenders are described as suffering various torments in Tartarus, the dungeon of Hades, in which are also confined, though without torment, Kronos and various dethroned gods. The antiquity of the Nekyia of the *Odyssey*, however, is doubtful.

Old Testament believers, conscious of an indissoluble tie of faith and hope with the living God, and of a covenant relation with him, began gradually to anticipate a deliverance from Sheol to some form of glorified and substantial life. (See Psalms xlix. 15, lxxiii. 24, xvi. 10, 11, xvii. 15; Job xix. 25–27.) In the more definite form of a resurrection, in a glorified body, to dwell forever upon the transfigured earth in the Messianic kingdom, this deliverance from Hades seems to be at least intimated in Isaiah xxvi. 19 and Ezekiel xxxvii., and is distinctly taught in Daniel xii. 2, 3. There also appears a retribution of evil to the evil in a resurrection to "shame and everlasting contempt." A distinction of final destiny, resting upon a distinction of character, being thus developed in religious consciousness among the Jews, which yet is not to be realized in its fullness until a day of final judgment, Hades, or Sheol, becomes an expectant state, into which is reflected back a measure of the same distinction of doom. This assigns to the righteous dead a special compartment of Hades, bright and blessed, known to the Jews as Abraham's bosom, or paradise (see Luke xvi. 19–31, xxiii., 43), which must not be confounded with the heavenly paradise mentioned in 2 Corinthians xii. 2, 4. The rest of Hades becomes thereby the abode of the unrighteous dead, passing over into the idea of hell in our present use of it. (See Luke xvi. 19–31, as above.) Whether the "Gehenna of fire," repeatedly mentioned by our Saviour, includes this anticipatory place of doom, or whether it denotes only the "eternal fire" into which the incurably selfish are consigned with the devil and his angels (Matthew xxv. 41), is matter of debate, the general opinion of the Church holding them identical in kind, though differing in degree. Yet see Revelation xx. 14.

When the Authorized Version was made in 1611, the English use of hell still retained its original indeterminateness, precisely equivalent to Hades or Sheol, as denoting the state of the unglorified or unrisen dead, without respect of character or condition. It is in this sense that, in the Apostles' Creed, Christ is said to have "descended into hell," not as implying a descent into the place of torment. Use having, however, gradually confined "hell" to this latter application, it has become necessary to distinguish in translation. Accordingly, the revisers commonly transfer Sheol in the Old Testament, and invariably transfer Hades in the New Testament, wherever, in the corrected text, it occurs in the Greek, namely, Matthew xi. 23, xvi. 18; Luke x., 15, xvi., 23; Acts ii. 27, 31; Revelation i. 18, vi. 8; xx. 13, 14, reserving hell to translate "Gehenna"; Matthew v.

22, 29, 30, x. 28, xviii. 9, xxiii. 15, 33; Mark ix. 43, 45, 47; Luke xii. 5; James iii. 6, and once to translate Tartarus (implied in a participle), 2 Peter ii. 4. The charge, therefore, brought against the revisers by a noted writer, of having "covered up" the grimness of Bible teaching "under classic flowers," is not only false, but is the reverse of the truth. They have brought out distinctions of the original which the elder version has neglected.

The question whether the Bible teaches that the sufferings of the wicked in hell after the day of judgment are to be absolutely endless, or whether, from the disintegrating processes of a being at discord with itself, these issue in ultimate extinction, or whether the Scriptures open glimpses of hope, implying a possible restoration of all the lapsed men and angels to holiness and unity with God, has commonly, in the Church, been answered in the first sense, although not merely Origen, but at least two great theologians and canonized saints, Gregory of Nazianzus and Gregory of Nyssa, favor the hope of universal restoration. In the time of Augustine, as he says, most Christians entertained this hope, and although he himself does not, he declares that it is no sign of rebellion against Scripture, but of a compassionateness which shrinks from giving this its full severity. As a compromise, he suggests the possibility of periodical remissions or mitigations of penal suffering. Modern theology in large measure is disposed to be less peremptory than was once thought requisite in pronouncing upon the precise interpretation of the Scriptural declarations concerning this awful mystery. Universalists sometimes use sterner, and orthodox writers milder, language than would once have been tolerated on either side. The use of *aionios*, eternal, is not decisive, as this is also applied to objects, like mountains, of indeterminate duration. On the other hand, such declarations as those of the compassionate Redeemer himself, in Matthew xii. 31, 32, xxvi. 24, are confessedly very hard to reconcile with the doctrine of a universal restoration.

Roman Catholic theology, whose doctrine of future things is peculiarly determinate, includes in hell all regions of the spiritual world which are not within the range of the beatific vision, comprising in it, therefore, the *limbus infantum* for unbaptized children, even when conceived as a place of "perfect natural beatitude," including the natural knowledge and love of God. Nor does it seem indisposed to admit purgatory as a part of hell, though destined to disappear after the judgment, as being occupied only by elect souls, whose admission to heaven can not be deferred beyond that point.

The Elysian Fields of the ancients may be regarded almost indifferently as heaven, hell, or paradise, being variously placed in the air, in Hades, or in the western ocean. The notion of unhappy spirits as roaming the earth, and even of holy souls as expiating their arrears of guilt in various localities on earth, appears to serve as transition to the apprehension of heaven and hell as depending less upon place than upon character. The thesis

> The mind is its own place, and in itself
> Can make a heaven of hell, a hell of heaven,

has never been condemned as heretical by any branch of the Church. According to Swedenborg, in the spiritual body mental affinity or alienation involves local contiguity or removal. As Christianity accounts that sphere of being as heaven in which God's will is perfectly *done*, so it accounts as hell that sphere of being in which God's will is absolutely *opposed*. An approach to either state is, respectively, an approach to heaven or hell.

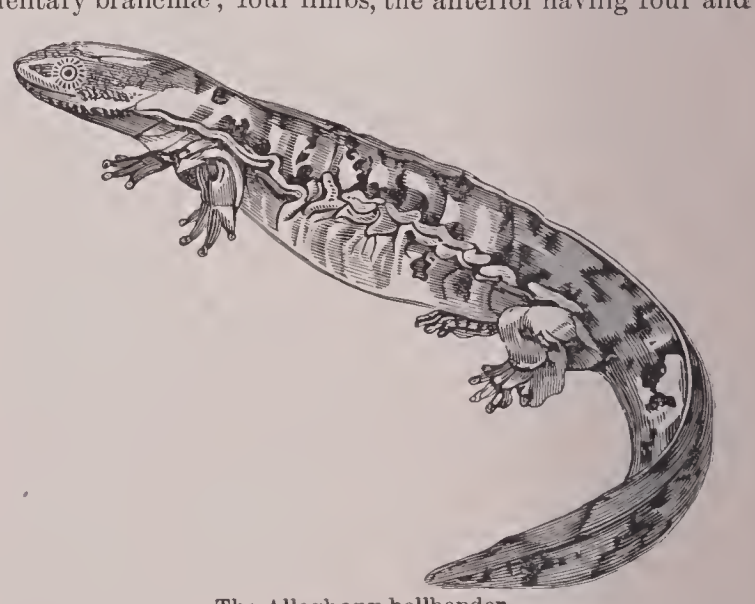
For notices of the Brahminist and Buddhist doctrines of the state of the dead, and of the fancies of the North American Indians, as well as of the distincter doctrines of Zoroastrianism, see HEAVEN. The Egyptians had very vivid, if not very spiritual, conceptions of the state of the dead, both for good and evil, although these do not seem to have had much influence on the development of Jewish doctrine. See HADES and SHEOL. CHARLES C. STARBUCK.

**Hell**, MAXIMILIAN: astronomer; b. at Schemnitz, Hungary, May 13, 1720; was the principal astronomer at Vienna, where he issued the well-known annual *Ephemerides Vindobonenses*. In 1769 he went to the North Cape to observe the transit of Venus. The station was among the most important of those occupied by astronomers; the publication of his observations was therefore looked for with the greatest interest. Shortly after they appeared doubts began to be expressed of their genuineness, but Hell disdained to make any formal reply to such insinuations. Little attention was given to the question thus raised until 1835, when Littrow, astronomer at Vienna, published a book giving a description of Hell's original journal, which had been preserved at the Vienna Observatory, with a facsimile of the observations, showing, as Littrow claimed, that the records had been falsified by Hell, and that the observations were to a greater or less extent spurious. This view was generally accepted until 1883, when Simon Newcomb, the American astronomer, visited Vienna to examine the manuscripts, and reached an opposite conclusion, showing that Littrow was entirely mistaken in his conclusions, owing to his being partially color-blind. Hell died in Vienna, Apr. 14, 1792.

**Hellani'cus** (in Gr. Ἑλλάνικος): a distinguished logographer (see LOGOGRAPHERS), preceding Herodotus; a native of Mytilene in Lesbos; b., according to Pamphila, B. C. 496, died about 411; but these dates are much questioned. Like Hecatæus and Herodotus, he visited the countries he describes, though scarcely any particulars of his life are known. He wrote a number of works (some state thirty), but probably parts of works are quoted by distinct titles. They related chiefly to early Greek and Persian history. His principal writings are *Deucalionea*, in two books; *Phoronis*, in two books; *Atlantis*, in two books; *Troica*, in two books; *Atthis*, in four books; *Æolica*, in two books; *Persica*, in two books; and a chronological work, *ἱέρειαι αἱ ἐν Ἄργει* (a list of the priestesses of Juno at Argos), in three books. Of his writings, fragments are left, collected by Sturz, *Hellanici Lesbii Fragm.* (1826); and by Müller, *Fragm. Hist. Græc.*, vol. i., pp. 45–69, vol. iv., pp. 629–37. See Mure's *Hist. Greek Lit.*, vol. iv. Revised by B. L. GILDERSLEEVE.

**Hellas**: See GREECE.

**Hellbender**: a tailed batrachian (*Cryptobranchus alleghaniensis*) peculiar to the fresh waters of North America, intermediate between the perennibranchiate amphibians and the salamander. It has a large and flat head; two concentric series of minute teeth in the upper jaw, and one series in the under jaw; a branchial orifice on each side; rudimentary branchiæ; four limbs, the anterior having four and



The Alleghany hellbender.

the posterior five short palmated toes; and a loose skin folded on the sides of the body. It attains a length of 2 feet, has a slaty-gray color with dark spots, feeds chiefly on fish, worms, and mollusks, is fierce and voracious, and is erroneously regarded as poisonous. The hellbender abounds in the waters of the Ohio and its tributaries, and is known also by the names mud-devil, ground-puppy, and mud-puppy. See MUD-PUPPY. Revised by D. S. JORDAN.

**Hell-diver**: See GREBE.

**Hel'le** (in Gr. Ἕλλη): a daughter of Athamas and Nephele, the royal pair of Orchomenus in Bœotia. Athamas divorced Nephele in order to marry Ino, a daughter of Cadmus, the founder and King of Thebes. Ino was a bad stepmother and determined to get rid of Phrixus and Helle; she caused a famine by parching the seed corn, and she bribed the messengers who had been sent to consult the oracle as to the cause of the famine to bring back word that Phrixus and Helle were enemies of the gods, and must be offered up in sacrifice. When the king, Athamas, in his character of high priest, was about to sacrifice them, their mother Nephele (the name means *Cloud*) descended from

heaven and placed her children on the back of Chrysomallus, the ram with the GOLDEN FLEECE (*q. v.*), who went with them through the air; but Helle fell off and was drowned in the Hellespont, which was named from her.

Revised by J. R. S. STERRETT.

**Hel'lebore** [readapted from O. Fr. *ellebore* < Lat. *helle'borus* = Gr. ἑλλέβορος, hellebore]: a remedy used especially by the ancients in cases of insanity. The best grew at Anticyra. It was the root of *Helleborus orientalis*, an herb of the family *Ranunculaceæ*. The black hellebore of modern pharmacy is chiefly the product of *H. niger* (which produces the flower called Christmas rose). Its properties are shared by *H. viridis* and *fœtidus*. These are all Old World species, and have violent cathartic properties. In overdoses they are active irritant poisons. Hellebore is not much used in medicine, except as an emmenagogue. For white hellebore, see VERATRUM.

Revised by CHARLES E. BESSEY.

**Hel'len** (in Gr. Ἕλλην): a son of Deucalion and Pyrrha, and the progenitor of the whole *Hellenic* nation, though Hesiod and Archilochus were the first to call the Greeks *Hellenes*. Hellen had three sons, Dorus, Æolus, and Xuthus. He was succeeded in the kingdom of Phthia by Æolus, whose descendants were the Æolians. Dorus settled in Doris on the slopes of Parnassus, and his descendants emigrated to the Peloponnesus. Xuthus settled in Attica, and by his sons Ion and Achæus became the progenitor of the Ionians and Achæans.

J. R. S. STERRETT.

**Hel'lenes**: See GREECE.

**Hel'lenist** [from Gr. Ἑλληνιστής, Hellenist, deriv. of ἑλληνίζειν, to speak Greek, deriv. of Ἕλλην, a Greek]: among the Jews of Palestine and other countries in the Roman period, and among the Jewish Christians of the same times, a name applied to the proselytes to Judaism of Greek or other foreign ancestry, and also to Jews living outside of Palestine who had adopted Greek, usually in some dialectical form, for their common tongue (whereas Aramaic was the Jews' language in Palestine), and had also more or less yielded to Greek civilization, which implied that in many respects they had ceased to be strict Jews. The latter class when living outside of Palestine were known as the "Jews of the Dispersion." After the time of Alexander the Great the Hellenizing of foreign nations began to assume enormous dimensions. His successors, the Seleucidæ and the Ptolemies, favored the tendency, and often found a much stronger support for their thrones in that movement than in their armies. The Hellenistic spirit did much in preparing the way for the spread of Christianity. In the Revised Version the term "Hellenist" is in the margin for Grecian Jews in Acts vi. 1, ix. 29.

Revised by SAMUEL MACAULEY JACKSON.

**Hellenistic Greek** [*Hellenistic* is from Gr. Ἑλλανιστικός, pertaining to the *Hellenists* (Gr. Ἑλλανισταί), or foreigners who spoke Greek]: the Greek language as it appears in the Septuagint (283–185 B. C.), the New Testament, the writings of Josephus and Philo, and those of some of the early Christians. It abounds in Hebrew and Aramaic forms, idioms, and even words. See GREEK LANGUAGE.

**Hellenop'olis** [originally *Drepanum* or *Drepane*]: a Bithynian city on the Propontis (Sea of Marmora), near the river Draco. It was named Hellenopolis by the Emperor Constantine the Great, probably because it was the birthplace of Helena, his mother. Constantine did much to build up the town, and so did Justinian in later days, but the place seems never to have been very important. Constantine lived much in this place on account of its mineral springs. It is now called *Hersek*.

**Heller**, STEPHEN: See the Appendix.

**Hel'lespont** [from Lat. *Hellespon'tus* = Gr. Ἑλλήσποντος; Ἕλλης, genit. of Ἕλλη, Helle + πόντος, sea]: the ancient name of the DARDANELLES (*q. v.*), the strait which connects the Propontis and the Ægæan; named from the old legend of HELLE (*q. v.*), according to the ancients. It was the scene of many events conspicuous in the history and mythology of antiquity. Being the highway to Constantinople, it is strongly fortified, and the men-of-war of European nations are not allowed to enter it, even in time of peace.

**Hell Gate**: a narrow part of East river, New York, so called because of the reefs that long encroached upon its channels, and the violent currents caused by them. The East river receives the tide at its two extremities—at the eastern, the Sound tide, and at the western, the Sandy Hook tide. The times as well as heights of these tides are different, and by such want of uniformity strong velocities are imparted to the currents.

To distinguish more clearly the positions and designations of the reefs, the Gridiron, Flood Rock, Hen and Chickens, and Negro Head, all of which constitute parts of one reef, will in this article be called by the name of the Middle Reef, between which and the reef whose visible projections are called Great and Little Mill Rocks, the Middle Channel is situated. The Eastern Channel is included between the Middle Reef and Hallet's Point. The main South or Ship Channel lies to the W. of Great and Little Mill Rocks, and between them and New York.

On the subject of an improved naval defense of Long Island Sound and of the harbor of New York, Lieut.-Commanding Davis, U. S. navy, wrote: "But a still more serious consideration is that of the increased facilities for naval defense which this improvement would afford." In the event of a rupture with a superior naval power, Long Island Sound and its shores would not, as before, be at the mercy of the enemy.

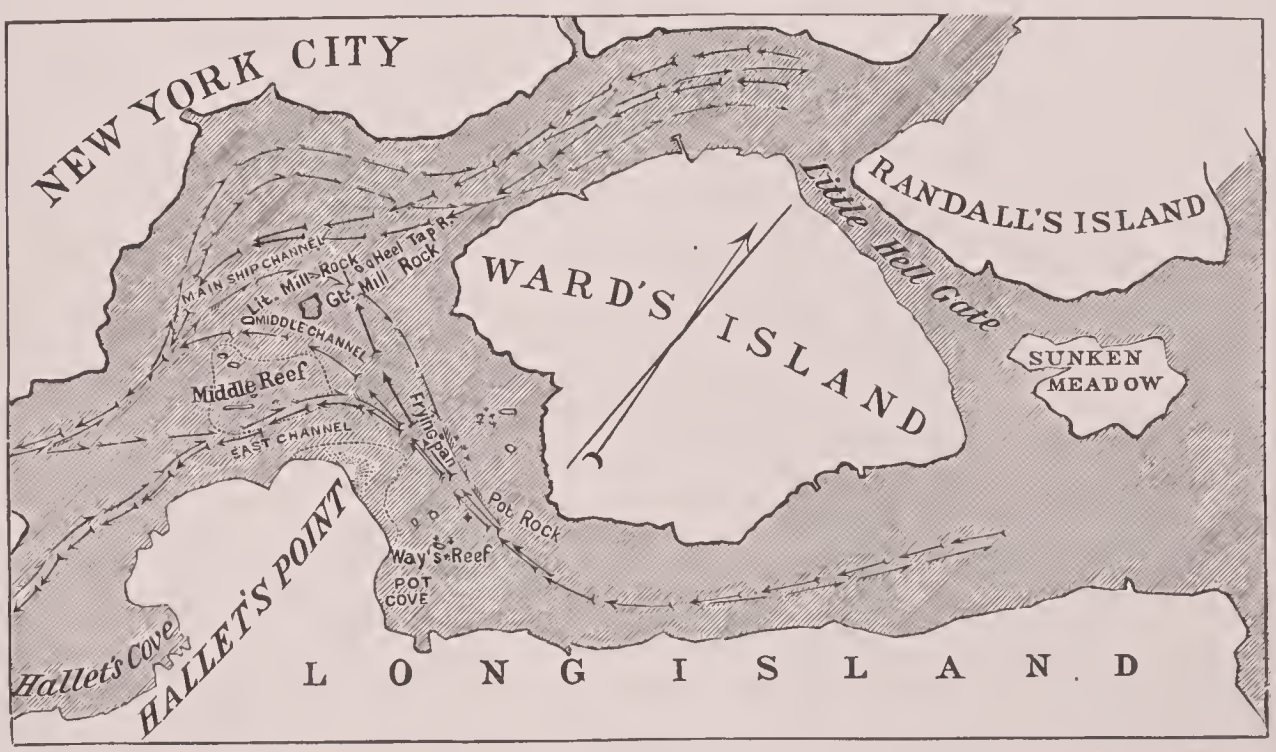



FIG. 1.—Map of Hell Gate.
Scale 1 : 25,000.

The necessity of doing something to diminish the dangers to navigation was urgent, for, according to some reports, one sailing vessel out of every fifty sustained more or less damage from being forced by the violent currents upon the rocks and shoals; while, according to others, fifty vessels went on shore in two months. Notwithstanding, nothing was attempted until 1851, when the process of surface-blasting introduced by M. Maillefert was applied by him. This process was very simple, and consisted in placing upon the rock a charge of gunpowder, usually 125 lb., contained in

a tin canister, and exploding it by means of the voltaic current. The weight of the water resting upon the charge served to tamp it and to increase the effects of the explosion. The services of divers were not called into requisition, but the charges were simply let down from a boat by means of an iron rod. No means were provided of removing the broken rock after the blasts, it having been taken for granted that the force of the explosion would be sufficient to project the *débris* into deep water. This assumption was a manifest error, and the consequence was that, in default of mechanical means of removing the broken rock, it was broken fine and powdered by the successive charges until it was small enough to be carried away into deep water by the tidal currents.

The rock in Hell Gate, so far as it has been examined, is a gneiss, stratified in thin layers, the direction being about N. 52° E., and the dip a few degrees from the perpendicular. The different layers, differing in composition, hardness, and durability under exposure to abrading influences, would necessarily be unequally worn, whether exposed to the action of the air or to rapid currents of water, and this unequal action has been tested by observation. The surfaces of the reefs are consequently very uneven. Sheets of rock or clusters of sheets, composed of the more durable materials, are continually found projecting many feet above the general surface. Pot Rock had 8 feet over it at low water, deepening quickly to 14 feet on two sides, and suddenly to 24 feet on the other two. Its form was quite pointed, and essentially that of a truncated pyramid, down to a depth of 18 feet, where the surface became flattened and of considerable development in every direction. Frying Pan on the top was 16 feet long and only 6 inches wide, and had over it a depth of 9 feet at low water. Way's Reef on the top was conical, and had a depth over it of 5 feet at low water. Bald-headed Billy was described as a single rock about 6 feet by 6, and capable of being easily blown into deep water.

Whenever the rock was of small area, projecting above the general level of the bed-rock, of a conical or columnar shape, or when it presented itself in narrow sheets, the process became very effective, and was in fact generally cheaper than any other. On the contrary, when the rock was in large mass, with flattened surface—which was the condition to which the rocks were generally brought after the projecting parts had been broken off—then the process became very slow and inefficient.

The duty of an examination of Hell Gate was committed in 1866 to Brevet Maj.-Gen. John Newton, U. S. Engineers, who was instructed by the engineer department to prepare a project with a view to its improvement for the purposes of navigation, and sufficiently in detail to present a plan and estimate for the necessary operations. This officer submitted his report in Jan., 1867, in which the estimate was based upon removing the reefs by blasting, after drilling the surface from a fixed platform.

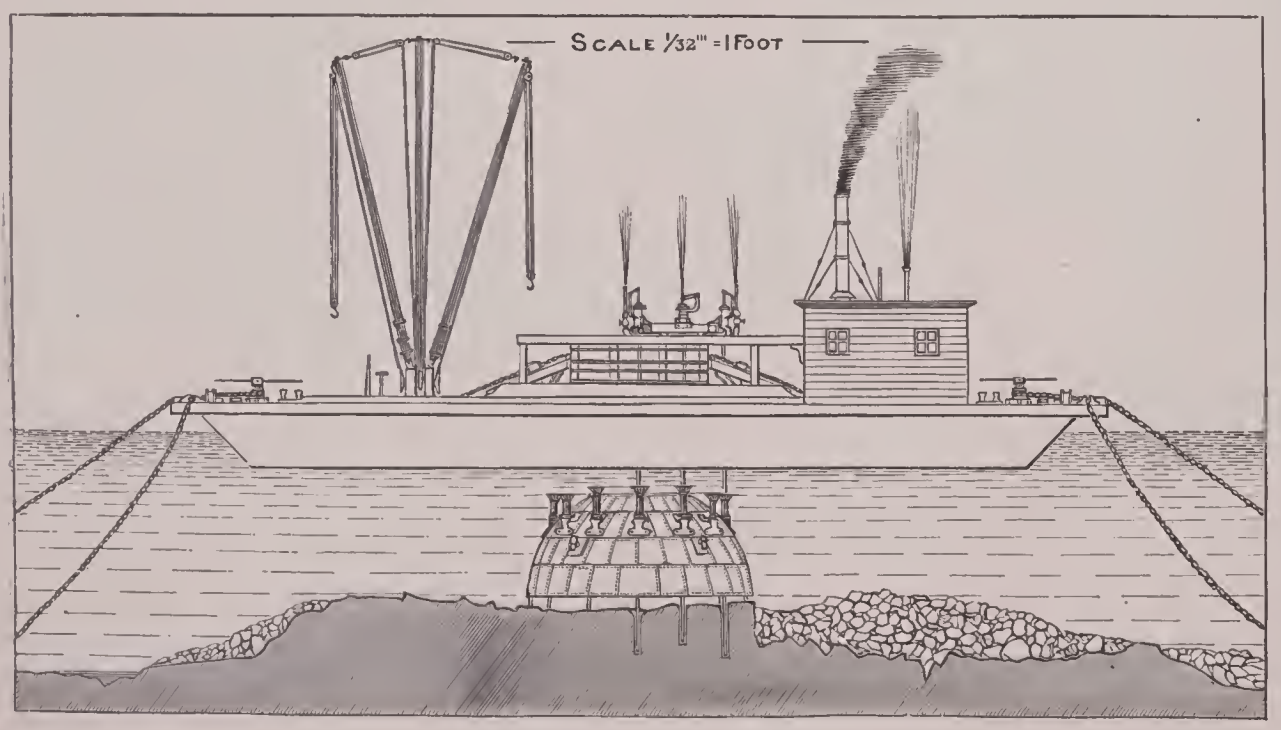



FIG. 2.—Submarine drilling scow.

From the considerations which were presented the construction and working features of the steam-drilling cupola scow, the invention of Gen. Newton, resulted. This machine consists of two parts—a large float or scow, having a well-hole in it of a diameter of 32 feet. It is built very heavy and strong, and is provided with an overhang or guard around it, faced with iron, and has proved itself capable of withstanding violent collisions with other vessels. Besides affording this security, it serves also to transport the caisson or dome from place to place, and is a working platform from which the drilling-engines are operated. The caisson or dome is a hemisphere of the diameter of 30 feet, composed of a strong iron frame covered with boiler iron. The dome is open at bottom and at top, and is provided at the bottom with legs to support and level it, which are arranged to be let go altogether after the dome is lowered. Owing to the hemispherical shape of the caisson, the pressures of the moving mass of water which are normal to the surface necessarily pass through the center, and there is consequently no tendency to an overthrow by the action of horizontal currents, but, on the contrary, an additional downward pressure favorable to stability is produced. This would not necessarily be the result if the dome was of small diameter, for in this case, when on the bottom, it might lie entirely within the region of vertical eddies produced by the uneven character of the rock, and these forces acting within the interior of the dome would tend to an overthrow. When the dome is large, a small portion comparatively lies within the area of these abnormal currents, while the outer surface acted upon by the horizontal currents gives rise to normal forces which tend to an equilibrium.

The caisson or dome is simply a framework, affording a fixed support to twenty-one drill-tubes through which the drills operate. The dome is connected with the scow by four chains communicating with four hoisting-engines, by which it is lowered or raised. A framework is built upon the scow around the well-hole, to support the carriage holding the drill-engines, which by these means may be placed directly over the drill-tubes. The engines simply raise the drill-rods, and allow them to fall by their weight upon the rock, the vertical play being 18 inches. The drill and drill-rods together are about 10 feet long, and weigh from 600 to 700 lb. The cutting edges are in the form of a cross, and are 5½ inches long.

The scow, having the dome swung by chains, is first anchored over the rock to be operated upon, so that the bow and aft moorings pull against the direct currents of the ebb and flood tides; but as these may vary somewhat in direction from one tide to another, as well as during the course of the same tide, it becomes necessary, in order to steady the scow, to have side anchors also. The diver descends to ascertain whether the location is well suited to placing the dome on the bottom, and if not to select a better. The required change in the position of the scow is made by lengthening and shortening the mooring-chains with capstans, which are arranged to be worked, at will, with steam or man power. The dome is then lowered, and when it touches or approaches near the bottom the legs are let go by the run, and, being held by self-acting cams, support the weight of the dome. The chains are now unslung from the dome, which is thereby without connection with the scow. The diver, if practicable, descends to ascertain which of the drill-tubes it is necessary to use to break up the rock within the dome, and how the surface offers itself to each particular

drill. The drill-rods being introduced within the drill-tubes —which is easily effected during the most violent currents— a rope or other flexible connection is now made between the top of the drill-rod and the piston-rod of the drilling-engines. A flexible connection is necessary to the act of drilling, as in this machine, the dome remaining fixed upon the bottom in one position, while the scow holding the drill-engines swings for short distances from changes in the directions and strength of the currents, no rigid connection between the engines and drills would be practicable. The length of the rope-attachment is regulated by a feed-gear for the rise and fall of the tides and continual changes of water-level.

The drilling being completed, preparations are made for charging the holes with nitroglycerin or other explosive. The chains are hooked on the dome, which is then raised from the bottom, and the scow swung off from the spot to a safe distance, without casting loose the moorings. This distance will depend upon the proposed amount of charge of nitroglycerin, and will vary from 175 to 350 feet. The nitroglycerin and tin cases, of different lengths to suit the varying depths of the drill-holes, are carried to the spot upon a small scow, from which the diver descends to the first hole to be charged. He is guided to this by a line. Withdrawing the plug, he introduces into the hole the tin cartridge, which has been filled by the men on the scow and passed down to him. Each cartridge is attached, before it is sent down, to the wires. The diver then passes on to the second hole, guided by the plug-line which connects the stoppers of the adjacent holes, and in this way the whole circuit of holes is visited and charged. The leading wires are connected with the battery when the small scow has been withdrawn, and then explosion is made.

After the rock broken by the explosion covers the greater part of the reef, its removal is commenced. This is effected by means of the steam-grapple. Operations of the steam-drilling scow were the removal of Coenties Reef, Ways Reef, Diamond Reef, Pilgrim Rock — a reef 450 feet N. E. of Diamond Reef— and of others.

*Hallet's Point Reef.*—This reef was in shape an irregular semi-ellipse, the longer axis, which lay next to the shore, being 720 feet in length, and the shorter semi-axis projected about 300 feet straight into the channel. It was equally in the way of small and large vessels, especially when coming down with ebb, in the effort to hug the Astoria side, and so avoid being thrown upon the Middle Reef. The area operated upon, which included all that portion within the contour-line of 26 feet below mean low water, contained about 3 acres. This space was perforated with 41 radial tunnels, long and short, and with 11 transverse galleries, leaving as supports to the roof 172 piers of the natural rock. The aggregate length of tunnels and galleries was 7,426 feet, and the amount of rock excavated from these and deposited in dump-piles on the land was about 35,000 cubic yards. The work of excavation was begun in the latter part of Oct., 1869, and terminated in June, 1875; deducting the time lost by suspension of work due to exhaustion of current appropriations, the actual period consumed in this work was four years and four months.

As soon as the excavation was finished the work of drilling holes in the roof and piers, to be afterward charged with explosives, was begun. At the completion, Mar. 25, 1876, there had been drilled in the roof 5,375 3-inch, and in the piers 1,080 3-inch and 286 2-inch, holes, the total length of holes drilled being 56,548 feet of 3-inch and 1,897 feet of 2-inch holes. Capt. William H. Heuer, of the Corps of Engineers, was on duty as superintendent from June, 1872, to May, 1876, and his services were very valuable. Capt. James Mercur, Corps of Engineers, relieved him. Capt. Mercur's services were very valuable in the preparation for the explosion and afterward in the tunneling of Flood Rock.

The proximity of the reef to the habitations at Astoria and Ward's and Blackwell's islands made it necessary to devise a system of explosion which, effecting the work of demolition, would at the same time do no damage to life and property.

The cubic contents of the roof and piers were 63,135 cubic yards, and the amount of explosives as follows:

| | Pounds. |
|---|---|
| Rend-rock | $9{,}127\frac{8}{16}$ |
| Vulcan powder | $11{,}852\frac{13}{16}$ |
| Dynamite, No. 1 | $28{,}935\frac{4}{16}$ |
| Total | $49{,}915\frac{9}{16}$ |

The explosives were packed at the respective places of manufacture in the cartridge-cases furnished by the Government. The number of holes charged was 4,427, and the number of tins used 13,596, 87 per cent. being 22 inches and the remainder 11 inches in length. One end of each tin case was fitted with a screw-cap with rubber washers to exclude water, the other end being arranged with four short lengths of brass wire soldered on the perimeter of the bottom and spread out. When the cartridge was pushed home, the wires, by their elasticity pressing against the surface of

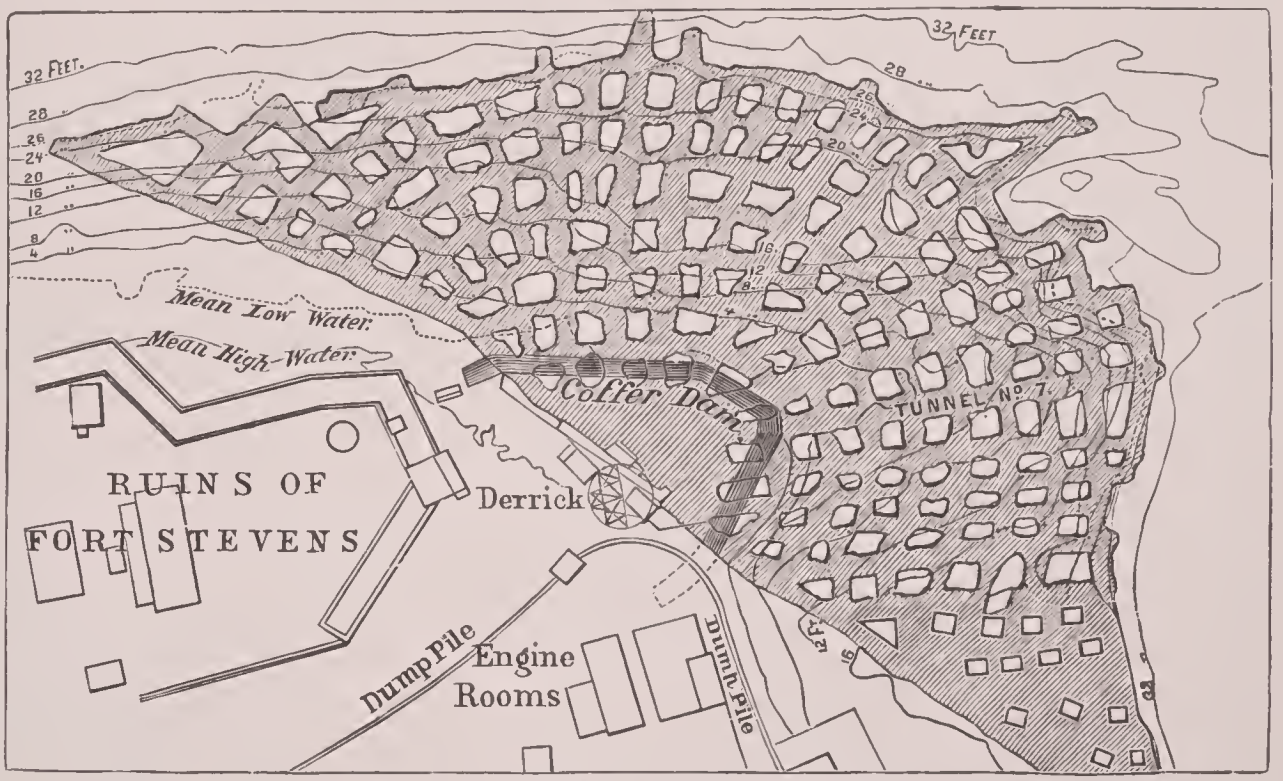



Fig. 3.—Plan of excavations; scale, 1 : 1,500.

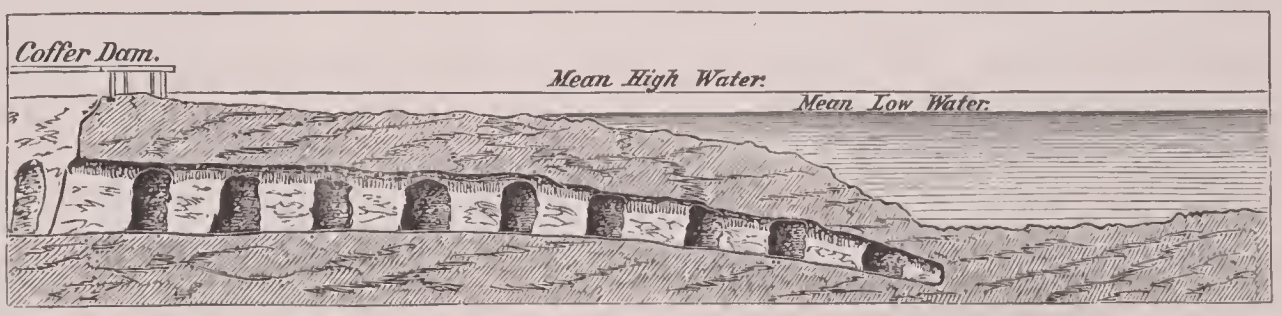



Fig. 4.—Longitudinal section through tunnel No. 7; scale, 1 : 750.

the hole, prevented a falling out. After charging the holes the next operation was to insert the priming charges, three-quarters of a pound each of dynamite, contained in a brass tube, in which was inserted a fuse as a detonator, containing 20 grains of fulminate of mercury.

| | | |
|---|---|---|
| Resistance of lead wire, per 100 feet..... | 0·157 | ohms. |
| Resistance of connecting-wire, per 100 feet... | 0·68 | " |
| Resistance of fuses, cold..... | 1·90 | " |
| Resistance of fuses at moment of explosion... | 2·01 | " |
| Resistance of battery, per cell..... | 0·15 | " |
| Electro-motive force of battery, per cell..... | 1·95 | volts. |
| Current required to explode fuses in series... | 0·675 | webers. |

The resistance of the wires and of the battery and its electro-motive force was revised by Gen. Abbot at the Engineer Torpedo School, and he also furnished the resistance of the fuses at the moment of explosion and the amount of current required to explode fuses in series.

The general formula is

$$C = \frac{E}{R + r_1},$$

which with the substitution of the values of the electro-motive force and the resistances enabled the relations of the batteries and the number and grouping of the charges to be determined.

The quantity of actual water raised by the explosion was trifling, as made evident by the almost total absence of a propagated wave. The explosive effect in the air was not perceptible, the window-glass in buildings close to the shaft, and of one in particular along the edge of the shaft, not having been in a single instance broken. The underground shock was trifling, but perceptibly felt, it is said, in New York and Brooklyn.

The broken rock from the explosion has since been grappled and removed, making the depth over the reef at Hallet's Point 26 feet at mean low water. The removal of the *débris* demonstrated the fact that all of the cartridges were exploded, including 822 without electrical connections, which therefore went off by sympathy.

*Flood Rock.*—The Middle Reef—commonly known as Flood Rock—1,200 feet long and 600 feet in extreme width, was in the middle of Hell Gate, and separated the east and middle channels. It constituted the largest and most formidable obstruction, and its removal more than doubles the navigable capacity of these waters. Work was begun June 7, 1875, and was continued until May, 1876, resulting in sinking two shafts 65 feet apart, one 51 feet and the other 23 feet deep, and in driving 229 feet of tunnels. The work of excavation was recommenced Oct. 7, 1876, and was stopped Dec. 31. The excavation was resumed Aug. 1, 1878, and continued, with interruptions—in all, of several months—until May 31, 1883, when work was suspended for want of funds. But for this need the reef would have been blown up in Oct., 1883. In the spring and summer seasons it would have been hazardous, because of the electrical condition of the atmosphere, to attempt the explosion; in the winter the explosives, in the form in which these had to be used in the work, would freeze and prove difficult and uncertain of detonating; so that practically the season was limited to about two months in the autumn. The next appropriation, $360,000, was made July 5, 1884, and was limited in its application to "removing the reef at Hell Gate." The whole amount was applied to the removal of Middle Reef (Flood Rock). Work was resumed in Aug., 1884. About 9 acres of reef were operated upon, and 21,670 feet of tunneling, in galleries whose floors lay from 50 to 64 feet below mean low tide, with walls from 10 to 24 feet thick between them, and supported by 467 columns of rock, each 15 feet square, were charged with 240,399 lb. of rack-a-rock (a substance formed by mixing 79 parts of finely ground chlorate of potash and 21 parts of dinitrobenzole) and 42,331 lb. of dynamite. There were 11,789 drill-holes in the roof and 772 in the pillars, and their total length was 113,102 feet, or more than 20 miles. The tunnels were filled with water prior to the explosion by means of siphons discharging into the lowest level of the excavation. The explosion was effected by electricity Oct. 10, 1885. The whole area of the reef was shattered. The water rose some 150 feet, and rock from 40 to 50 feet. The underground shock was small, but was perceptible for many miles around. When the rock is removed the channel will be fully 1,200 feet in width. The actual oversight of the preparations for this explosion fell upon Lieut. G. McC. Derby, of the Corps of Engineers, Gen. Newton being confined for the most part, as chief of engineers, to his station in Washington, and his assistant, Col. Walter McFarland, being frequently called away by duties connected with the numerous works in his charge.

Unlike the explosion at Hallet's Point, but few of the 12,561 separate charges fired were ignited by electric discharge—the explosion being effected by the electric ignition of 591 primary charges, placed 25 feet apart, each composed of 10 lb. of dynamite No. 1, and by the sympathetic explosion of the rest. Gen. Newton in 1876 directed Mr. Striedinger, just prior to the explosion at Hallet's Point, to test the fact of the reported sympathetic explosion of charges of dynamite immersed in water, and the fact was verified, but the time was too short to do more than that. In 1885 Col. McFarland and Lieut. Derby were directed by Gen. Newton to make exhaustive experiments upon sympathetic explosions in water suited to the conditions at Flood Rock, and the results obtained were that dynamite charges encased in tubes of sheet copper 0·005 of an inch thick could certainly be fired by the explosion of 10 lb. of dynamite at a distance of 27 feet. And this carefully found result enabled the engineers to dispense with electric connections, except for a very limited number of the charges fired.

Gen. Newton gave up the charge of Hell Gate Dec. 31, 1885, and the removal of the broken reef is not finished, owing, it is believed, to inadequate appropriations.

JOHN NEWTON.

**Hellgramite-fly**: See ENTOMOLOGY.

**Hellin**, hel-yeen': town; in the province of Albacete, Spain, on the Menedo; beautifully situated on the slope of the Sierra de Segura; 69 miles by rail N. N. W. of Murcia (see map of Spain, ref. 17–H). It is well built and contains interesting remains of a Roman castle. In its vicinity are rich sulphur mines and sulphurous springs used for bathing. Pop. (1887) 13,679.

**Hellmann**, JOHANN GEORG GUSTAV, Ph. D.: meteorologist and bibliographer; b. in Loewen, Silesia, July 3, 1854; educated at the gymnasium at Brieg, and in the Universities of Breslau, Berlin, and Göttingen; after completing his education spent two years in Spain making hypsometrial observations in the Sierra Nevada, and studying the climatological conditions of the subtropical zone. He then made an official study of the Government meteorologieal services, and spent a year at St. Petersburg with Dr. Wild, director of the Russian service. In 1879 he took part in the International Meteorological Congress at Rome, where he proposed the international meteorological tables and the bibliography of meteorology. In the autumn of 1880 he entered the Royal Prussian Meteorological Institute as assistant, and is now the first officer. He is one of the editors of the *Deutsche Meteorologische Zeitschrift*, and is a prolific writer, the most extensive of his works being the *Repertorium der Deutschen Meteorologie* (Leipzig, 1884). MARK W. HARRINGTON.

**Hellmuth**, hel'moot, ISAAC, D. D., D. C. L.: Anglican bishop; b. near Warsaw, Poland, Dec. 14, 1820; educated at the University of Breslau; became in 1856 an Anglican minister in Canada; founded Huron College (1863) and Hellmuth College (1865), London, Ontario, and Hellmuth Ladies' College (1869); was successively archdeacon and dean of Huron; became in 1870 suffragan Bishop of Norfolk and coadjutor of Huron, and in 1871 succeeded Dr. Cronyn as Lord Bishop of Huron. Dr. Hellmuth resigned his see in 1883 to become assistant to the Lord Bishop of Ripon, England. On the death of Bishop Bickersteth, of Ripon, Dr. Hellmuth became rural dean of Bridlington, England (1885). He has published a work on *The Authenticity and Genuineness of the Pentateuch* and *A Biblical Thesaurus*.

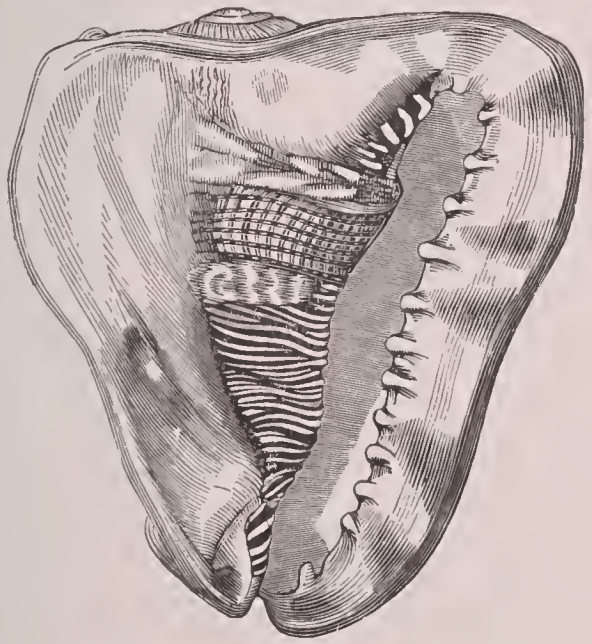
**Hellquist**, CARL GUSTAF: historical painter: b. in Kongsör, in Vestmanland, Sweden, in 1851. He has painted a number of scenes from Swedish history, and has received many medals. Hellquist is professor in the Berlin School of Arts, and since he became a resident of Germany he has produced several pictures from German history, among them *Luther's Arrival at Wartburg*. R. B. A.

**Helm** [M. Eng. *helme* < O. Eng. *helma*: M. H. Germ. *helm* > Mod. Germ. *Helm*, handle, rudder. See HALBERD]: on shipboard, the steering apparatus, including wheel, tiller, and rudder. To *put down the helm* is to bring the ship's head to the wind; to *put up the helm* is the reverse. By means of the wheel the rudder is inclined to an angle varying from the ship's course, until by the action of the water upon the rudder the ship's direction is properly modified.

**Helmet** [from O. Fr. **helmet, elmet*, dimin. of **healme, heaume*, from O. H. Germ. *helm*, helmet > Mod. Germ. *helm*]: a piece of armor for the head. This is the general term applied to defensive head-coverings of all epochs and of all materials and shapes. Leather caps and caps stuffed and lined with felt, etc., and also caps of skin with the hair left on, are always worn before the skill of the iron-workers is sufficient to enable them to make iron head-gear. Bronze helmets are sometimes worn by peoples well advanced in certain arts, but still unskilled in iron-work. Thus the helmets of early Greek peoples were often of bronze, very finely manufactured. These Greek helmets sometimes left the face exposed; sometimes a *nasal* or nose-piece and two side-pieces covering the cheeks came so near to meeting one another that only the eyes and parts of the cheeks were left uncovered; sometimes also the cheek-pieces were hinged to the cap, and intended to be tied together under the chin. In a similar manner, and even more generally, the helmets of the Romans left the face uncovered. In fact the shield was expected to protect the face and throat, the helmet being rather calculated to resist blows from behind and from above. It was left for the nobles and gentlemen of the Middle Ages to cover their heads with completely closed helmets, those of the time of Richard I. of England being the first. The *heaume* was always a closed head-piece, sometimes made with an adjustable vizor, or with two movable pieces, the *vizor* and the *beaver*. As the heaume grew heavier and larger in the competition between weapons of offense and armor of defense, lighter head-pieces, such as the bassinet, were used, and in the thirteenth and fourteenth centuries some such lighter head-piece was worn in war, and at the moment of going into battle the great heaume was put on outside of it, covering the neck and often resting on the shoulders. This was so oppressive that the *salade* was introduced, a solid and strong cap for the top and sides of the head, the neck and throat being protected by other parts of the armor; and finally the *armet* was invented, a perfect piece of armor, but very elaborate and very costly. Very soon after this last invention, complete armor began to disappear, and the *morion*, a kind of steel hat with a brim, replaced all other head-pieces, except that the armet continued to be the head-piece of ceremony and of state, and as such is represented in portraits of men of very high rank, down to the reign of Louis XIV. and of James I. of Great Britain.

RUSSELL STURGIS.

**Helmet-shell**: the large shell of gasteropods of the genus *Cassis* of which there are some thirty-five living and as many



*Cassis tuberosa.*

fossil species. The living ones are found in all tropical seas, and are used in making shell cameos. *Cassis cornuta* gives a white figure on an orange ground; *C. tuberosa* and *madagascarensis*, white on claret color; *C. rufa*, a salmon color on orange.

**Helm'holtz**, HERMANN LUDWIG FERDINAND, von: physiologist, physicist, and mathematician; b. at Potsdam, Prussia, Aug. 31, 1821. He took his degree in medicine at Berlin 1842; was a military surgeon until 1847, during which year he published his famous memoir, *Ueber die Erhaltung der Kraft* (upon the *Conservation of Energy*). Helmholtz taught anatomy in the Berlin Academy of Art 1848–49; he became Professor of Physiology and General Pathology at Königsberg (1850), where in 1851 he announced the invention of the ophthalmoscope. In 1855 he was appointed Professor of Anatomy and Physiology at Bonn, and in 1858 he was elected to fill the newly created chair of Physiology at Heidelberg. His greatest works are *Handbuch der physiologischen Optik*, the preparation of which occupied ten years (1856–66), and the almost equally important *Lehre von den Tonempfindungen* (1862). From the first, von Helmholtz had been a physicist as well as a physiologist, and in 1871 he became Professor of Physics and director of the physical laboratory of the University of Berlin, positions he held until 1887, when he was called to the head of the great physico-technical institute for research, established by the German Government at Charlottenburg. In 1883 Helmholtz, who had long been a privy councilor to the Emperor William I., became *von* Helmholtz, hereditary nobility having been conferred upon him by that monarch. Under von Helmholtz Berlin became the greatest center in the world for the study of experimental and theoretical physics. His own contributions, chiefly in the latter field, have been accorded the very highest rank. D. near Berlin, Sept. 8, 1894. E. L. NICHOLS.

**Helmholtz**, ROBERT, von: physicist; son of Professor Hermann von Helmholtz. He published several papers of note, particularly in the domain of the physics of gases. Two of these, entitled *The Steam-jet and the Dissociation of Gases*, in collaboration with F. Richarz (Wiedemann's *Annalen*, vol. xl., p. 161), and *The Radiation from Burning Gases*, were posthumous. The latter was awarded the prize of the Society for the Promotion of Industries in Germany. Robert von Helmholtz died at the very beginning of his scientific career, in Aug., 1889. E. L. NICHOLS.

**Helmont**, JAN BAPTISTA, van: physician; b. at Brussels, 1577; studied at the University of Louvain; became a mystic, and after varied experiences married a rich lady, settled down at Vilvoorden, and spent all his time in his laboratory and in curing people according to a new method. He was a leading alchemist. His writings, *Ortus Medicinæ* (1648), *Opuscula Medica Inaudita* (1644), are of much interest. D. Dec. 30, 1644.

**Helmstedt**: town; in the duchy of Brunswick, Germany; 24 miles E. S. E. of the city of Brunswick (see map of German Empire, ref. 4–E); has a great name in Church history, as its university, founded in 1575 by Julius, Duke of Brunswick, and suppressed by Jerome Bonaparte in 1809, was the seat of the syncretistic tendency of German theology—that form of Lutheranism which, originating from Melanchthon, or at least developing under his influence, sought a reconciliation with the Reformed Church. The town has large alum and vitriol works, and carries on a brisk trade. Pop. (1890) 10,955.

**Hel'mund**: a river of Afghanistan; rises in the Kuh-i-Baba Mountains, W. of Cabul; flows S. W. through Afghanistan, and receives a number of tributaries, by means of which it drains about one-third of Afghanistan S. of Cabul and Herat. It empties into the salt lake Hamun-i-Sawaran. In the upper part of its course it traverses a desert waste; the lower half of its course is fringed with villages, grain-fields, and gardens. C. C. A.

**Heloder'ma** [Mod. Lat., from Gr. ἧλος, nail + δέρμα, skin]: a genus of lizards, of the family *Helodermatidæ*, having, besides other distinctive anatomical characters, the head and rest of the body covered with rounded scales, suggestive of small nail-heads. The tongue is fleshy and slightly forked, the teeth are grooved and connected with the outlets of very largely developed salivary glands. The color is orange yellow, with irregular black markings, the brilliancy of coloration varying according to surrounding conditions and the time that has elapsed since the shedding of the epidermis. There are two species, *Heloderma horridum*, from Northern Mexico, and the Gila monster (*H. suspectum*) from Arizona, New Mexico, and Texas. They are sluggish in their movements, and feed to a considerable extent on birds' eggs. The helodermas are of great interest, from the fact that they are the only known venomous lizards, although the extent to which they are poisonous doubtless is dependent on the conditions under which the bite was inflicted. Marvelous tales are told in Mexico of *H. horridum*, and how men have died after having been bitten by this reptile. On the other hand, the bite of the heloderma has been followed by no serious results, and it is a question as to whether death re-

sulted from the bite, or from the ensuing treatment. Chickens, pigeons, and cats have been bitten without any ill consequences, but pigeons, frogs, and rabbits injected hypodermically with the saliva of this lizard have died in a few minutes. The poison does not attack the nerve centers, but acts on the heart, producing paralysis of that organ. See article *Lizard* in *Ency. Brit.* (9th ed., vol. xiv., p. 735); Sir Joseph Fayrer in *Proc. Zoöl. Soc.* (London, 1882, p. 632); S. Weir Mitchell and E. T. Reichert, *Med. News* (Feb. 10, 1883) and *Science* (vol. i., p. 372); and H. C. Yarrow in *Forest and Stream* (vol. xxx., p. 412). F. A. Lucas.

**Heloise**, or **Eloise**: See Abelard.

**He'los**: town of Laconia, near the mouth of the Eurotas; founded by Helius, the youngest son of Perseus. It defended itself with great stubbornness against the Dorians, who after conquering it took revenge by making all its inhabitants slaves; hence the name Helots (*q. v.*) for the Spartan serfs or state slaves, who were hired out to citizens, but might not be sold or emancipated. When Pausanias visited it in the second century A. D. he found it in ruins, and even its site is not precisely known.

**He'lots** [from Lat. *Helo'tæ* = Gr. Εἱλῶται, plur. of Εἱλώτης, inhabitant of Ἕλος, a town of Sparta. See Helos]: the third and lowest class in ancient Sparta; the serfs of the state. They were divided among the *Spartiatæ*, or highest class, by lot, and tilled their lands, paying to their masters a fixed portion of the harvest. They also served in war in various humble capacities. The *Crypteia* was an organized guard over the Helots by young Spartans, made necessary by the great numbers of the former (twice as many at least as all other classes together) and their general uneasiness, but the statement that there was actual hunting and slaying of the Helots by this police guard is unfounded. See Greece, Ancient History of. C. H. Thurber.

**Helper**, Hinton Rowan: See the Appendix.

**Helps**, Sir Arthur: author; b. at Streatham, Surrey, England, July 10, 1813; graduated at Cambridge in 1838; became private secretary to the Chancellor of the Exchequer, and in 1859 clerk of the privy council for England. Among his numerous works are *Thoughts in the Cloister and the Crowd* (1835); *Essays Written in the Intervals of Business* (1841); several dramas; *The Claims of Labor* (1844); *Friends in Council* (1847; 2d series, 1859); *Companions of my Solitude* (1851); *Conquerors of the New World* (1852); *Spanish Conquest of America* (1855–61); *Life of Pizarro* (1869); *Brevia* and *Casimir Maremma* (1870); *The Life of Cortez* and *Thoughts on Government* (1871); *Life of Brassey* (1872); *Ivan de Biron* (1874); *Social Pressure* (1874). Helps's writings are in a pure though not forcible style. He enjoyed the special favor and patronage of Queen Victoria for many years. D. in London, Mar. 7, 1875.

**Hel'singborg**: town of the province of Malmö, Sweden, on the Sound, opposite to Elsinore, in Denmark (see map of Norway and Sweden, ref. 14–D). Pop. (1890) 20,410.

**Hel'singfors** [Swed.; Helsing fall]: the capital of the grand duchy of Finland; on the Gulf of Finland (see map of Russia, ref. 5–B). It is a handsome town, with broad streets intersecting at right angles, fine parks, and stately public buildings. It has an excellent harbor, and is strongly fortified. Its fortifications, of which Sveaborg and Gustavsvärd are the two most important points, stretch over a row of seven rocky islands, and were in 1854 bombarded by the allied French and British fleet. Helsingfors has a university (removed from Åbo in 1827) attended by about 2,000 students, a military academy, and a considerable trade. The principal articles of importation are colonial and manufactured wares, wine, etc.; those of exportation are lumber, paper, and butter. The city was founded by Gustavus I. of Sweden in the sixteenth century, and the majority of the inhabitants are still Swedish in race and speech. Pop. (1894) 66,734, exclusive of the garrison.

**Helst**, Bartholomew, van der: portrait-painter; b. at Haarlem, Holland, in 1613. His works are to be seen in Holland and Belgium. His most important pictures are at Amsterdam; the one most famous is the *Banquet of the Civic Guard*, in celebration of the treaty of 1648, which acknowledged the independence of the Dutch republic; this is now in the museum, commonly called *Banquet of the Archers*. Also in the museum are a portrait group of the *Umpires* or judges of a shooting-match, and a dozen single portraits of great value, among which is the *Princess Mary*, daughter of Charles I. of England and mother of William III. of England. There are several portraits in the museum of Rotterdam, and others at The Hague, London, and Munich. He lived and died at Amsterdam, leaving a son who was also a distinguished portrait-painter. D. Dec. 16, 1670. Revised by Russell Sturgis.

**Helvel'lyn**: a mountain of Cumberland, England, 3,118 feet high, one of the highest points of land in England.

**Helvetian**, or **Helvetic, Republic**: the name of the state established in place of the Swiss Confederation after the French conquest in 1798, and maintained till Mar. 10, 1803. See Switzerland, History of.

**Helve'tii** [Lat., from Celtic, meaning high-hill men]: the ancient Celtic inhabitants of Western Switzerland. Cæsar's *Commentaries* (*De Bello Gallico*) give a graphic account of their attempt to occupy more fertile parts of Gaul, and of their terrible punishment and subjugation by the Romans (58 B. C.). Previously (107) they had met and defeated a Roman army, and had accompanied the Cimbri in their invasion of Italy, but made good their retreat after the defeat by Marius (101). In 70 A. D., refusing to recognize Vitellius, and taking the part of Galba, they were severely punished by the former. In later times they scarcely appear as a separate people. Revised by G. L. Hendrickson.

**Helve'tius**, Claude Adrien: encyclopædist; b. in Paris, Jan., 1715; was educated at the College of Louis-le-Grand; trained by an uncle at Caen for a financial career; appointed in 1738 to the lucrative office of farmer-general; a little later to that of chamberlain to the queen's household; acquired a large fortune; married the Countess de Ligniville; retired in 1751 to an estate at Voré, in Le Perche, where he spent the greater part of the remainder of his life in the care of his property and in literary labors. Having associated much while in Paris with the French philosophers of the day, Diderot, Holbach, and d'Alembert, he acquired a taste for philosophical study, and in 1758 brought out the celebrated work *De l'Esprit*, on which his fame chiefly rests. In this book he began with the declaration that "the difference between man and the other animals is simply the difference in their external form"; that "if nature, instead of giving us hands and flexible joints, had terminated our limbs with hoofs like those of a horse, we should have remained wanderers on the earth, chiefly anxious to find our needful supply of food, and to protect ourselves against the attacks of wild beasts"; and that "the structure of our bodies is the sole cause of our superiority over the beasts." He then advances to the position that "our thoughts are simply the product of two faculties which we have in common with other animals—viz., the faculty of receiving impressions from external objects and the faculty of remembering those impressions." From these premises he advances to the position that "all our notions of virtue and duty must be tested by reference to our senses, and the gross amount of physical enjoyment which they afford." "As all our emotions spring directly from our physical sensibilities," and "as our sensibilities are dependent on the outer world," it follows that "everything we have and are we owe to the objects which surround us." As a necessary corollary to these doctrines it followed not only that man is called upon to abandon himself most completely to the gratification of his appetites and passions, but also that in case he finds that he is not what he desires to be, he should change or overthrow those surrounding objects which compel him to be what he is. If those objects are political forms he should alter them or sweep them away. Thus the book furnished the basis of revolution in politics as well as in ethics. It had immeasurable popularity in France, and attracted great attention everywhere in Europe. The influence it exerted on morals in France was probably greater than that exerted by any other book during the eighteenth century. At his death Helvetius left several other works, that entitled *De l'Homme, de ses Facultés, et de son Éducation*, being the only one of importance. D. at Paris, Dec. 26, 1771. For his philosophy in a nutshell see the author's introduction to *L'Esprit*; also Morley, *Diderot and the French Encyclopædists*. C. K. Adams.

**He'mans**, Felicia Dorothea (*Browne*): poet; b. at Liverpool, England, Sept. 25, 1794; married Capt. Hemans in 1812, and in 1818, after the birth of five sons, separated from him on account of the uncongenial character of the union. Mrs. Hemans from that time resided in Wales, Lancashire, and Ireland, engaged chiefly in literary production. Mrs. Hemans's best poetry is characterized by grace and tenderness,

which is especially exhibited in her less ambitious pieces. Her works include *Early Blossoms* (1808); *The Domestic Affections* (1812); *The Forest Sanctuary* (1827); *Records of Women* (1828); *Songs of the Affections* (1830). D. near Dublin, May 12, 1835.

**Hematite**: See HÆMATITE.

**Hematozoa**: See HÆMATOZOA.

**Hemeralopia**: See BLINDNESS.

**Hemibran'chii**, or **Hemibranchiates** [Mod. Lat.; Gr. ἡμι-, half + βράγχια, gills]: an order of teleost fishes with the palatine bone directly articulated with the quadrate, without the intervention of the pterygoid: with jaws normally developed; the mouth being bounded above by the premaxillary, behind which is the supermaxillary; branchial apparatus imperfect, the superior branchihyals being rudimental, and at least the fourth wanting; anterior pharyngeal bones distinct; scapular arch connected directly with the post-temporal, no postero-temporal being developed; mesocoracoid absent; and ventral fins abdominal, the pubic bones having no connection with the scapular arch. To this order belong several families, the sticklebacks and the trumpet-fishes being the best known. They differ from most fishes in the structure of the shoulder-girdle, and the union of the palatine arch directly with the quadrate bone, as well as by the imperfection of the branchial arches, to which the ordinal name refers.

THEODORE GILL.

**Hemichorda'ta** [Mod. Lat., from Gr. ἡμι-, half + χορδή, an intestine, cord made of an intestine]: the group of animals known as ENTEROPNEUSTA (*q. v.*), so called in allusion to the fact that the notochord occurs only in the anterior portion of the body. See also CHORDATA. J. S. K.

**Hemicra'nia**: See MIGRAINE.

**Hemi'na**, L. CASSIUS: a Roman historian of the second century B. C., whose work in at least four books began with the founding of Rome, and included the second Punic war. The few fragments are given in Peter's *Frag. Hist. Rom.* (Leipzig, 1883), pp. 68–74. M. W.

**Hemiple'gia** [Mod. Lat., from Gr. ἡμι-, half + πλήσσειν, strike, smite]: that kind of paralysis which affects only one side of the body; or if both sides are affected, it is from the occurrence, a very rare one, of double hemiplegia—that is, of two concurrent paralytic strokes, one affecting each side. It manifests itself usually in the upper and lower extremities of one side, and in the parts of the head which are supplied by the fifth nerve. It may be the result of an apoplectic stroke, or of a slow effusion, or of the growth of a tumor within the brain. Owing to the decussation of the pyramids, the paralysis takes place usually on the side of the body opposite to the side of the brain in which the lesion has occurred. For example, if there be a tumor growing in the left hemisphere of the brain the paralysis will, as a rule, be manifested in the right side of the body, because the nerve-fibers cross over from side to side near the base of the brain. But if the lesion occur below this crossing, there may be hemiplegia on the same side. Hemiplegia affects chiefly the nerves of motion, but affects more or less those of sensation also. Temporary attacks of hemiplegia are also observed in chorea, epilepsy, and hysteria. The treatment of hemiplegia varies with the condition of the patient and the cause of the stroke. Generally time and rest are important to the relief of the patient.

Revised by W. PEPPER.

**Hemipodii** [Mod. Lat., from Gr. ἡμίπους, half-footed; ἡμι-, half + πούς, ποδός, foot]: an order, or sub-order, of gallinaceous birds containing the little bush-quails of the Old World; the equivalent of the family *Turnicidæ*. The crop is wanting and the arrangement of the bones of the palate is different from that of other fowls. The hemipodes are among the smallest of the game-birds, and with the exception of one species, which ranges into Southern Europe, are residents of Asia, including the Malayan region, Africa, and Australia. They are very pugnacious, the females especially so, and are sometimes trained, like game-cocks, for fighting by the Javanese. F. A. LUCAS.

**Hemip'tera**: an order of insects which derives its name from the fact that in many forms the anterior pair of wings are horny on the anterior half and membranous behind. Since this is not true of all, but since all are characterized by having the mouth parts converted into a beak or proboscis for piercing the animals or plants on which they feed, the group has frequently been termed *Rhynchota* (Gr. ῥύγχος, a beak). The group is further characterized by having the first joint of the thorax free, and an incomplete metamorphosis. The beak is composed of the under-lip rolled into a usually three-jointed tube, in which the mandibles and maxillæ, drawn out into four piercing organs, play freely back and forth. Under the term *Hemiptera* are included those insects to which the common name bug is properly applied. The order is usually divided into two sub-orders, the *Homoptera* and the *Heteroptera*. In the *Homoptera* the wings, when present, are of the same membranous structure throughout, and when at rest lie inclined upon the sides of the body. Here belong the cicadas (harvest-flies and seventeen-year locusts), the leaf-hoppers, in which the legs are fitted for springing, and the plant-lice and scale insects (frequently elevated into a sub-order, *Phytophthires*). In the *Heteroptera* the anterior wings are half horny, half membranous, and are folded flat when not in use. In some the wings are lacking. The beak is usually carried folded back between the bases of the legs. Here belong the water-skaters, the water-scorpions (*Nepidæ*), rear-horses, bed-bugs, and the like. The various LICE (*q. v.*) are frequently included as a third sub-order of *Hemiptera*. No general account of the *Hemiptera* of America has appeared. The student must seek scattered monographs and papers. See ENTOMOLOGY. J. S. KINGSLEY.

**Hemitripter'idæ** [Mod. Lat.; liter., belonging to the hemitripterus family; deriv. of *hemitripterus*; Gr. ἡμι-, half + τρι-, root of τρεῖς, three + πτερόν, wing, fin]: a family of acanthopterygian fishes, with the vertebræ in greatly increased number (16 + 23), having an enlarged sub-orbital bone articulating with the preoperculum, and distinguished by the elongated spinous dorsal fin, combined with the characters of the true cottoid (the head not compressed, no true scales, and ventrals imperfect and enveloped in a thick skin). The family is represented on the coasts of the U. S. by a species known as the deep-water sculpin (*Hemitripterus acadianus*). THEODORE GILL.

**Hemlock**, or **Spotted Hemlock**: a biennial plant (*Conium maculatum*), family *Umbelliferæ*, native in Europe, but naturalized and cultivated in the U. S. for medicinal purposes. It has an erect, round, branching stem from 3 to 6 feet high, marked with brownish-purple spots, whence the name "spotted hemlock." It bears large deep-green, decompound leaves, and small white flowers in compound terminal umbels. The plant, especially in summer, has a peculiar fetid, mousy smell. The leaves and fruit are used in medicine, the active principle being a liquid alkaloid, *coniine*, most abundant in the fruit. This is a yellowish oily fluid, volatile, of acrid taste, and strong mousy odor, slightly soluble in water, but freely in alcohol, ether, and oils. The action of hemlock results in destroying the conducting power of the nerves of motion, producing thus muscular weakness and paralysis, the effect showing itself first in the muscles of the eyes and lids and of the legs. In poisonous doses it produces complete paralysis, and thus death by paralysis of the nerves of respiration. It is not certain whether the hemlock used by the ancients as a state poison was this plant or the *Cicuta virosa*, a much more virulent herb. Hemlock has had a variety of medicinal virtues assigned to it, but its only rational use is to subdue abnormal motor activity or irritability. Many of the preparations of hemlock are apt to be inert, from lack of the volatile active principle, having been prepared from weak specimens of the plant. Revised by H. A. HARE.

**Hemlock-tree**, or **Hemlock-spruce** [so called from the resemblance of its branches to those of the hemlock plant]: the *Tsuga*, or *Abies canadensis*, one of the most common of the coniferous trees of the Northern States and British America. It is a very large tree, and when young is very graceful. Though the timber is coarse and cheap, it is very serviceable, and immense quantities of it are employed in house-carpentry in the older and longer-settled parts of North America. The bark and its extract are very extensively employed in tanning leather in the U. S.—much more so than any other astringent substance. The wood is of little value as fuel, burning up very quickly and with a loud crackling noise. "Hemlock oil" is distilled from its leaves and twigs, and "Canada pitch" is obtained from the old trees. The Carolina hemlock is *Tsuga caroliniana*. In cultivation the hemlock is one of the most graceful and comely of all trees, especially when young. It succeeds well in ornamental hedges. Several cultivated or horti-

cultural varieties are sold. If wild trees are transplanted to the open garden, care should be taken to select those which stand in sunny and exposed places. L. H. Bailey.

**Hemmelinck**, John: See Memlinc.

**Hemmingsen**, Niels: Danish theologian; b. on the island of Laaland, May 12, 1513; son of a poor peasant. After studying at Lund, he went (1537) to Wittenberg, where he remained five years, being one of Melanchthon's favorite pupils; became Professor of Greek at the University of Copenhagen in 1543, Professor of Theology in 1553, and several times rector. In 1579, on account of his Calvinistic teachings, he was dismissed from the university and deprived of his orders. He spent the rest of his life quietly in Roskilde, the latter part of it completely blind. He was a voluminous writer, all his works with one exception being in Latin. This Danish work, *Lifsens Vej* (The Way of Life, 1570), was intended both for the instruction of the people and as a confession of his own faith. His most important work is *Syntagma institutionum christianarum* (1574), the first system of theology published in Denmark. Besides theological writings, he published a number of essays on marriage and divorce, superstitions, etc. He was called "Universalis Daniæ præceptor." D. May 23, 1600. D. K. Dodge.

**Hemorrhage**: See Bleeding.

**Hemorrhoids**: See Piles.

**Hemp** [O. Eng. *henep* : Icel. *hampr* : Germ. *hanf*; a word common to all Teutonic tribes and borrowed from some people, probably the Scythians of Southern Russia, prior to the first mutation of consonants; cf. Gr. *κάνναβις*, Lith. *kanapes*, themselves loan-words]: a fiber, the use of which in Persia and India antedates the period of accurate knowledge, and the introduction of which into Europe was contemporaneous with civilization. This fiber is similar to that of flax, but coarser and stronger. (See Fiber.) The plant which produces it is also known as hemp, and is cultivated for its seed and for the oil which is expressed from the seed, and the hemp of warm countries, especially of India, possesses peculiar medical properties. (See Hashish.) The plant is known botanically as *Cannabis sativa*, and is an annual belonging to the nettle family (*Urticaceæ*). It is a dicœcious plant, having the fruit-bearing or female flowers, and the sterile or male flowers, upon different plants. Hemp grows 4 to 12 feet high, and makes its growth almost as rapidly as Indian corn. The stem is somewhat angular, rough, and hairy, branching freely when growing singly, but very little when crowded. The leaves are generally compound, five to seven leaflets being united upon the end of one leaf-stalk. The leaflets are 3 to 5 inches long, slender, and toothed at the edges. The staminate or male flowers are of a greenish-white color, and occur in loose clusters in the axils of the leaves near the top of the plant or the ends of the branches, while the pistillate or fruit-bearing flowers occur mostly in pairs close set in the axils of the upper leaves. As usually cultivated, it flowers in June and ripens its seed in August.

The leading hemp-producing countries of the world are Russia, Turkey, India, Holland, Germany, Italy, and Great Britain. The Riga hemp of Russia combines fineness and strength, and is regarded as the best. There is, however, a kind produced in Italy called "garden hemp," raised with great care by hand-culture, which is the finest. The fiber is separated from the boon much as flax is, and is spun and woven in almost identically the same way. Excellent sheetings and shirtings, white and strong, are made from hemp, and towelings (huckaback), osnaburgs, tablecloths, napkins, floorcloths, sail-duck, and the like, are manufactured on a large scale, and form articles of extensive commerce. By far the greatest consumption of the fiber is for rope, cordage, and twine.

*Cultivation.*—The cultivation for fiber is simple, the seed being sown as early as the ground is warm on well-prepared sward ground, which, if of a clayey nature, should be plowed in the autumn and worked again in spring. It is not usual to manure directly for the crop. Four to six pecks of seed are used in the U. S. to the acre, but the quantity varies according to the climate and to the strength of the soil, upon which also the vigor of the plants depends. In England 2 to 3 bush. of seed are used, but there the height of the plants is about 4 to 6 feet; in the U. S. it is frequently 7 to 9. The seed is thoroughly harrowed in and rolled, and requires no attention until it is cut. Cutworms are often quite injurious to it, and crows and blackbirds on a hemp-field are the farmer's best friends. Hemp has no diseases that are serious. When the blossoms of the flowering (male) plants turn yellow and fall off, it is usual in the U. S. to cut the whole crop; but in Europe, as soon as the "blossom hemp" has fertilized the crop and the seed is set, the hands pass through, pull all the male plants, and, binding them in bundles, dry and stack them for subsequent rotting. The female plants remain until the seed is ripe, when they are cradled, the tops, in which the seed is, cut off, and the stalks dried and stacked. Hemp is generally cradled, but if over 7 feet high this is hardly possible, and it should be cut with sharp bush-scythes. After two or three days' sunning the hemp is bound and stacked, either upon the ground if it is to be dew-rotted, or near the pools if it is to be water-rotted. The rotting is performed in the autumn or at the commencement of cool weather, and requires in pools or vats ten to twenty days, according to the temperature. Vats under cover are preferred, each being about 20 by 40 feet, and 2 to 3 feet deep. The hemp is laid in crossways, and weighted down by stones laid upon planks. The water is changed by drawing off and refilling when required. The process is completed when the fiber separates readily from the stalk, or of its own accord springs off from it like a fiddle bow-string. It is dried and stacked, and "broken" in the winter. This operation is like that of breaking flax, but performed with heavier implements. The boon is scutched and beaten out of the fiber, which is twisted into hands or hanks and pressed into bales for market. In dew-rotting the hemp is exposed to the weather in thin layers, and turned occasionally until the gumminess of the stalks is gone and the fiber separates from the boon as before described.

When hemp is cultivated for the seed it is planted upon ground suitable for corn, manured the fall before if the soil be not too light and sandy. It flourishes in moist rich soils. The culture is like that of corn, the hills being 3½ to 4 feet apart, according to the richness of the land. A dozen or more seeds are dropped in each hill, and at the first hoeing the plants are thinned to five or six. Cutworms may take two or three of these, and at the second hoeing they are reduced to four. When the blossom-hemp can be distinguished, these plants are removed, and two or three of the others left to each hill. One plant of the male or blossom-hemp is allowed to remain in the alternate hills each way, making one to each four hills, and as soon as the seed is set, the blossoms having ceased to shed their pollen (the yellow dust which falls when they are shaken), these plants too are removed, leaving only the seed-bearing plants in possession of the soil. The seed-hemp is cut before the seed shells out of itself, stacked till dry, and the seed beaten out. This must be winnowed with care, and spread in thin layers in warm airy lofts, or otherwise, so that it shall not heat. The crop is 12 to 15 bush. per acre. Hemp-seed is largely consumed as food for cage-birds and fancy poultry. It contains about 25 per cent. of oil, which is of a greenish-yellow color, and is used in the manufacture of certain soaps and somewhat in paints and varnishes.

Hemp is only locally grown in the U. S., though its culture is extending in several localities. In 1890 there were grown 11,511 long tons, worth $1,102,602. Nearly 92 per cent. of this was grown in ten counties in the State of Kentucky. The only other States in which hemp was grown at all were Illinois, Nebraska, Missouri, New York, Ohio, Kansas, and California.

The name "hemp" is commercially applied to several coarse fibers which come chiefly from tropical or extreme southern countries. They resemble true hemp only in the fact that the fiber may be used for cordage and perhaps other purposes for which hemp is employed.

Revised by H. H. Wing.

**Hem'pel**, Charles Julius, M. D.: physician; b. at Solingen, Germany, Sept. 5, 1811; studied in Paris and the University of New York, where he graduated, having removed to the U. S. in 1835. He became in 1857 Professor of Materia Medica and Therapeutics in the Homœopathic Medical College of Philadelphia; not long after settled in Grand Rapids, Mich. He published a German grammar (1842); *True Organization of the New Church* (1848); several translations of homœopathic medical works; *Homœopathic Theory and Practice* (1865); *The Science of Homœopathy* (1874). D. at Grand Rapids, Sept. 25, 1879.

**Hemphill**, Charles Robert, D. D.: a minister of the Presbyterian Church South; b. in Chester, S. C., Apr. 18, 1852; educated in the University of South Carolina, the

University of Virginia, the Columbia Theological Seminary, and the Johns Hopkins University. He is of Scotch-Irish descent. He was tutor in Hebrew in the Columbia Seminary 1874–78; Professor of Latin and Greek in the Southwestern Presbyterian University, Clarksville, Tenn., 1879–82; Professor of Biblical Literature, Columbia Seminary, 1882–85; and from 1885 pastor of the Second Presbyterian church, Louisville, Ky. He has published some important critical papers, including *Christ's Testimony to the Mosaic Authorship of the Pentateuch* (1884), and *The Testimony of Christ and the Apostles to the Authorship of the Pentateuch* in *Moses and his Recent Critics* (1889).

WILLIS J. BEECHER.

**Hemp'stead**: village; Nassau co., N. Y. (for location of county, see map of New York, ref. 8–K); on the Long Island Railroad; 21 miles E. of New York city. It contains Hempstead Institute (non-sectarian), union free school, several public halls, machine-shops, patent-leather factory, and two weekly newspapers, and has many handsome residences owned by New York business men. Pop. (1880) 2,521; (1890) 4,831; (1900) 3,582.

**Hempstead**: city; capital of Waller co., Tex. (for location of county, see map of Texas, ref. 5–I); on the Brazos river, and the Houston and Tex. Cent. Railroad; 50 miles N. W. of Houston, 100 miles N. of Galveston. It is in a high, fertile, and healthful region, in which cotton and corn are the principal products, and has a cotton-factory, a cotton-seed oil-mill, and other industrial establishments. Pop. (1880) 1,612; (1890) 1,671; not returned separately in 1900.

**Hems**: same as HOMS (*q. v.*).

**Hemsterhuys**, hem'ster-hois, FRANCIS: son of the Hellenist Tiberius Hemsterhuys; b. at Groningen, Holland, in 1720. He held a subordinate diplomatic position, studied art, literature, and philosophy, and wrote, in French, letters, *Sur la sculpture*, *Sur les désirs*, *Sur l'homme et ses rapports*, etc., which were collected in 1792 in two volumes, *Œuvres Philosophiques* (2d ed. 1809). He belongs to the sentimental school of philosophy of the eighteenth century. D. at the Hague in 1790.

**Hemsterhuys**, or **Hemsterhusius**, TIBERIUS: Hellenist; b. at Groningen, Holland, Jan. 9, 1685; studied mathematics, philosophy, and philology in his native city and at Leyden; was appointed professor at Amsterdam in 1704; of Greek at Franeker in 1717; and at Leyden in 1740, where he died Apr. 7, 1766. No modern scholar, with the exception of his great contemporary Richard Bentley, possessed a more intimate knowledge of Greek since the time of Joseph Scaliger and Isaac Casaubonus, and it is due to Hemsterhuys primarily that the study of the Greek language and its literature, which had fallen into desuetude, was again revived and firmly re-established in the universities of Western Europe, Valckenaer and Ruhnken, his great pupils, contributing not a little to this result. His principal works are editions of the *Onomasticon* of Pollux (1706), Lucian (1743), and the *Plutus* of Aristophanes (1744), an epoch-making performance, for in this work the paramount importance of scholia for purposes of textual criticism and exegesis was for the first time recognized. He was also the first to utilize the evidence furnished by the study of Greek art for the elucidation of Greek literature. See the famous *Elogium Hemsterhusii*, by D. Ruhnken (in *Opuscula*, vol. i., 239 ff.), and L. Müller, *Geschichte der class. Philol. in den Niederlanden*, pp. 74–82.

ALFRED GUDEMAN.

**Hen**: See POULTRY.

**Hénault**, ā'nō, CHARLES JEAN FRANÇOIS: historian; b. in Paris, Feb. 8, 1685; intended to enter the priesthood, but, after two years at the Oratory, changed his mind, and was soon a prominent figure in the literary and fashionable circles of the capital. Two discourses which he wrote in 1706 and 1708, respectively, won him fame, and in 1710 he was appointed president of the court of *enquêtes*. In 1723 he became a member of the French Academy. His principal work, the *Nouvel Abrégé chronologique de l'Histoire de France*, appeared in 1744, and eight editions were published in his lifetime. D. in Paris, 1770. His *Mémoires* were published in 1854.

**Henbane** [M. Eng., hen + bane]: the *Hyoscyamus niger*; a plant, generally biennial, though sometimes annual; family *Solanaceæ*, native in Europe, but naturalized in the U. S., growing in waste places in the Northern and Eastern States. The root somewhat resembles that of parsley, and poisoning has resulted from eating it by mistake. The stem is erect, round, branching, from 1 to 4 feet high; the leaves numerous, large, deeply sinuate, sea green, and both leaves and stem viscid and hairy. The flowers are yellow, beautifully veined with purple. The whole plant has a rank, offensive smell. The leaves and seeds are used in medicine, the active principle being an exceedingly poisonous alkaloid, *hyoscyamin*, which may be obtained in colorless needle-like crystals. The action of henbane on the system is almost identical with that of belladonna, causing increased pulse-rate, dryness of the throat, giddiness, staggering gait, dilatation of the pupils, delirium, and, in sufficient dose, death. It is considered to have more tendency to produce sleep than belladonna, though this is doubtful. Its uses in medicine are in the main similar.

EDWARD CURTIS.

**Hendec'agon**, less correctly **Endec'agon** [from Gr. ἕνδεκα, eleven + γωνία, corner, angle]: a plane rectilineal figure of eleven sides. The area of a regular or equilateral endecagon is very nearly equal to 9.36564 times that of the square of one of its sides.

**Henderson**: city; capital of Henderson co., Ky. (for location of county, see map of Kentucky, ref. 3–D); on the Ohio river, and the Lv. and N., the Lv., St. L. and Tex., and the Ohio Val. railways; 143 miles W. S. W. of Louisville. It has large tobacco-stemming interests, employing 25 stemmeries and 2 large factories, and a cotton-mill with $350,000 plant, woolen-mill with $250,000 plant, whisky distilleries, foundry, carriage and wagon factories, and 6 periodicals. The county-fair grounds are here. The river is spanned by a bridge opened Aug. 6, 1885. Pop. (1880) 5,365; (1890) 8,835; (1900) 10,272.

EDITOR OF "GLEANER."

**Henderson**: town; capital of Vance co., N. C. (for location of county, see map of North Carolina, ref. 2–H); on the Richmond and Danville Railroad and the Seaboard Air Line; 43 miles N. of Raleigh. It is in the celebrated Golden tobacco belt and a choice cotton-growing region, and has 5 tobacco warehouses, 4 tobacco-factories, 3 academies, canning-factory, and 3 newspapers. Pop. (1880) 1,421; (1890) 4,191; (1900) 3,746.

EDITOR OF "HUSTLER."

**Henderson**: town; capital of Chester co., Tenn. (for location of county, see map of Tennessee, ref. 7–C); on the Mobile and Ohio Railroad; 18 miles S. E. of Jackson, 100 miles E. by N. of Memphis. It is in an agricultural and a particularly choice fruit-growing region, and has three churches, Methodist Episcopal College, West Tennessee Christian College, weekly newspaper and growing trade interests. Pop. (1880) 493; (1890) 1,069: not returned separately in 1900.

EDITOR OF "NEW ERA."

**Henderson**: town; capital of Rusk co., Tex. (for location of county, see map of Texas, ref. 3–J); on the Int. and Gt. N. Railroad; 75 miles W. of Shreveport, La., 160 miles N. of Houston. It is in an agricultural and fruit-growing region, and has a college and two weekly newspapers. Pop. (1880) 1,656; (1890) 1,536; not returned separately in 1900.

EDITOR OF "TIMES."

**Henderson**, ALEXANDER: ecclesiastic; b. at Creich, Fifeshire, Scotland, in 1583; was educated in the University of St. Andrews, and was appointed Professor of Rhetoric and Philosophy there in 1610. Early in 1612 he was presented with the living of Leuchars. His appointment was extremely unpopular there on account of his approval of Episcopacy, but his views changed and his long residence in Leuchars was marked by strong confidence and affection between him and his parishioners. As troubles came on he proved himself a mighty leader among men. In 1636 Charles I. undertook to change the constitution of the Scottish Church, but he met with the most decided opposition. The National Covenant was renewed, and Henderson drew up the bond. On Mar. 1, 1638, the public signing began in the Greyfriars church in Edinburgh, and in July, same year, Henderson proceeded to the north to debate the case with the Aberdeen professors of divinity. In this undertaking he failed; but when the General Assembly met in the Cathedral of Glasgow, Nov. 21, 1638, he was unanimously chosen moderator. When the trial of the bishops began the king's commissioner, the Marquis of Hamilton, formally dissolved the Assembly under pain of treason; but the Assembly, nevertheless, continued its sittings. Eight of the bishops were excommunicated, the other six were deposed, and Episcopacy and the articles of Perth were prohibited. Very much against his wishes, the Assembly transferred Henderson from Leuchars to Edinburgh.

While the king and the people were preparing for war

Henderson published *The Remonstrance of the Nobility* and *Instructions for Defensive Arms*, the former of which contributed very much to form in England a just opinion of the Covenanters' cause. Then followed the events known as the first and second bishops' wars, each of which closed by the king being compelled to yield everything. Henderson was active in the negotiations, finally visiting London on this business. While there he preached to crowded audiences in St. Antholine's church, held service according to the Scottish form, and published several pamphlets; and when, in the same year, the king went to Scotland, Henderson was appointed one of the royal chaplains and dean of the chapel royal. He seems to have made a very favorable impression on Charles I., and the impression continued unaltered, though later on his attempts to reconcile the king with the Parliament utterly failed.

The famous meeting of the General Assembly in Aug., 1643, again chose Henderson for its moderator, and he drew up the Solemn League and Covenant, which was adopted with slight changes, not only in Scotland, but by both houses of the English Parliament and by the Westminster Assembly, thus becoming common law for both kingdoms. As Scotch commissioner to the Westminster Assembly, Henderson stayed in England from 1643 to 1646. He often took a leading part in the debates of the Assembly.

In 1646, after the Independents gained the ascendency in England, and the only chance left to the king seemed to be a reconciliation with the Presbyterians, he sent for Henderson to Newcastle, professing scruples of conscience, and desiring to confer with him. They exchanged a series of papers, eight of which (five by the king and three by Henderson) have been printed. Then Henderson, who had long been ill, returned to Edinburgh, where, eight days later, Aug. 19, 1646, he died. Besides the above mentioned writings—of which the correspondence with the king is of special interest—he published in 1641 *The Order and Government of the Church of Scotland*. A volume of *Sermons, Prayers, and Pulpit Addresses* was published in 1867 from the notes of a hearer. See Aiton's *Life and Times of Alexander Henderson* (Edinburgh, 1836); McCrie's *Life of Alexander Henderson* (Edinburgh, 1846); *The Letters and Journals of Robert Baillie* (1841–42); Howie, *Scots' Worthies*; Hetherington, *Church of Scotland*, vol. i.; Burton's *History of Scotland*.

Revised by Willis J. Beecher.

**Henderson**, Charles Hanford: See the Appendix.

**Henderson**, Charles Richmond: See the Appendix.

**Henderson**, James Pinckney: politician; b. in Lincoln co., N. C., Mar. 31, 1808, from whence he removed to Mississippi and engaged in the practice of law. In 1836 he was appointed a brigadier-general in the army of the republic of Texas; on its disbandment was chosen Attorney-General, and subsequently (1837–39) Secretary of State of the republic. He went as minister from Texas to Great Britain to procure the recognition of the republic, and in 1844 to the U. S. to secure its annexation, which being accomplished he was chosen its first Governor (1846–47). In the Mexican war he commanded a division of Texan volunteers, with the rank of major-general. In 1857 he was elected U. S. Senator from Texas. D. at Washington, D. C., June 4, 1858.

**Henderson**, Peter: horticulturist; b. near Edinburgh, Scotland, in 1823. At sixteen years of age he was apprenticed to a gardener, and at twenty he emigrated to the U. S. He pursued gardening for many years, but entered the seed business in 1865, becoming a partner in the firm of Henderson & Fleming. His books are *Gardening for Profit* (1866), which marked an epoch in market-gardening in the U. S., and of which nearly 250,000 copies had been sold when he died; *Practical Floriculture* (1868); *Gardening for Pleasure* (1875); *Handbook of Plants* (1881); *Garden and Farm Topics* (1884); and he was joint author of *How the Farm Pays* (1884). D. in Jersey City, N. J., Jan. 17, 1890.

**Henderson**, William James: See the Appendix.

**Hendersonville**: town (founded about 1845); capital of Henderson co., N. C. (for location of county, see map of North Carolina, ref. 5–E); on the Richmond and Danville Railroad; 21 miles S. of Asheville, 255 miles W. by S. of Raleigh. It is in a region producing principally cabbages, potatoes, apples, and hay; is the seat of Judson College (Baptist), has an academy, Methodist, Baptist, Presbyterian, and Protestant Episcopal churches, and weekly newspaper. Pop. (1880) 554; (1890) 1,216; (1900) 1,917.

Editor of "Times."

**Hendricks**, Thomas Andrews: Vice-President of the U. S.; b. in Muskingum co., O., Sept. 7, 1819; removed with his father in 1822 to Shelby co., Ind.; graduated in 1841 at South Hanover College; was admitted to the bar in 1843. In 1850 he was an active member of the State constitutional convention; member of Congress 1851–55 from the Indianapolis district; commissioner of the general land-office of the U. S. 1855–59; U. S. Senator (Democratic) 1863–69. He was chosen Governor in 1872 for the term of four years, and was nominated Vice-President of the U. S. by the Democratic party June 29, 1876, and July 11, 1884. He was elected Vice-President of the U. S. Nov. 4, 1884. D. at Indianapolis, Ind., Nov. 25, 1885.

**Hendrickson**, George Lincoln: philologist; b. in Winchester, Ill., May 15, 1865. He graduated at Johns Hopkins University; continued his studies in Germany; was Professor of Latin in Colorado College in 1889–91; and in the latter year was appointed to the same chair in the University of Wisconsin. He contributed philological papers to the *Colorado College Studies*, vol. i., and to *The American Journal of Philology*, vol. xiii., 2, 4, and xiv., 2.

**Hendrix**, Eugene Russell, D. D., LL. D.: bishop; b. in Fayette, Mo., May 17, 1847; educated at Wesleyan University and Union Seminary, New York: president of Central College, Fayette, Mo., 1878–86; in 1886 made bishop of the Methodist Episcopal Church South.

**Heneker**, Richard W.: See the Appendix.

**Hengest**, hen'gest, or **Hengist** [O. Eng., horse, steed: O. H. Germ. *hengist* > Mod. Germ. *hengst*, steed]: a prince of the Jutes, who in 449, with Horsa, his brother, landed with 300 followers at Ebbsfleet on the Isle of Thanet, and was employed by Vortigern, King of Britain, to repel the Picts and Scots. This the Jutes accomplished by aid of fresh reenforcements from the Continent, but soon turned their arms against the Britons, whom they overcame in a series of bloody wars. Horsa was slain at Ægleshrep 455; Hengest declared himself King of Kent 457, and repeatedly defeated the Britons in battle (465–473). D. 488. The very existence of Hengest and Horsa has been sharply questioned by modern critics, but it is probable that, after the obviously mythical parts of this story are rejected, a considerable portion of truth remains.

**Heng'stenberg**, Ernst Wilhelm: theologian and author; b. at Fröndenberg, Westphalia, Oct. 20, 1802; studied (1819) Oriental languages and theology at Bonn. In 1826 he was appointed Extraordinary Professor of Theology at the University of Berlin; in 1828 ordinary professor; in 1829 Doctor of Theology. In 1827 he founded in Berlin the *Evangelische Kirchenzeitung*, which soon became one of the most prominent religious periodicals in Germany; and after some years' labor as professor, journalist, and author he stood as the acknowledged head of the old Lutheran orthodox party. During the reign of Frederick William IV. he had great influence at court, and consequently great power at the university, but the exclusiveness of his theoretical views made him intolerant in practical life, and he raised a bitter opposition against himself. D. in Berlin, May 28, 1869. His best services were directed to the defense of the Old Testament against destructive criticism. His principal works are *Christologie des Alten Testaments* (3 vols., Berlin, 1829–35; 2d ed. 1854–57; Eng. trans., Edinburgh (Clark's Foreign Theological Library), 4 vols., 1854–58); *Einleitung ins Alte Testament* (3 vols., 1831–39: translated under the title *Contributions to the Introduction of the Old Testament*, 3 vols., 1847–48); *Commentar über die Psalmen* (4 vols., 1842–47; 2d ed. 1849–52; translated *Commentary on the Psalms*, 3 vols., 1843–44); *Das Hohelied Salomons* (1853); *Der Prediger Salomo* translated, 1859); *Ecclesiastes* (1860); *Das Evangelium des Johannes* (3 vols., 1861–63; translated *Commentary on the Gospel of St. John*, 2 vols., 1865); *Die Offenbarung Johannes* (2 vols., 1849–51; 2d ed. 1862; translated, 2 vols., 1852); and *History of the Kingdom of God in the Old Testament* (1869–71, 3 parts; translated, 2 vols., 1871–72).

Revised by Samuel Macauley Jackson.

**Henkle**, Moses Montgomery, D. D.: clerical writer; b. in Pendleton co., Va., Mar. 23, 1798; entered the itinerant ministry of the Methodist Episcopal Church in 1819, and filled important stations in Ohio, Pennsylvania, Kentucky, Tennessee, and Alabama. He was for some time associated with Dr. J. B. McFerrin in editing *The Christian Advocate* at Nashville; he also edited *The Southern Lady's Companion* 1847–55. He wrote largely for the periodical press. He

published several books, among which are the *Platform of Methodism* (1851); *Analysis of the Principles of Church Government* (1852); *Life of Bishop Bascom* (Nashville, 1854), etc. He was connected with several literary institutions as professor or president. D. in Richmond, Va., 1864.
Revised by S. M. Jackson.

**Hen'le**, Friedrich Gustav Jakob, M. D.: b. at Fürth, Bavaria, July 9, 1809; graduated M. D. at Bonn 1832; became an assistant in the anatomical museum at Berlin, and in 1834 prosector in the university, but was imprisoned for connection with a students' society which had become offensive to the government; became in 1837 a private tutor of histology and pathological anatomy; was 1840–44 Professor of Anatomy at Zurich; held a similar professorship at Heidelberg 1844–52, and in the latter year took the chair of Anatomy at Göttingen: did much for microscopic anatomy, pathology, physiology, anthropology, etc., and has a worldwide fame in these departments of science. Among his works are *Ueber Schleim- und Eiterbildung* (Berlin. 1838); *Vergleichende Anatomie des Kehlkopfs* (Leipzig, 1839); *Pathologische Untersuchungen* (Leipzig, 1840); *Handbuch der allgemeinen Anatomie* (Berlin, 1841); *Handbuch der rationellen Pathologie* (2 vols., Brunswick, 1846–52); *Handbuch der Systematischen Anatomie* (3 vols., 1855–68); *Grundriss der Anatomie des Menschen*, with atlas (Brunswick, 1880; 2d ed. 1883). D. at Göttingen, May 13, 1885.

**Hen'ley**, John: known as Orator Henley; b. at Melton-Mowbray, England, Aug. 3, 1692; was educated at St. John's College, Cambridge, where he wrote two numbers of *The Spectator* (396, 518); took orders in the Church; received appointments in London and elsewhere; became incumbent of Chelmondiston 1723, but soon gave up that living in consequence of reports affecting his character; opened the Oratory in London 1726, where he declaimed twice a week upon religion, fashion, and other subjects, and where he attempted to found a sect of Henleyarians, and to establish a system of popular education. In 1746 he was arrested by order of Lord Chesterfield for treasonable speeches. D. Oct. 13, 1759. Among his works are the *Complete Linguist, or a Universal Grammar*; *Oratory Transactions* (1728, *seq.*); *Esther, a Poem*; *History of Swedeu*; and *Primitive Liturgy*; and for a time he edited *The Hyp-Doctor*, a stupid weekly comic paper, subsidized by Walpole.

**Henley**, William Ernest: See the Appendix.

**Hen'lopen, Cape**: See Cape Henlopen.

**Henna** [= Arab. *heuna*], or **Alkan'na** [from Span. *alcana*, from Arab. *al henua*, the henna]: a paste made from the leaves of *Lawsouia inermis* or of *L. spinosa*, mixed with catechu, and used in the East to stain the nails, the fingertips, and the edges of the eyelids of women and the beards of men. It primarily gives an orange color, which, if desired, may be changed to black by adding other stains. Some species of *Hibiscus* are in Eastern Asia put to the same use. The Lawsonias are shrubs of the order *Lythraceæ*. Their leaves are used in Europe for dyeing leather. The use of the henna for dyeing the nails, the inner surface of the hands, and the soles of the feet was of very early date in Egypt, as is proved by the mummies. The practice was at one time so general in that country that it would have been considered a breach of decency not to comply with the custom. Probably it was introduced among the Jews by Solomon's wife, the daughter of Pharaoh. Since it is still practiced throughout Southern Asia, from the Mediterranean to India, it can hardly be considered as a mere caprice. Indeed the henna is said to restrict perspiration and to produce an agreeable coolness in the hands and the feet.
Revised by H. A. Hare.

**Hen'nepin** (Fr. pron. eṅ'păṅ'), Louis: Franciscan missionary and explorer; b. at Ath, in Flanders, about 1640. In 1675 he became a missionary to Canada. He was (1679–80) a member of La Salle's memorable band of explorers, who traversed the Great Lakes and the upper Mississippi and its tributaries. He returned to Europe, and soon afterward published *Description de la Louisiane* (Paris, 1683), a valuable work, though full of exaggerations, and *Nouvelle découverte d'un très grand pays* (1697), which contains his previous work, enlarged by a narrative of a pretended voyage down the Mississippi to its mouth. In later life Hennepin abandoned the habit and the obedient life of his order, though still claiming the title of Récollet missionary. D. at Utrecht about 1706.

**Hennequin**, eṅ'kăṅ', Alfred: French dramatist; b. at Liège, Belgium, Jan. 13, 1842. He was educated as a civil engineer, and practiced his profession first on the Belgian state railways, later as manager of one of the tramway systems in Paris. He early began to write plays, however, producing in Brussels, under the pseudonym Alfred Lebrun, two comedies: *J'attends mon oncle* (1869) and *Trois chapeaux* (1870). In Paris he made a hit with *Le procès Veauradieux* (1875), and thereafter entirely abandoned his profession for play-writing. He wrote alone or in collaboration the following gay and not always too proper pieces: *Les dominos roses* (1876); *Bébé* (1877) and *Nounon* (1879), with Émile Najac; *La femme à papa* (1879), with Millaud; *La corbeille de noces* (1880); *La vente à Tata* (1881); *Ninetta* (1882); *Cherchez la femme* (1885). Excessive production and fatigue produced finally softening of the brain, from which Hennequin never recovered. He died at Épinay, Aug. 7, 1887.
A. R. Marsh.

**Henner**, hen'năr', Jean Jacques: figure and portrait painter; b. at Bernwiller, Alsace, Mar. 5, 1829; a pupil of Drolling and Picot; Grand Prix de Rome 1858; third-class medals, Salons of 1863, 1865, and 1866; first-class, Paris Exposition, 1878; officer Legion of Honor 1878; member of the Institute 1889. A most skillful technician, who paints with a somewhat conventional arrangement of light and shadow, but whose methods are individual. His painting of the nude figure is luminous and beautiful in general tone. Four fine works are in the Luxembourg Gallery, Paris, and a *Nymph* is in the collection of W. T. Walters, Baltimore. Studio in Paris.
William A. Coffin.

**Hen'nessy**, Sir John Pope: British colonial governor; b. in Cork, Ireland, 1834; educated at Queen's College, Cork; called to the bar at the Inner Temple in 1861; entered the House of Commons 1859; Governor of Labuan 1867; of the West African settlements 1872; of the Bahamas 1873; of the Windward islands 1875; of Hong Kong 1877; of the colony of Mauritius 1882. He contested North Kilkenny in Dec., 1890, against the Parnell candidate immediately after Mr. Parnell's exposure, and was elected by a large majority. D. in Youghal, Oct. 7, 1891.
C. H. T.

**Henoch**, hā'nōkh, Edward Heinrich, M. D.: physician; authority on diseases of children: b. in Berlin, Germany, July 16, 1820; educated at University of Berlin; professor in University of Berlin since 1858; director of the clinic for children's diseases since 1872; author of *Klinik der Unterleibskrankheiten* (3d ed. 1867); *Beiträge zur Kinderheilkunde* (1861–68); *Vorlesungen über Kinderkrankheiten* (7th ed. 1893).
C. H. T.

**Henotheism** [Gr. εἷς, ἑνός, one, and θεός]: defined by Max Müller, with whom the term originated (*Contemporary Review* for 1878, p. 710), as "a belief and worship of those single objects, whether semitangible or intangible, in which man first suspected the presence of the Invisible and the Infinite, each of which was raised into something more than finite, more than natural, more than conceivable, and then grew in the end to be an *Asura* or living thing, a *Deva* or a bright thing, an *Amartya*, that is, not a mortal, and at last an immortal and eternal Being—in fact, a God, endowed with the highest qualities which the human intellect could conceive at the various stages of its own growth." This, according to Max Müller, is the "general name for the earliest form of religion among the Vedic Indians" (Hindus). He further says (pp. 723–724), henotheism as the worship of single gods is totally different from monotheism, or the worship of one god, involving a distinct denial of all other gods, and from polytheism, the worship of many divinities, which together form one divine polity.
S. M. Jackson.

**Henri I.**, King of Haiti: See Christophe, Henri.

**Henrietta**: town; capital of Clay co., Tex. (for location of county, see map of Texas, ref. 2–H); on the Little Wichita river, and the Mo., Kan. and Tex. and the Ft. Worth and Denver Railways; 13 miles S. of Red river, 96 miles N. W. of Fort Worth. It is in an agricultural and stock-raising region, and coal has been found in its vicinity. It contains a normal college, public school, private school, Roman Catholic convent, two weekly newspapers, flour-mills, ice-factory, cigar-factory, electric lights, and water-works. The town was founded prior to 1861, was destroyed by Indians, and was re-established in 1874. Pop. (1890) 2,100; (1900) 1,614.
Editor of "Independent."

**Henriquez**, Francisco Fernandez de la Cueva: See Fernandez de la Cueva Henriquez.

**Henry**: city; Marshall co., Ill. (for location of county, see map of Illinois, ref. 4–E); on the Illinois river and on

the Chi., Rock Is. and Pac. Railway; 33 miles N. by E. of Peoria, 128 miles S. of Chicago. The river is here spanned by an iron and wood bridge that cost $80,000, and the first lock and dam for the improvement of the river were built here. The city contains 6 churches, electric-light and telephone plants, artesian well, fine school-building, and 2 weekly newspapers. Senachwine Lake, a popular pleasure resort, is 4 miles distant. Pop. (1880) 1,728; (1890) 1,512; (1900) 1,637.

EDITOR OF "REPUBLICAN."

**Henry**, DOM: cardinal; King of Portugal; third son of Emanuel the Fortunate; b. on Jan. 31, 1512. He was educated for the Church, and in his twentieth year (1532) was made Archbishop of Braga; when he ascended the throne he held three archbishoprics—namely, those of Braga, Lisbon, and Coimbra—besides the immensely wealthy abbacy of Alcobazar. In 1539 he was made grand inquisitor of Portugal, and it was he who introduced the Inquisition into the Portuguese colonies. In 1545 he was made a cardinal. He ascended the throne of Portugal Aug., 1578. Urged to decide as to his successor, he delayed the decision, and died Jan. 30, 1580. He was succeeded by Philip II.

Revised by C. K. ADAMS.

**Henry I.** (styled BEAUCLERC on account of his learning): King of England; son of William the Conqueror and Queen Matilda, and successor of William Rufus; b. at Selby, Yorkshire, in 1068. His youth was marked by strange quarrels with his elder brothers; and when William II. died Henry hastened to assume the crown (1100) while Robert was absent in Palestine. He at once recalled Anselm, declared the validity of the Confessor's laws, and married Maud of Scotland, shrewdly securing the Church, the English, and the Scots against Robert in the coming struggle, in which Henry was entirely successful; he was acknowledged Duke of Normandy in 1106, and soon engaged in advantageous wars with France. The drowning of his son William in 1120, and the troubles with his nephew William in Normandy, and with the Welsh in the West of England, greatly disturbed the last of his reign. D. at Rouen, Dec. 1, 1135, leaving as his heir his daughter, the countess Matilda of Anjou, former wife of Henry V. of Germany. His influence was immeasurable in uniting Normans and English into one people; for after his reign the two races never met in arms on English soil. An old chronicler says of him, "Peace he made for man and deer."

Revised by C. K. ADAMS.

**Henry II.**: first Plantagenet King of England; son of Geoffrey Plantagenet and of Matilda, former Empress of Germany, the heiress and only surviving child of Henry I.; b. at Le Mans, in Maine, Mar. 5, 1133; was educated in Normandy and England; in 1152 invaded England with troops for the overthrow of King Stephen, with whom in 1153 a peace was concluded by which Henry was acknowledged as heir to the crown; succeeded Stephen in 1154, having in 1151 become Count of Anjou, Touraine, and Maine by his father's death; and by his marriage in 1152 with Eleanor of Aquitaine, the divorced Queen of France, he acquired sovereignty over nearly half of France, subject in some degree to French suzerainty. The great events of Henry's eventful reign were the Irish conquest; the wars with the Scots, Welsh, and the French king; the destruction of more than 1,000 feudal castles in England—"dens of thieves" Henry called them; the contest with Thomas à Becket; the subscription to the Constitutions of Clarendon (1164); and the rebellion of his sons and queen. He was, says Freeman, the great legislator of English feudalism, but was always Angevin, never English, in his feelings. D. at Chinon, July 6, 1189. See Green, *Henry II.*

Revised by C. K. ADAMS.

**Henry III.**: King of England; b. at Winchester, Oct. 1, 1207; succeeded John, his father, in 1216. Henry's minority at his accession, and the great power acquired by the barons under King John, crippled his authority and made his reign a weak one. Simon de Montfort, Earl of Leicester, was the great leader in the task of recovering for the nobles the privileges lost under Henry II., and by giving representation to the boroughs, formed the nucleus of the House of Commons. This was not accomplished, however, without a civil war, in which the king was defeated and captured at Lewes in 1264. De Montfort was defeated and slain in the following year by Prince Edward and Gloucester at Evesham. Henry III. was, notwithstanding the misfortunes of his reign and the misgovernment with which he has been often reproached, a man of some talent—chiefly eminent as a builder; many of the finest structures in the Early English Gothic style are the work of Henry and of his brother Richard, King of the Romans. D. at Westminster, Nov. 16, 1272, having reigned fifty-six years, and was succeeded by his son, Edward I. See Prothero, *Life and Times of Simon de Montfort* (1887).

Revised by C. K. ADAMS.

**Henry IV.**: first Lancastrian King of England; b. at Bolingbroke, Lincolnshire, Apr. 3, 1367; son of John of Gaunt, the fourth son of Edward III., while his mother was a lineal descendant of Henry III. He was made Earl of Derby and Duke of Hereford. With his adversary, the Duke of Norfolk, he was banished in 1398 by Richard II., who seized his immense estate upon the death of John of Gaunt in 1399. Soon Henry landed at Ravenspur, in Yorkshire, with a small following, the king being absent in Ireland. All England joined Henry, and Richard was dethroned and Henry crowned. Henry's defective title led him to persecute the Lollards, so as to win the support of the Church, but his reign was much disturbed by formidable rebellions. On Mar. 3, 1401, the first case of burning for heresy occurred in England. D. Mar. 19, 1413. See Wylie, *England under Henry IV.*

Revised by C. K. ADAMS.

**Henry V.**: King of England; son and successor of Henry IV.; b. at Monmouth, Aug. 19, 1387; served in his youth against the rebellious Glendower and Hotspur. The tales of his irregular life in youth are at least gross exaggerations. He was very popular, and his father seems to have been jealous of him. He came to the throne in 1413, persecuted the Lollards, and in 1414 announced to Parliament his intention of making the conquest of France upon the strength of Edward III.'s claim to that sovereignty; landed near Harfleur, which he took Sept. 22, 1415; totally defeated the greatly superior force of the French at Agincourt, Oct. 25, in one of the notable battles of history; occupied the greater part of France, aided by the Duke of Burgundy and other malcontents; married in 1420 the French princess Catharine, and was recognized as heir-presumptive. The remainder of his reign was largely occupied by wars in France. D. at Vincennes, Aug. 31, 1422. See Church, *Henry V.*

Revised by C. K. ADAMS.

**Henry VI.**: the last Lancastrian King of England; son of Henry V.; b. at Windsor, Dec. 6, 1421; succeeded his father on Sept. 1, 1422, and in 1431 was crowned King of France at Paris. His reign was marked by the wars of the Roses, maintained on the Lancastrian side more by the energy of Margaret of Anjou, the queen, than by the pious but irresolute Henry. The weakness of the king was largely responsible for the rebellion headed by JACK CADE (*q. v.*). In France Joan of Arc and her followers had expelled the English, and the popular sense of disgrace vented itself upon the unoffending king whose title was indeed defective. Perhaps the best of Henry's work was in founding Eton School (1440) and King's College, Cambridge (1443), and in building the great chapels which are among the glories of English architecture. He was found dead in the Tower (where he had been imprisoned), May 21, 1471.

Revised by C. K. ADAMS.

**Henry VII.**: the first of the Tudor Kings of England; b. in Wales, Jan. 28, 1456. He was descended, on his mother's side, from John of Gaunt (son of Edward III.) and Catharine Swynford, whose offspring had been legitimated by the pope, the king, and the Parliament. His father was a son of Owen Tudor, a Welsh gentleman, and Catharine, widow of Henry V. of England, whose marriage to Tudor has been denied. Young Henry became Earl of Richmond; was attainted by the Yorkists 1461; and in 1471 retired to France; attempted a revolt in 1483; landed at Milford Haven in 1485; defeated and killed Richard III. at Bosworth; married Elizabeth, heir of the Yorkist sovereigns, 1486, thus happily uniting the houses of York and Lancaster. His reign was much disturbed by insurrections. The king was politic, encouraged commerce and industry, and filled his treasury by means previously untried, and unquestionably illegal. D. Apr. 22, 1509. See Gairdner, *Henry VII.* (1889).

Revised by C. K. ADAMS.

**Henry VIII.**: second of the Tudor monarchs of England; son and successor of Henry VII.; b. at Greenwich, June 28, 1491; became in 1502 Prince of Wales on the death of his brother Arthur; married Catharine of Aragon, Arthur's widow, in 1509; succeeded to the crown in 1509; joined the Emperor Maximilian in a war with France 1511-

14, during which war the Scots were utterly overthrown at Flodden Sept. 9, 1513; made Wolsey chancellor 1515; was involved in competition with Francis I. and Charles V. for the imperial crown of Germany; wrote in 1521 his book on the sacraments against Luther, for which he received from the pope the title of "defender of the faith"; made war in 1522 against France in the interest of Charles V.; applied in vain in 1528 to the pope for a commission to inquire into the legality of his marriage. The king applied in 1529, by Cranmer's advice, to the universities with better success. The influence of the king and Wolsey at Rome was completely foiled by the Spanish interest in the queen's behalf, and the great seal was taken from Wolsey and given to Sir Thomas More. The convocation was now compelled to acknowledge Henry as the head of the English Church; the king married Anne Boleyn in 1533, and the following year Parliament declared the former marriage with Catharine invalid, at the same time declaring that the succession should lie with the issue of the marriage of Henry with Anne Boleyn. As this act was not assented to by More and Fisher they were executed, Thomas Cromwell made vicar-general, and the visitation and destruction of monasteries began. Anne Boleyn was executed on a charge of unfaithfulness, and Jane Seymour was married to the king in 1536; Roman Catholic insurrections broke out in 1536, and Queen Jane died in 1537; Anne of Cleves was married to the king in 1540, soon after which Cromwell was executed, and the marriage annulled by convocation and Parliament; Henry married Catharine Howard in the same year, and had her executed in 1542; was married in 1543 to Catharine Parr, his sixth and last wife. Many Roman Catholics, and Reformers as well, were executed during the latter part of Henry's reign, and great numbers of the nobles and aristocracy died on the scaffold on suspicion of treason. D. at Westminster, Jan. 28, 1547. The two modern English political parties have been said to date from this reign, in which there was a conservative or national Catholic party, led by Bishop Gardiner and others (many of them becoming Roman Catholics again under Queen Mary), and a reforming party, led by Thomas Cromwell, Cranmer, and others scarcely less distinguished. Notwithstanding the turbulent and bloody vicissitudes of the reign, Henry VIII. has always been held in great esteem by the masses of the English people. He not only united in his own person the claims of the houses of York and Lancaster, thus putting an end to the long struggle of the Roses, but in all his characteristics, mental, moral, and physical, he was the most intensely English of all English kings. He fought the battle of England against the popes of Rome in a way that seems strangely to have secured for him an affectionate admiration. For the best defense of Henry's character, see Froude's *History*, vol. i.–iv.; see also Brewer's *Calendar of State Papers* (1862, *seq.*); and Brewer's ed. of Fuller's *Church History*. Revised by C. K. Adams.

**Henry I.**: King of France; b. 1005; succeeded Robert II., his father, 1031; was a weak prince, whose reign was much disturbed by civil wars and public calamities. D. at Vitri, Aug. 4, 1060, and was succeeded by Philip I., his son.

**Henry II.**: King of France; b. Mar. 31, 1519; married Catharine de' Medici 1533; succeeded Francis I., his father, 1547. His reign was distinguished by bloody persecutions of the Protestants, and by wars with Charles V. and his son, Philip II. of Spain. These wars were at first advantageous to France as military operations, but afterward the French were disastrously defeated at Naples, at St.-Quentin, and Gravelines. These battles were followed by the disastrous peace of Cateau-Cambrésis (1559), by which Henry gave up the greater part of his advantages. D. July 10, 1559, in consequence of a wound received in a tournament. Revised by C. K. Adams.

**Henry III.**: King of France; third son of Henry II. and Catharine de' Medici; b. at Fontainebleau, Sept. 19, 1551; served as Duke of Anjou against the Huguenots 1569–73; elected King of Poland in 1573; abandoned Poland, and succeeded his brother, Charles IX., as King of France 1574. His reign was disturbed by the wars of the League, designed to prevent the succession of Henry IV., and is further memorable for the assassination of the Guises 1588, and for the king's unbounded licentiousness. Henry was stabbed by Jacques Clément, a partisan of the Guises, and died Aug. 2, 1589. He was the last of the Valois line, and was succeeded by Henry IV., the first Bourbon king. See Freer's *Henry III.* (3 vols., 1858). Revised by C. K. Adams.

**Henry IV.**: King of France and Anjou, the first Bourbon monarch of France; succeeded Henry III. in 1589, being a lineal descendant of Louis IX. Henry was born at Pau, Dec. 14, 1553, the son of Antoine de Bourbon and Jeanne d'Albret, Queen of Navarre; he was bred a Protestant by his mother, and trained to all hardy exercises. In 1569 he joined the Protestant army under Coligny. In 1572, after the peace of St.-Germain, and just before the massacre of St. Bartholomew, he married Margaret of Valois, sister of Charles IX., and was compelled to abjure his faith. He had just succeeded to the crown of Navarre, but was detained at court until 1576, when he escaped and put himself at the head of the Protestants, and by his valor and skill greatly bettered their circumstances in the wars which followed. In 1584 Francis of Anjou died and Henry became heir-presumptive to the crown. In 1585 he was excommunicated by Sixtus V., and declared incapable of the succession. Then followed the "war of the three Henrys" (1586–87), the murder of Henry III. (1589), the claim of the cardinal of Bourbon to the throne, the battle of Ivry (1590), the siege of Paris, the Spanish invasion under Parma, and a long and varied war, in which Henry, with small means and the ineffectual support of the English, performed prodigies of valor and activity. In 1593 Henry professed the Roman Catholic faith, and the fear of the ambition of Philip II. caused many of Henry's former enemies to go over to his side; he was anointed king at Chartres 1594; entered Paris, and in the course of four years had expelled the Spaniards and brought all France to subjection. In 1598 he published the Edict of Nantes and restored toleration. Prosperity followed such as France had never known before. Henry was murdered by one Ravaillac, a fanatic, May 14, 1610, and all France mourned the event as a national calamity. See Matthieu, *Histoire de Henri IV.*, and Freer, *Henry IV.* (6 vols., 1860–63).

Revised by C. K. Adams.

**Henry (I.) the Fowler**: King of Germany and Duke of Saxony; b. in 876; succeeded his father, Otho I., as duke in 912; elected to succeed Conrad I. in 919; carried on wars with Lorraine (which he conquered in 923–925), with the Hungarians, the Slavi, Danes, etc. This great monarch was one of the founders of the German supremacy in the Middle Ages, as terrible in war as he was just and wise in peace. He is reckoned as Henry I. in the line of German emperors, but never bore the imperial title, except in consequence of having been saluted *imperator* by his troops, in the old Roman fashion. D. at Mansleben, July 2, 936.

**Henry II.**: Emperor of Germany; the last of the Saxon line of German monarchs, and the first Henry who properly bears the imperial title, known also as The Lame; b. May 6, 972; succeeded to the duchy of Bavaria 995; was elected King of Germany, to succeed Otho III., in 1002; carried on wars in Poland, and with vassals in Germany, and with Italy and France, etc.; erected Hungary into a kingdom 1007; was crowned Emperor of the Romans 1014. D. at Grone, Saxony, July 14, 1024; was canonized 1152 on account of his zeal for the Church, and is honored July 15.

**Henry III.**: Emperor of Germany, surnamed The Old, The Black, or The Pious; b. at Osterbeck, in the Low Countries, Oct. 28, 1017; was elected king in 1026, and succeeded Conrad II., his father; ruled with the greatest dignity and success, managed the affairs of Church and state alike; was crowned emperor in 1039; compelled Hungary, Bohemia, Apulia, and Calabria to acknowledge themselves as vassals of the empire; built many churches and cathedrals, including those at Worms, Mainz, and Spires; won applause by challenging Henry I. of France to mortal combat, and died at Botfeld, Oct. 5, 1056. His first wife was a daughter of Canute of England.

**Henry IV.**: Emperor of Germany; son of Henry III.; b. Nov. 11, 1050; was king when but three years old, and succeeded Henry III., his father, in 1056. His reign was a long series of bloody contests with vassals at home and with Pope Gregory VII. in Italy, who at the period of Henry's lowest fortunes compelled him to sue at Canossa for absolution (1077). This he received, and after many years of warfare in Germany he compelled the pope to retire, under the protection of Robert Guiscard, to Salerno (1084). Henry was dethroned and imprisoned by his son, Henry V., in 1105, but escaped, and died at Liége, Aug. 7, 1106. See Floto, *Heinrich IV.* (2 vols., 1855–57); Giesebrecht, *Ges. des deuts. Kaiserz. IV.* Revised by C. K. Adams.

**Henry V.**: Emperor of Germany; b. Aug. 11, 1081; was crowned king and colleague of his father, Henry IV., in 1099; deposed his father 1105; was crowned emperor 1111. His reign was much disturbed by discussions with the popes regarding investitures, and he was four times excommunicated. A compromise was reached in the important concordat of Worms (1122), in which the advantage rested with the pope. Wars at home and with Flanders, Hungary, and Poland vexed Germany during his reign. He married Matilda, daughter of Henry I. of England. D. at Utrecht, May 23, 1125. He was the last of the Salic line.

**Henry VI.**: Emperor of Germany, surnamed THE CRUEL; b. in 1165; succeeded Frederick Barbarossa, his father, in 1190. His reign was much disturbed by Italian wars, and is famous for the imprisonment of Richard Lionheart at Trifels (1192–94). D. at Messina, Sept. 28, 1197, poisoned, it was supposed, by his wife.

**Henry VII.**: Emperor of Germany (Henry of Luxemburg); b. in 1262; was elected King of the Romans in 1308; invaded Italy at the head of a Ghibelline army, and had an interview with Dante; received the iron crown of Lombardy in 1311; was crowned emperor in 1312. D. Aug. 24, 1313, poisoned, it was supposed, while receiving the Eucharist.

**Henry**, surnamed THE LION: Duke of Saxony and Bavaria; son of Henry the Proud; b. at Ravensburg, 1129; succeeded to the duchy of Saxony, and in 1156 made good his claims to Bavaria; extended his dominions by conquest until he became the most powerful of German princes and the rival of the Emperor Frederick. His desertion of the latter in the war against the Lombard League was one of the causes of the defeat at Legnano in 1176. Refusing to obey the emperor's summons to appear before the Diet at Worms in 1177, he was placed under the ban, stripped of his possessions, and withdrew to England, but regained a portion of his dominions by an agreement with Frederick's successor, Henry VI. D. at Brunswick, 1195.

**Henry**, CALEB SPRAGUE, D. D., LL. D.: clergyman and author; b. at Rutland, Mass., Aug. 2, 1804; graduated at Dartmouth in 1825; studied divinity at Andover and at New Haven. After holding Congregational pastorates at Greenfield, Mass. (1829–31), and at Hartford, Conn. (1833–35), he was ordained in the Protestant Episcopal Church, and was Professor of Mental and Moral Philosophy in Bristol College, Pennsylvania (1835–38). In 1837 he became one of the founders of *The New York Review*, and edited it till 1840. He was (1838–52) Professor of Philosophy and History in the University of New York; 1847–50 rector of St. Clement's, New York, and in Litchfield, Conn. (1870–73). D. in Newburg, N. Y., Mar. 9, 1884. Among his works are enlarged translations from the French, *An Epitome of the History of Philosophy* (New York, 2 vols., 1842), and of Cousin's *Elements of Psychology* (Hartford, 1834; 4th ed. rev. 1856); and the original works, *Compendium of Christian Antiquities* (Philadelphia, 1837); *Moral and Philosophical Essays* (New York, 1839); *About Men and Things* (1873); and *Satan as a Moral Philosopher* (1877).

Revised by S. M. JACKSON.

**Henry**, JOSEPH, LL. D.: physicist; b. at Albany, N. Y., Dec. 17, 1797; educated in the common schools of that city and in the Albany Academy, where (1826) he became Professor of Mathematics, and (1827) began a course of investigation which was continued for a number of years, and resulted in certain highly important discoveries in electricity and electro-magnetism. Though previously to these investigations the electro-magnet in a certain sense was known, it was nothing more than a philosophic toy, in which a feeble magnetism was excited by currents of low intensity. The means of developing in soft iron a high degree of magnetization, or of producing such an effect at a distance in any appreciable degree at all, were unknown. Prof. Henry's first success consisted in producing the electro-magnet properly so called; an exceedingly important invention which no subsequent improvement has essentially modified. He next demonstrated that the difficulty of exciting electro-magnets at a distance, which had led Barlow in 1824 to pronounce the idea of an electric telegraph to be chimerical, may be completely overcome by the use of a battery of high electro-motive force, provided that the receiving electro-magnet be constructed with many turns of a single wire. He also showed that the magnetization of an iron bar depends not only upon the amount of current which traverses the coils around it, but also upon the number of turns of wire, so that when it is desired to bring an electro-magnet into action at a great distance, the loss of current due to the resistance of the intervening circuit may be compensated by winding the magnet with many turns of fine wire. It was the demonstration of this principle which first made the electric telegraph a possibility. In a communication made to *The American Journal of Science* in 1831, describing some of his experiments, Prof. Henry called attention to the practicability of applying what he called the intensity-magnet to telegraphic uses. During the same year he produced the first mechanical contrivance ever invented for maintaining continuous motion by means of electro-magnetism; and he also constructed and exhibited a similar contrivance for making signals by electro-magnetism at a distance—the signals being produced by means of a lever striking on a bell. This was operated by a current sent through more than a mile of insulated wire carried in successive turns around the walls of an apartment in the Albany Academy. He also devised a scheme for producing large mechanical effects at a distance, by causing heavy weights to fall in consequence of the rupture of electric currents. Some of the electro-magnets constructed by him at this time were of enormous power. One of these, prepared for Yale College (1831), sustained a weight exceeding a ton, and another at the College of New Jersey carried not less than 3,600 lb. In 1832 he made the discovery of the secondary currents produced in a long conductor by the induction of the primary current upon itself; and he succeeded in the same year in producing the electric spark by means of a purely magnetic induction. The spark was similarly and almost simultaneously produced by Mr. J. D. Forbes, of Edinburgh (afterward Principal Forbes), but the two results were independent of each other. These discoveries embraced the germ of the science of magneto-electricity, which subsequently received from Faraday so large a development.

Prof. Henry's services to science as an investigator of the phenomena of electro-magnetic induction received appropriate recognition when the chamber of delegates of the electrical congress, held in Chicago in 1893, unanimously gave to the practical unit of self-induction the name of "the Henry."

In 1832 Prof. Henry was elected Professor of Natural Philosophy in the College of New Jersey, and in his earliest lectures at Princeton demonstrated the feasibility of an electro-magnetic telegraph, with experimental illustrations. He visited Europe in 1837, and in London held interviews with Prof. Wheatstone, the inventor of the needle magnetic telegraph, to whom his discoveries were already well known, and whom he acquainted with his plans for producing not only signals, but large mechanical effects at distances indefinitely great, by means of electro-magnetism. In 1846 he was elected secretary of the Smithsonian Institution at Washington, being the first incumbent of that office, a position he held till his death. In 1849 he was elected president of the American Association for the Advancement of Science. In 1868 he was elected president of the National Academy of Sciences. This distinguished post he held till his death. He was made chairman, in 1871, of the light-house board of the U. S., and in this capacity was constantly engaged till 1878. He received the honorary degree of doctor of laws from Union College in 1829, and from Harvard University in 1851. He published *Contributions to Electricity and Magnetism* (1839), and numerous papers in *The Am. Philos. Trans.*, *The Am. Jour. of Science*, *The Jour. of the Franklin Inst.*, the *Proceedings of the Am. Assoc. for the Adv. of Sci.*, and in the annual reports of the Smithsonian Institution. D. May 13, 1878.

Revised by E. L. NICHOLS.

**Henry**, MATTHEW: divine and author; son of Philip Henry, a Nonconformist clergyman; b. at Broad Oak, Flintshire, Wales, Oct. 18, 1662; studied law and divinity; became Nonconformist (Independent) pastor at Chester 1687, at Hackney, London, 1712. D. at Nantwich, June 22, 1714. Chiefly remembered for his *Exposition of the Old and New Testament*, which was a reproduction of his regular expository sermons and covers the entire Bible, but his own work ends with the Acts. The remainder was prepared by thirteen Nonconformist divines. The first volume appeared in London, 1708, fol.; vol. v., 1710, completes the Gospels; vol. vi. appeared later. The work passed through numerous editions, and has the distinction of being eminently readable, while destitute of scholarship. He also wrote other religious works and a

*Life* of his father (1698). His own *Life* has been written by W. Tong (1716) and by J. B. Williams (1828; n. e. 1865); cf. *Diaries and Letters of Philip Henry*, edited by Matthew Henry Lee (1883). Revised by S. M. Jackson.

**Henry**, Patrick: lawyer and statesman; b. at Studley, Hanover co., Va., May 29, 1736; son of John Henry, a Scotchman of strong and sound intellect and liberal education. His mother was of the family of Winstons, the members of which are said to have been marked by vivacity of spirit and by "a gift for music and for eloquent speech." The father was the nephew of William Robertson, the historian, and second cousin of the mother of the British statesman and orator, Henry Brougham. Patrick inherited many of the characteristics of both his parents. In early years he cared little for books, but after he was ten years of age, with the help of his father and of an uncle, he acquired some knowledge of Latin and Greek, and a little more of mathematics. At the age of fifteen he was put into the shop of a country tradesman, but after a year of apprenticeship his father set him up in trade for himself. At the end of a year the experiment terminated in failure. At the age of eighteen he married Sarah Shelton, the daughter of a small tavern-keeper in the neighborhood. During the next two years he tried to get a living from a small farm, but failed. At the age of twenty he once more turned his hand to merchandise, but in three years' time he was bankrupt. After six weeks of study he was admitted to the bar in 1760. Though the tradition is that for some years he had very little practice, the recent discovery of his fee-books shows that from the first his practice was large and lucrative. It was not, however, till 1764 that general attention was called to his ability by means of "The Parsons' Cause," a celebrated case in which all his abilities were enlisted and displayed. The testimony is abundant that his oratory exceeded anything ever before heard in Virginia. In 1765 he was elected a member of the House of Burgesses, and at once distinguished himself by introducing and advocating the passage of the celebrated series of resolutions in regard to the Stamp Act. Of the memorable struggle that ensued few details have been preserved, except in regard to what Mr. Jefferson called the "torrents of sublime eloquence from Mr. Henry." It was at the climax of a passage of invective that he exclaimed: "Cæsar had his Brutus; Charles the First his Cromwell; and George the Third" ["Treason!" shouted the Speaker. "Treason! treason!" arose from all parts of the room. The orator paused in defiance of these exclamations, and then deliberately added]— "and George the Third may profit by their example. If this be treason make the most of it." The resolutions passed by a majority of only one or two, but they unquestionably had a prodigious influence on public opinion throughout the colonies. Mr. Henry now became at once the acknowledged leader of the friends of colonial liberty in Virginia, and his distinguished ability as a speaker and advocate won him fame and fortune at the bar. From early life he had been a reader of history, and he was now able to bring to his speech numerous illustrations from his historical knowledge. His acquaintance of the law was neither very comprehensive nor very profound, but his gift of speech and of generalization was such that he had a marvelous power over the court as well as over the jury. He was sent to the General Congress at Philadelphia in 1774, and was chosen its first Speaker. In 1775, in the Virginia convention, he delivered his celebrated speech in favor of putting the colonies into a state of defense. From 1776 to 1779 he was Governor of Virginia, an office which he held a second period, from 1781 to 1786. Though elected to the Federal convention of 1787, he positively declined to take his seat, urging as his reason his professional engagements and his repugnance to the attitude of Congress on the question of the free navigation of the Mississippi. After the adoption of the constitution by the Constitutional Convention he was the most strenuous opponent of its ratification by Virginia. He held that the convention had transcended its authority in adopting a new constitution instead of amending the old one; that it had adopted a consolidated government instead of amending a confederacy; that the new form would destroy the State governments and swallow the liberties of the people; that while it had created a tremendous power over the States, it had extended no shield over them for their protection; that, in short, in its details as well as in its general spirit, its functions were such as to inspire distrust and alarm. Holding these views, he pleaded not for a rejection of the constitution outright, but for a postponement of action until a "bill of rights" could be submitted to the other States for their adoption. He fought his battle with extraordinary power and skill at every point in the proceedings. Of the printed report of more than 600 pages, the speeches of Henry occupy nearly a quarter of the entire space. In one speech alone he was on his feet for seven hours. Though he was unsuccessful, his advocacy reduced the majority in favor of the constitution from fifty to ten. After the final adoption Mr. Henry entered with great zeal into the plan of securing such guarantees as were afforded by the first ten amendments, and his efforts exerted a very powerful influence. During the next five years he confined himself closely to the honorable and lucrative duties of his profession. In 1794 he retired to private life, but the appointments that were tendered him bear ample evidence of the high esteem in which he was held. In 1794 Governor Lee appointed him U. S. Senator, but he declined the offer. In Oct., 1795, Washington tendered him the position of Secretary of State, and in December of the same year that of Chief Justice of the U. S. Feb. 25, 1799, President John Adams nominated him as envoy extraordinary and minister plenipotentiary to France. All of these great offices he declined. It was not until the passage of the "Virginia and Kentucky Resolutions" that the old man came forth from his happy retirement and lifted up his feeble but still eloquent voice in opposition to the spirit of disunion. He declared Virginia to be to the union what the county of Charlotte was to Virginia. In the most explicit terms he denied the right of a State to decide upon the constitutionality of federal laws. But his great speech in defense of the union was too much for his feeble strength. Though he was elected to the House of Delegates by a large majority as the representative of the union cause, he was never able to take his seat or to appear again in public. His death occurred June 6, 1799. His attitude on the great question of the indestructibility of the union, though perfectly consistent with his former views, secured the bitter enmity of Jefferson, the author of the Kentucky Resolutions, and did much to create the disfavor in which for many years the great orator was held. The *Life* of Henry by Wirt abounds in erroneous statements. See Tyler, *Patrick Henry*, in American Statesmen Series, and William Wirt Henry, *Patrick Henry, Life, Correspondence, and Speeches* (3 vols., 1891). The third volume is exclusively devoted to the letters and speeches. C. K. Adams.

**Henry**, William Alexander, Q. C.: judge; b. at Halifax, Nova Scotia, Dec. 30, 1816; was admitted a barrister in 1841 and appointed queen's counsel in 1849. He has been for many years prominent in the affairs of Nova Scotia; was solicitor-general 1854, 1859, and 1863; provincial secretary 1856–57; and has been surrogate, mayor of Halifax, etc. He took a prominent part in the question of the union of the provinces in 1867. He was judge in the trial of election cases in Nova Scotia in 1874, and was appointed a judge of the Supreme Court of Canada in Oct., 1875. He was instrumental in procuring measures for the protection of Canadian fisheries, in establishing a complete system of telegraphs for Nova Scotia, and in publishing the revised statutes of that province. Revised by C. H. Thurber.

**Henry**, William Wirt, LL. D.: lawyer and historical writer; b. at Red Hill, Va., Feb. 14, 1831; educated at the University of Virginia; member of the Legislature four sessions; president American Historical Association and of the Virginia Historical Society. Author of *Life, Correspondence, and Speeches of Patrick Henry* (3 vols., 1890–91), and historical addresses and essays. D. Dec. 5, 1900. C. H. T.

**Henry, Cape**: See Cape Henry.

**Henry of Battenberg**, Prince: son of Prince Alexander of Hesse; b. Oct. 5, 1858; married, July 23, 1885, Princess Beatrice; is governor of the Isle of Wight and of Carisbrooke Castle.

**Henry the Navigator**: the fourth son of King John I. of Portugal; b. at Oporto in 1394; greatly distinguished himself at the conquest of Ceuta in 1415, and was afterward placed at the head of African affairs. He fixed his residence at Sagres, in Algarve, near Cape St. Vincent, where he established a school of navigation in which a number of young Portuguese noblemen were educated. Every year he sent out expeditions of exploration. In 1418 the Madeira islands were discovered; in 1440 Cape Blanco, on the coast of Guinea, was reached. From this school issued that movement of maritime discovery and commercial enterprise which placed

the Portuguese people at the head of European civilization for more than half a century, and whose two greatest results were the discovery of America and the discovery of the water-route to India around the Cape of Good Hope. The introduction of the compass and the astrolabe was due to him. Henry died at Sagres, Nov. 13, 1460.

**Hen'schel**, Georg: singer, composer, and conductor; b. at Breslau, Germany, Feb. 18, 1850; was educated at the Leipzig Conservatory and Berlin. His voice is a baritone. In 1881 he was appointed conductor of the Boston Symphony Orchestra, and remained for three seasons. In 1885 he went to London and has remained there conducting, singing, and teaching, occasionally visiting the U. S. D. E. H.

**Henselt**, Adolph (von): See the Appendix.

**Henshaw**, Henry Wetherbee: ornithologist and ethnologist; b. in Cambridgeport, Mass., Mar. 3, 1850. He prepared for Harvard, but owing to ill-health was unable to enter college. He spent the winter of 1869–70 in Louisiana collecting birds, and the following year visited the less known portions of Southern Florida. In 1872 he was offered the position of assistant field naturalist to the Wheeler survey, then operating in Utah. Subsequently he was called to Washington to assist in the preparation of the natural history reports, and became permanently attached to the survey as naturalist, a post he held for nine years. In 1875 his report (300 pp.) upon the ornithological results obtained by the survey up to that time was published, and minor reports upon the same subject followed annually. In 1879 he was appointed to a position in the Bureau of Ethnology, and took charge in 1880 of the Indian division of the tenth census. He has published several papers on archæological subjects, including one entitled *Animal Carvings from Mounds of the Mississippi Valley* (1886). J. W. Powell.

**Hentz**, Caroline Lee: author; a daughter of Gen. John Whiting; b. at Lancaster, Mass., June 1, 1800. In 1825 she married Nicholas M. Hentz (d. 1856), a French gentleman, who was an artist and entomologist, as well as a teacher of languages and belles-lettres, and with him she resided successively at Northampton, Mass., Chapel Hill, N. C., Covington, Ky., Cincinnati, O., Florence, Ala., Tuscaloosa, Ala., Tuskegee, Ala., Columbus, Ga., and Marianna, Fla., where she died Feb. 11, 1856. She wrote a novel, poem, and play before she was thirteen years old, and afterward the play *De Lara*, in competition for a prize; *Lamorah*, a tragedy; *Constance of Weidenberg*; the tales *Linda* (1850); *Rena* (1851); *Eoline* (1852); *Helen and Arthur* (1853); *The Planter's Northern Bride* (1854); *Ernest Linwood* (1855); and numerous other novels and some poetry.

**Henzada**, hen-zaa'dăă: a district and city of the Irawadi division of Lower Burma; on the Irawadi river above Rangoon, and E. of Arakan. Area, 1,948 sq. miles. It is a level plain, subject to inundations, from which it is protected by immense embankments, and is everywhere suitable for the cultivation of rice. Pop. 320,000. The chief town is Henzada, on the right bank of the Irawadi, in about lat. 17° 40′ N. (see map of S. India, ref. 3–I). Pop. 17,000. The district was once a part of the Talaing kingdom of Pegu, but was annexed to Burma in 1753. M. W. H.

**He'par Sul'phuris** [Lat., liver of sulphur, so called from its brownish or liver color]: a crude mixture of the bisulphide and trisulphide of potassium with the sulphate of potash. It is employed as a medical remedy.

**Hepat'icæ**: See Liverworts.

**Hepati'tis** [Mod. Lat., from Gr. ἧπαρ, ἥπατος, liver: Lat., *jecur*: Sanskr. *yakṛt*, liver]: an inflammation of the liver. Hepatitis may be acute or chronic, the latter being much more common than the former. The only form of acute inflammation of the liver substance proper is that characterized by formation of pus, constituting *abscess of the liver*. This is a rather more common disease in the tropics, and most frequently is a sequel of dysentery. Acute inflammation may also attack the gall-ducts in the liver substance, and this generally leads to Jaundice (*q. v.*). Chronic inflammation of the liver is known as cirrhosis, just as certain chronic inflammations of other organs are called cirrhosis. It is met with especially in heavy drinkers, whence the name "gin-drinker's liver," and causes irregularity of the surface, giving rise to the name "hob-nail liver." It is a progressive incurable disease, generally accompanied by ascites or abdominal dropsy. Syphilis may lead to cirrhosis, but only in rare instances. William Pepper.

**Hepburn**, James: See Bothwell, James Hepburn, Earl of.

**Hepburn**, James Curtis, A. M., M. D., LL. D.: Japanese scholar and missionary; b. at Milton, Pa., Mar. 13, 1815. He graduated at Princeton College in 1832, and studied medicine thereafter in the medical department of the University of Pennsylvania. In 1840 he offered his services as a medical missionary to the Presbyterian Board of Foreign Missions, and was accepted. He sailed with his wife for Siam in 1841, but went no farther than Singapore. Their destination was then altered to China, where Dr. Hepburn spent the next few years, leaving in 1846 on account of broken health. In 1859 he entered the newly opened Japan field, and resided in Yokohama for thirty-three years. Dr. Hepburn is author of the standard *Japanese-English Dictionary*, which is now in its fourth edition. In 1892 he published a Japanese dictionary of the Bible. J. M. Dixon.

**Hephæs'tion** (in Gr. Ἡφαιστίων): the friend of Alexander the Great; b. at Pella about 357 B. C. At what time he and the prince became companions is not known; they are first mentioned together on the occasion of Alexander's visit to Troy, where Hephæstion brought the same honors to the grave of Patroclus as Alexander to that of Achilles. But after that time they never separated until the death of Hephæstion in Ecbatana in 324, one year before that of Alexander. Alexander never preferred Hephæstion to a better man, and Hephæstion never disappointed the confidence Alexander placed in him. When Hephæstion died Alexander sent messengers to inquire of Jupiter Ammon how he should honor Hephæstion, and was instructed to sacrifice to him as a hero. Alexander then celebrated the funeral, which was one of the most magnificent in history. A portion of the walls of Babylon was razed in order to make room for the pyre, which cost 12,000 talents, while the animals offered in sacrifice to the new hero numbered 10,000, and the entire army were guests of the king on the occasion. Temples were erected in honor of Hephæstion in various parts of the empire. Revised by J. R. S. Sterrett.

**Hephæstion**: a Greek grammarian of Alexandria, according to Suidas; flourished about A. D. 150, as Julius Capitolinus speaks of him among the tutors of the Emperor Verus. To him is ascribed the Ἐγχειρίδιον περὶ μέτρων (*Manual of Meters*), from which most of our knowledge of the Greek meters is obtained. Suidas assigns to him other works not now extant. The best edition of the *Manual* is by Gaisford (Oxford, 1810, 8vo; Leipzig, 1832; revised, Oxford, 1856, 2 vols.). Revised by J. R. S. Sterrett.

**Hephæs'tus** (in Gr. Ἥφαιστος): in Greek mythology, the god of fire and lightning and the smith of the gods, identified by the Romans with Vulcan (*q. v.*). Homer found his myth already fully elaborated. It illustrates the origin of the gods from natural phenomena, for Hephæstus and fire (his element) continued to be synonymous terms even in post-classical times. His home and smithy were on Olympus. His frame was huge, the upper part of his body being well developed, strong, and powerful, though he was lame from his birth, and his weak and puny legs barely allowed him to hobble along. The ancients themselves explained his body as being typical of the twofold nature of fire—its might and its uncertain flickering character. He has to walk with a staff, and he is supported by little golden maidens endowed with intellect, his own handiwork, and even then his gait is halting. Externally he is a common smith, but his cunning works prove his divinity, for they are such as no mortal could execute. In Homer Hephæstus is the son of Hera by Zeus, though his descent from Zeus gradually became obscured and finally forgotten. Hesiod does not know of his descent from Zeus, and makes Hera beget him of herself in envy that Zeus had begotten Athene without her assistance. But disgusted at his lameness, she cast him out of heaven in the hope thus to conceal him from the gaze of the gods. The Nereides Thetis and Eurynome cared for him in their home in the depths of the sea, where he abode nine years and wrought wondrous works. There is another version of his fall, according to which Zeus grasped him by the foot and hurled him out into space because he wished to assist Hera, whom Zeus had suspended from heaven. He fell upon Lemnos, and was cared for by Sintian men. By command of Zeus, Hephæstus made Pandora (*q. v.*) by mixing earth and water. He thus became the creator of the human race, though to Prometheus the honor of man's creation is usually ascribed. It was Hephæstus who cleft the head of Zeus with an ax in order that Athene might be born from it. In the *Iliad* Charis is his wife; in the *Odyssey* he is married to Aphrodite.

Though reckoned as one of the twelve great gods, he was singularly helpless except in his own realm of fire, where he was supreme. He was of a kindly disposition, as witness his gentleness toward Hera and his sympathy for Prometheus. As the halting cup-bearer of the gods he caused infinite merriment in Olympus. In later times his forge is transferred from Olympus to the center of volcanoes, where his activity may still be noted.

LITERATURE.—Rapp, in Roscher's *Ausführliches Lexicon*; Schwartz, *Ursprung der Mythologie* (Berlin, 1860); Blümner, *De Vulcani in veteribus artium monumentis figura* (Breslau, 1870); Roscher, *Die Gorgonen* (Leipzig, 1879) and *Nektar und Ambrosia* (Leipzig, 1883); Preller-Robert, *Griechische Mythologie* (Berlin, 1888); Kuhn, *Herabkunft des Feuers und des Göttertranks* (Gütersloh, 1889).

J. R. S. STERRETT.

**Heptan'omis** [= Gr. Ἑπτανομίς, liter., the seven provinces; ἑπτά, seven + νομός, province; deriv. of νέμειν, divide, distribute]: the central division of Egypt lying between the Delta and the Thebaïs, and including the territory between Memphis and Hermopolis Magna. The threefold division belongs to the Græco-Roman period, and the name is first used by Ptolemy in the first part of the second century. In the middle of the fifth century (*Notitia Dignitatum*) it is replaced by the name Areadia. During the French occupation the threefold division of the land was revived.

CHARLES R. GILLETT.

**Hep'tarchy** [from Mod. Lat. *heptar'chia*, a seven-rule = Gr. ἑπτά, seven + ἄρχειν, rule]: a government by seven, especially applied in a somewhat misleading way to the seven principalities of the Anglo-Saxons in England before the reign of Egbert, the first King of England, who became King of Wessex 800, and died 836. Eight kings, of six different kingdoms (all except Essex and Mercia), had at times possessed a certain supremacy over the rest. The actual number of kingdoms was sometimes greater and sometimes less than seven, and yet seven stand out so prominently that they have led to the use of the term heptarchy. The seven kingdoms were: 1, Kent (449–823); 2, Sussex (477–823); 3, Wessex (519–823); 4, Essex (526–823); 5, Northumbria (547–827); 6, East Anglia (571–823); 7, Mercia (584–827). In 828 Egbert of Wessex, the eighth bretwalda, became the first hereditary King of England; but some of the minor kingdoms existed for many years thereafter.

Revised by C. K. ADAMS.

**Hep'worth**, GEORGE HUGHES, D. D.: minister and author; b. in Boston, Mass., Feb. 4, 1833; studied divinity at Cambridge, Mass., and graduated 1855; pastor of Unitarian church at Nantucket 1855–57; of the Church of the Unity, Boston, 1858–70; became in 1862 a regimental chaplain in Louisiana, and served in 1863 on the staff of Gen. Banks. He was (1870–72) pastor of the Church of the Messiah, New York. In 1872 he became a Trinitarian, and soon organized the Church of the Disciples, of which he was pastor till Feb. 14, 1879; pastor of Belleville Avenue Congregational church, Newark, N. J., 1882–85; became an editor of *New York Herald* in 1885. His works include *Whip, Hoe, and Sword* (Boston, 1864); *Rocks and Shoals* (1870); *Starboard and Port* (1876). Revised by S. M. JACKSON.

**He'ra** (in Gr. Ἥρη, Ἥρα): in Greeian mythology, a daughter of Cronus and Rhea. Cronus swallowed her just as he had done all his children before the birth of ZEUS (*q. v.*), who, in pursuance of the plans of Gaea, gave Cronus an emetic. In this way the children were saved, and Hera became the wife of Zeus and the queen of heaven. She was a very ancient and venerable goddess, worshiped everywhere throughout the Greek world, but especially in Argos and Mycenæ, near which place her most celebrated temple stood. Homer paints her as jealous, spiteful, and quarrelsome. Roscher, in his *Juno und Hera* (Leipzig, 1875), has brought forward strong arguments in favor of the moon-goddess theory, showing first that Hera was the counterpart of the Italic moon-goddess Juno; that in common with all moon-goddesses she was the goddess of women, childbirth, and marriage; that she was especially concerned with the monthly menstruation of women; that like Juno her festivals were celebrated at the time of the new moon; that she was the queen of heaven, not merely because she was the wife of Zeus, but especially because the moon is by right the queen of the stars; that she was worshiped in high places from which the phases of the moon might best be observed, etc. The old idea that Hera was the earth was based on a misconception. Her marriage with Zeus, the highest god, was regarded as the ideal marriage; it was called the sacred marriage, and its incidents were imitated in mortal marriages. The children of this marriage were Hebe, Eileithuia, Ares, and Hephæstus. Hera resented bitterly the amours of Zeus with mortal women, and she was wont to visit her wrath both upon the women and their offspring. Leto experienced her anger, and so did Alemene, and Semele, and Io, and Callisto. She sent the sphinx to distress the Thebans because Hercules was born there; she hated all Trojans because Paris did not give her the golden apple that was inscribed "To the most beautiful"; she made Teiresias blind because in a mooted question between Zeus and herself he decided in favor of the former. The few statues of Hera that have come down to us are divided into two classes, those with a veil and those without. She usually stands on her left foot with her right leg bent at the knee, so that her foot is shoved back and rests on the toes; her right arm is bent at the elbow, and is elevated so that the whole arm rests on a scepter which she holds in her hand; her left arm is lowered slightly in front of her, and in her hand she holds a patera. The best statues of Hera without a veil are the Torso from Ephesus (now in Vienna) and the Barberini statue (now in the Vatican). The best statues of Hera with a veil are the bronze statuettes in Vienna, in Turin, in Paris, and in Florence. Of busts, the most celebrated are the Juno Farnese (in Naples) and the Juno Ludovisi (in Rome), concerning the relative importance of which expert opinion varies, though Brunn, the prince of archæologists, awards the palm to the Juno Farnese. It is not absolutely certain what artist fixed the type of Hera, though probably it was Polyclitus, from whose colossal sitting statue in gold and ivory in the Heræum, near Mycenæ, the Juno Farnese was probably imitated or copied. The head found by archæologists from the U. S. at the Heræum during the course of excavations on the site bears a striking resemblance to the head of the Juno Farnese, and is a strong argument in favor of the theory that both come from a Polyclitean original, though if this theory be correct then the personality of the copyist or imitator must be made responsible for the fact that he did not imitate accurately, for the Hera of Polyclitus certainly wore a high, broad headband or crown.

LITERATURE.—Schwartz, *Sonne, Mond und Sterne* (Berlin, 1864); Overbeek, *Griechische Mythologie* (Leipzig, 1873); Roscher, as cited above, and Roscher and Vogel in the *Ausführliches Lexicon* under *Hera*. J. R. S. STERRETT.

**Heraclei'a**: a Greek city of Lucania, in Southern Italy; near a place now called Policoro, and not far from the Tarentine Gulf. It was founded 432 B. C., and attained great wealth and power, and became a kind of capital for the Italiote Greeks. In the first century B. C. it was a Roman *municipium* of some importance. In 1732, not far from its site, were found the bronze tablets containing the *Lex Julia municipalis* of Cæsar (45 B. C.), a monument of great importance for the student of Roman history and Roman law. Many other ancient towns bore this name, among which was an important one on the south coast of Sicily.

Revised by G. L. HENDRICKSON.

**Heraclei'dæ** [Lat. = Gr. Ἡρακλεῖδαι, plur. of Ἡρακλείδης; Ἡρακλῆς (Hera's fame), Heracles + patronymic ending -ίδης, son of]: the descendants of Heracles (Hercules), to whom many prominent Greek families traced their origin. But the name especially belongs to those Heraeleidæ who joined the Dorians in their invasion and conquest of the Peloponnesus, which is often called "the return of the Heracleidæ," because they were considered as Achæans by race. The Greek historians narrate with considerable detail the exploits and successes of the Heraeleidæ in the early Dorian wars, and much of the story must be regarded as possessing historic truth. The Heraeleidæ became the progenitors of several princely houses, and were even admitted to rule over Dorians. Revised by J. R. S. STERRETT.

**Heracleop'olis** [Egyptian, Chenensuten or Chenensu; present, Ahnas]: the name given by the Greeks to the capital of the twentieth nome of Upper Egypt. Its site is now 12 miles W. and inland from Benisuef, and is marked by a few pillars and a large mass of rubbish. It was a very ancient city, and in the twelfth dynasty was an important center of literature and art. In mythology it was also important, since it is mentioned in the legend concerning the destruction of mankind for revolt against the sun-god Ra, and it also contained the hill upon which Ra first appeared, bringing light and order into the world. CHARLES R. GILLETT.

**Heracli'des Pon'ticus** [Lat. = Gr. Ἡρακλείδης ὁ Ποντικός. *Heraclides* (Ἡρακλείδης) called *Ponticus* from his native place on the *Pontus* Euxinus]: author; b. probably B. C. 378. He appears to have gone at an early age to Athens, where he attached himself to Plato, about 361 or 358; he attended the lectures of Aristotle also, and must have studied the Pythagorean philosophy, which he followed in his writings on natural philosophy. He was a man of great learning, and wrote on a great variety of subjects—philosophy, natural science, mathematics, music, grammar, history, and poetry—so that he was fairly entitled to the designation of *polyhistor*. Of all his writings only fragments remain, with the exception of a small treatise entitled (Ἐκ τῶν) περὶ πολιτειῶν (Extracts from Forms of Government), which is believed to be merely a compilation from different writings of the author, possibly also from Aristotle's treatise on the subject. For another work, called Ἀλληγορίαι Ὁμηρικαί (Allegories from Homer), which passes under the name of Heraclides, see HERACLITUS. The best editions of the Περὶ πολιτειῶν are that of Köler (Halle, 1804), that of Coraës (Paris, 1805), of Schneidewin (Göttingen, 1847), and in Müller's *Fragm. Hist. Græc.* (vol. ii., pp. 197–224). See Roulez, *Comment. de vita et scriptis Heraclidis* (Louvain, 1828); and the *Prolegomena* to Schneidewin's and Müller's editions.

Revised by B. L. GILDERSLEEVE.

**Heracli'tus**: surnamed THE DARK (σκοτεινός); philosopher; b. at Ephesus, in Asia Minor, according to some authorities, about 535 B. C., according to others about 500. The son of Blyson (or Heracion), he belonged to the noble family of the Codrids. Unlike most of the philosophers of his time, he took no part in public affairs. He is said to have refused the proffered sovereignty of Ephesus, as well as an invitation to the court of Darius. The stories related about him are to a very great extent legendary. His contempt for the unthinking rabble, as well as for the social and political condition of Ephesus, was extreme. Though he was evidently acquainted with the works of Hesiod, Pythagoras, Xenophanes, and Hecatæus (see *Diog. Laert.* ix., 1, 1), he was apparently justified in asserting that he had learnt everything from himself. The profoundest of the pre-Socratic philosophers, he had numerous disciples for many succeeding ages. He is known to have written only one work, which, like most other philosophical works of the time, was entitled *On Nature*. It went under several other names, and was divided into three parts: I. *On the All*; II. Political; III. Theological. The much talked-of obscurity of his writing, usually considered as intentional on his part, or as owing to fear of persecution for impiety, probably was due rather to the fact that he wrote only for the few, and that prose-writing and philosophical terminology were in his day very undeveloped. Of the work of Heraclitus, which was apparently extant in the third century A. D., numerous fragments are scattered through the works of various authors. The best collections of them are in Mullach's *Fragmenta Philosophorum Græcorum*, vol. i., pp. 310–329; Schuster's *Heraklit von Ephesus*, vol. iii. of Ritschl's *Acta Societatis Philologæ Lipsiensis*; and Bywater's *Heracliti Ephesii Reliquiæ*. The second contains on pp. 351–358 an excellent Heraclitean bibliography. Besides these, the following works are valuable: Schleiermacher, *Herakleitos der dunkle von Ephesos* (1808); Hegel, *Geschichte der Philosophie* (1833), vol. i., pp. 327–353; J. Bernays, *Heraclitea* (1848); F. Lassalle, *Die Philosophie Herakleitos des dunkeln von Ephesos* (1858, 2 vols. 8vo, written from an extreme Hegelian standpoint, and with a very imperfect knowledge of Greek); A. Gladisch, *Herakleitos und Zoroaster* (1859); Bernays, *Die Heraklitischen Briefe* (1869); E. Zeller, *Philosophie der Griechen*, 3d ed., vol. i., pp. 523–603; J. Mohr, *Ueber die historische Stellung Heraklits von Ephesos*; Teichmüller, *Neue Studien zur Geschichte der Begriffe*, Heft. i., *Herakleitos*, ii., pp. 103–253, *Herakleitos als Theolog*; Pfleiderer, *Die Philosophie Heraklits von Ephesus im Lichte der Mysterienidee*; Patrick, *The Fragments of the Work of Heraclitus of Ephesus on Nature, translated from the Greek Text of Bywater with an Introduction, Historical and Critical*; G. Mayer, *Heraklit von Ephesus und Arthur Schopenhauer*; C. Baumker, *Das Problem der Materie in der griech. Philosophie*, pp. 19–33; Th. Gomperz, *Griechische Denker*, vol. i., pp. 49–65.

*Philosophy.*—The philosophy of Heraclitus, which Gladisch and others have tried to connect with Zoroastrianism, was, in fact, a development of the Ionic or Hylozoic doctrine, influenced by the speculations of the Eleatic Xenophanes. This development consists in an advance from the idea of *being* to that of *becoming*. The principle—i. e. the inner essence of all things (not their origin)—is fire (πῦρ, πρηστήρ), a fine, dry, ever-active, necessarily self-determined ether, whereof the purest form is soul or spirit, and which, by rhythmical, qualitative, and local change, resulting in condensation and rarefaction, creates and uncreates the sensible world. The way to creation (διακόσμησις), or the downward way (ἡ ὁδὸς κάτω), is through extinction or deprivation (χρησμοσύνη), and proceeds thus—fire, water, earth; the way to dissolution (ἐκπύρωσις), the upward way (ἡ ὁδὸς ἄνω), is through ignition or fullness (κόρος), and proceeds—earth, water, fire. All things are in motion (πάντα χωρεῖ): stability is an illusion produced by uniformity of motion. Resolution into original fire is utter spiritual activity, and, at the same time, rest and peace in the union of contraries; creation is relaxation of activity, but, at the same time, war, through the declared opposition of contraries. War, strife, is therefore the parent of all relative created things. These are known to us through our senses, which, however, though necessary, are bad witnesses, unless corrected by the inner, universal wisdom which alone recognizes in and through itself the inner λόγος or fate, which is the law of the universe—a law hidden from the foolish, but open enough to the wise. The soul is immortal, a part of the dry, primal fire, but takes rest from utter activity in the creation of a body. The microcosm is the image of the macrocosm, a shorter rhythmic pulse within a longer. The philosophy of Heraclitus deeply affected all subsequent thought. It furnished a leading element in the doctrines of the Sophists; caused the reaction of Soerates in favor of a permanent, transcendental element in nature and man; was revived by Zeno, and made the basis of Stoicism; passed thence into Greek Christianity, which it supplied with some of its leading doctrines—e. g. those of the Logos, or Word, of a final conflagration (ἐκπύρωσις), etc.; and, finally, passed in a sublimated form into the *Logic* of Hegel. At the present moment it bids fair to be resuscitated in the form of Monism, and has doubtless a great and beneficent future.

THOMAS DAVIDSON.

**Heraclitus**: Greek grammarian; author of *Homeric Allegories* (Ἀλληγορίαι Ὁμηρικαί), in which Homer is allegorized in an absurd fashion. The work was attributed by Gesner to Heraclides Ponticus, and published under his name by Schow (1782). Since then R. Schmidt has claimed the authorship for Porphyry, another idle guess. The time remains uncertain. See the edition by Mehler (1851). B. L. G.

**Heraclius**: Byzantine emperor; b. in Cappadocia about 575; came to the throne after a successful revolt against the Emperor Phocas in 610; was noted for his conduct of the war against the Persians under Chosroes II., who during the early years of his reign ravaged the Asiatic provinces of the empire, and so reduced the imperial revenues that in 618 Heraclius was forced to discontinue the public distributions of grain, and planned to change his capital from Constantinople to Carthage. Dissuaded from this by the prayers of the people and gaining a respite from his Western foes, the Avars, by a humiliating treaty, he raised an army, entered Asia Minor, won the battle of Issus, and, after a series of brilliant campaigns which place him among the greatest generals of history, crushed the power of Chosroes in the battle of Nineveh in 627. The rest of his reign, in contrast to the activity which he showed in the Persian war, is marked by a singular apathy in the midst of dangers more serious than the encroachments of Chosroes. The Mohammedans wrested Syria and Egypt from the empire while he busied himself with useless theological dialectics, and made only dilatory and feeble efforts to save the provinces. D. in 641.

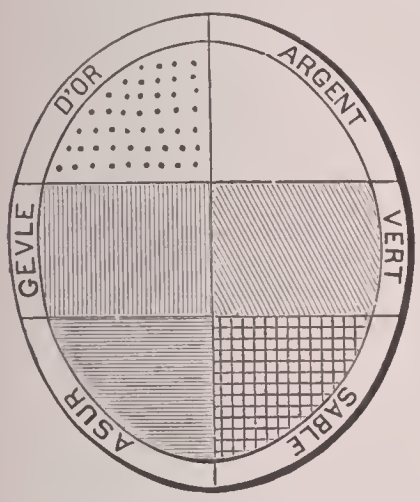
F. M. COLBY.

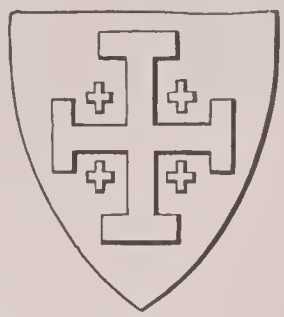
**Herald** [M. Eng. *herald*: M. H. Germ. *herolt* (> Mod. Germ. *herold*) from O. Fr. *heralt* (> Mod. Fr. *héraut*): Span. *heraldo*: Ital. *araldo*; Teuton. cf. O. H. Germ. *heriwalto*, herald; *hari*, army + *waltan*, rule]: a messenger charged with an important mission, as a declaration of war or international treaty; in the Middle Ages an official who marshaled the combatants in the lists, and served as a messenger between princes. The heralds were charged also with questions of genealogy and heraldic bearings. See HERALDRY.

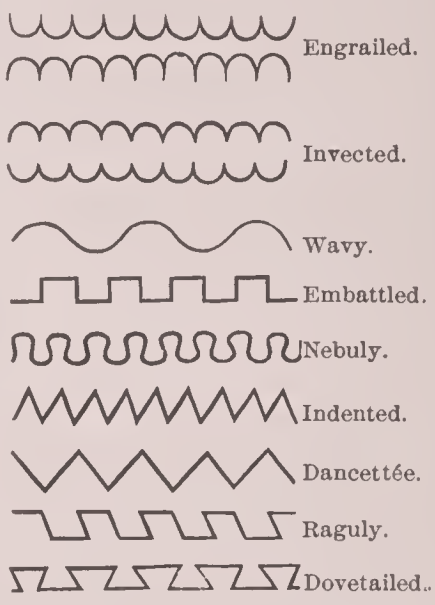
**Heraldry** [from O. Fr. *heraulderie*; deriv. of *heralt*, herald. See HERALD]: in general, the science which treats of coat-armor, descents, precedence, ceremonies, and processions—that is, the art and occupation of a HERALD (*q. v.*);

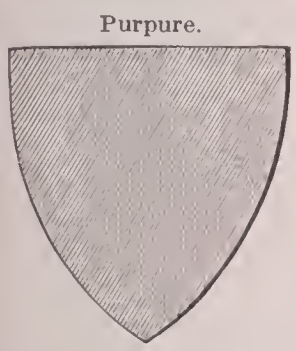
in a narrower sense, the science of coat-armor, or the art of identifying, drawing, and describing coats-of-arms. In Great Britain the whole subject is intrusted to the College of Arms or Heralds' College, which has the right of granting and confirming coats-of-arms; of recording pedigrees and descents, and of visiting the counties of the kingdom for that purpose; of directing solemn ceremonies, particularly those of a coronation; and of deciding all questions of precedence. Its officers are Garter, Clarencieux, and Norroy kings-of-arms, with six heralds and four pursuivants. In the U. S. there is no official body charged with these functions.

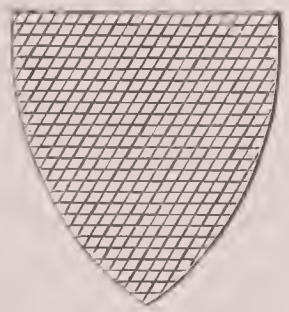
The older (though perhaps not the oldest) writers have attributed a fabulous antiquity to the use of armorial bearings. The science of heraldry can not be traced with any certainty beyond the twelfth century. It appears to have had its origin in necessity. When warriors wore armor and looked exactly alike, even concealing their faces in their helmets, some method of distinguishing them was absolutely necessary. The shield was the most conspicuous part of their armor, and nothing would be more natural than to decorate it with color, or to enrich it with figures of natural or artificial objects. Hence arose the system of tinctures, ordinaries, and charges; from which simple beginnings the whole science of heraldry, or, as some prefer calling it, of armory, has been developed. The tinctures are divided into metals, colors, and furs. The metals are two, gold and silver, called *or* and *argent*. The colors are red, black, blue, green, and purple, called respectively *gules*, *sable*, *azure*, *vert*, and *purpure*. To these some writers add orange tawny and blood color, in heraldic language, *tenné* and *sanguine*, which they call *stainand* colors. The usual pigments are gold, or gamboge, for or, and pure white for argent. Silver is more correct, but its tendency to tarnish makes it objectionable. Vermilion, India-ink, ultramarine, and verditer with gamboge answer well for the colors, and purple can be readily made by mixing carmine (lake) with Prussian blue. The furs are ermine and vair; the former white, with black spots, arranged in a peculiar way (see cut below), the latter composed of bell-shaped or shield-shaped figures, alternately argent and azure, placed in rows, base to base, so that the base of every white figure touches that of every blue one (see cut). Modifications of these furs have been introduced from time to time. They are ermines, with the field sable and the spots argent—i. e. ermine reversed—and therefore more correctly called by the French heralds contre-ermine; erminois, the field or and the spots sable; erminites, the same as ermine, but with a red hair on each side of the white spots; pean, the field sable and the spots or. The derivatives of vair are vair en point, when the point of one figure is opposite the base of another, and countervair, when those of the same tincture are placed base to base. The term vairé is also used when the figures but not the tinctures of vair are given. Thus the arms of Earl Ferrars are blazoned vairé, or, and gules. A modification of vair, in which the skins take the form of crutch-heads, or potents, is known as potent, of which there are four varieties. It is extremely rare in English heraldry, and may be of any metal and color. When a charge appears in its natural colors it is said to be proper. The annexed arrangement of tinctures (omitting purpure, which is given separately) is borrowed from Mr. Planché, who has engraved it from Sir Nicholas Bysshe's edition of *Upton*, A. D. 1674. The mode of indicating the tinctures which it presents, and which is found very useful in engravings or in sculpture, or under any circumstances in which the blazon or description can not be given, is said to have been invented by Father Silvestre de Petrasancta in the seventeenth century. Or is shown by a multitude of dots; argent is white; gules is indicated by perpendicular and azure by horizontal lines; vert by diagonal lines from right to left, and purpure by similar lines from left to right; sable is marked by perpendicular and horizontal lines crossing each other. The right or dexter part of the shield is opposite the left hand of the person looking at it, and the left or sinister opposite his right hand; animals, etc., used as charges, unless it be otherwise specified in the blazon, always look to the dexter. Modern heraldic illustrators make little use of the lines of Petrasancta, but prefer giving the arms in their books in outline or *trick* and accompanying them with the blazon, thereby saving trouble and expense in drawing and engraving. It is a general rule that color is not to be placed upon color, nor metal upon metal. Exceptions, however, occasionally occur; and they are called by the French arms *pour enquérir*, meaning that there is something peculiar in their origin, about which inquiry is to be made. A good example is found in the arms of the kingdom of Jerusalem: "Argent, a cross potent between four crosslets or." See above.

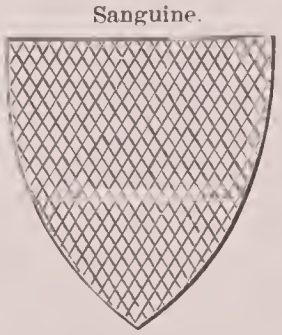


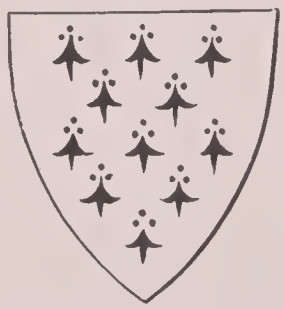



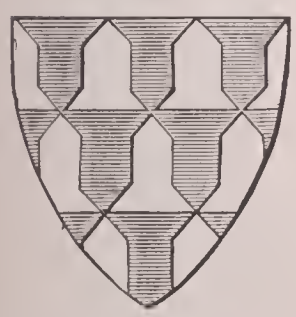


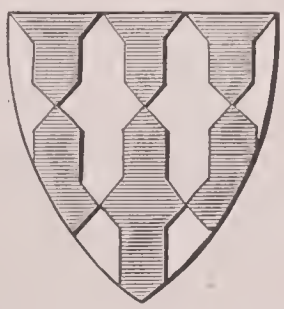


Purpure.

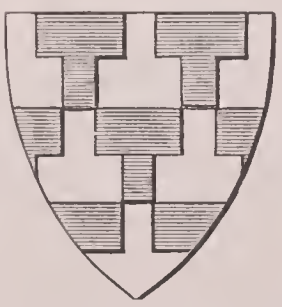

Tenne.


Sanguine.


Ermine.


Vair.

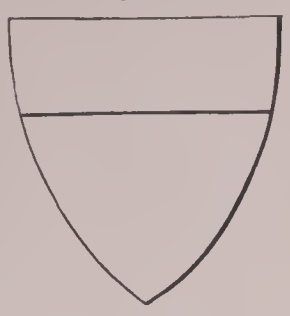

Countervair.

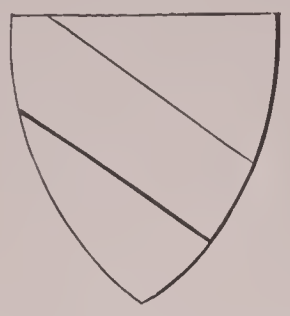

Potent.

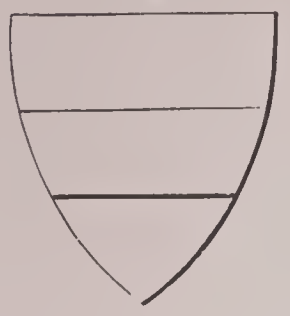
Anything borne upon the field is a charge, and charges may be put upon other charges. The ordinaries are the simplest charges, and may be considered divisions of the field formed usually by straight lines, though the lines may be engrailed, invected, embattled, wavy, nebuly, indented, dancettée, raguly, or dovetailed. Invected is the reverse of engrailed—i. e. in the former the points turn outward, in the latter toward the inner part of the ordinary. The ordinaries are usually reckoned as nine in number, as follow: the chief, the bend, the fess, the pale, the bend sinister, the cross, the saltire, the chevron, and the bar. Mr. Planché, indeed, suggests the substitution of the quarter and the pile for the bend sinister and the bar, but he supports his proposal by no very cogent argument. "The two latter," he says, "are

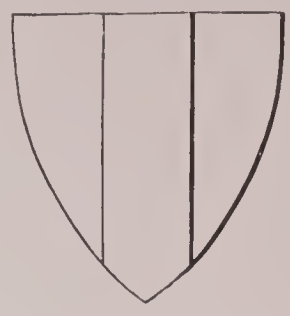
merely varieties of the bend and the fess"; but that is probably the very reason why they are introduced.

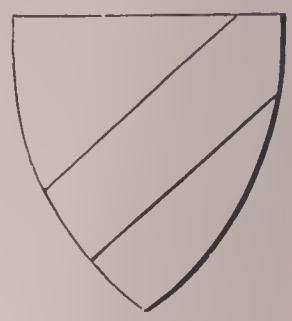
The chief is formed by a horizontal line, cutting off the chief or upper part of the field, the bend, by two parallel

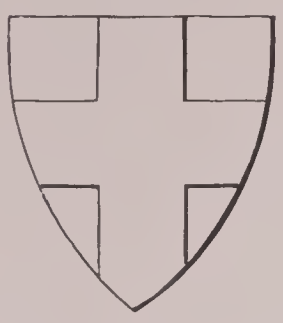

Chief.

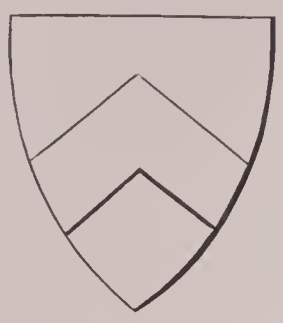

Bend.


Fess.

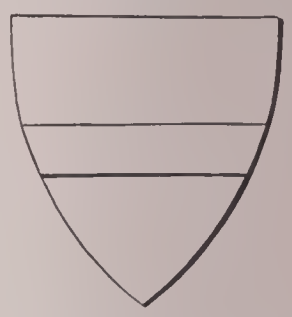

Pale.


Bend sinister.


Cross.


Chevron.

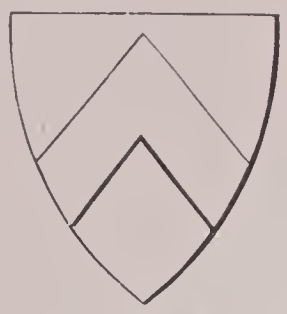
Saltire.

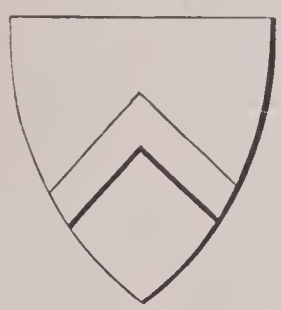

Bar.

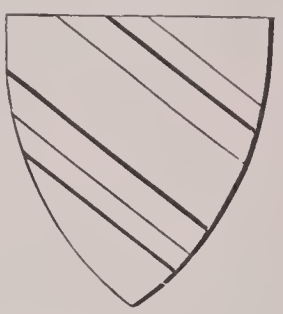
The dimensions of the ordinaries are usually one-third of the field when charged, or one-fifth when uncharged, except the chevron and the bar, which occupy one-fifth. In practice, however, it is hardly possible to follow these stringent rules, and it is common to make the ordinaries smaller.

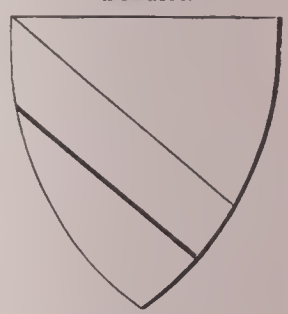
diagonal lines from the dexter chief to the sinister base; the fess by two similar lines crossing the shield; and the pale, by the like lines from chief to base. The bend sinister is the bend reversed. Several of the ordinaries have diminutives, as the couple close for the chevron, and the cottise for

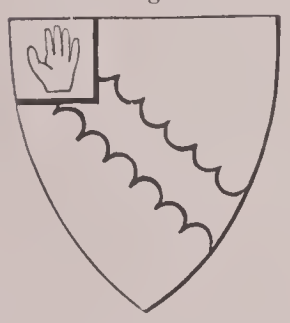
Chevron couched.


Chevron enhanced.


Chevronel.

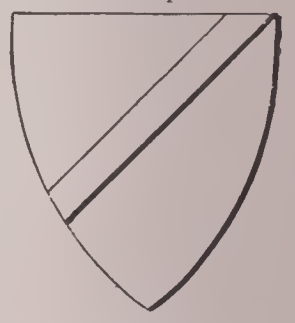

Bend cottised.

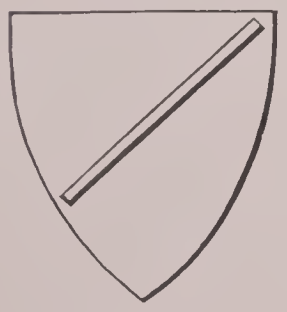

Bendlet.

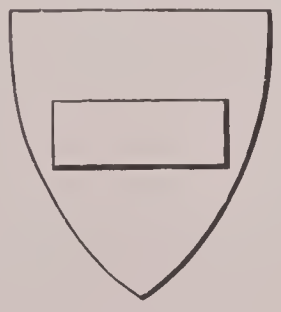

Bend engrailed.

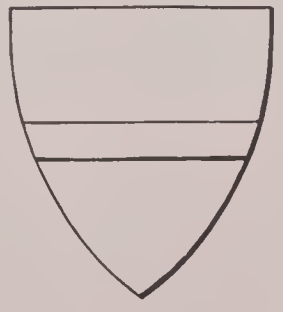
Two bendlets.

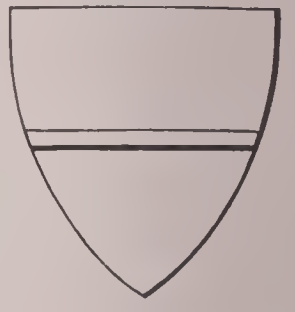
Three bendlets enhanced.

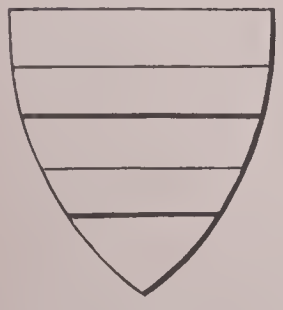

Scarpe.

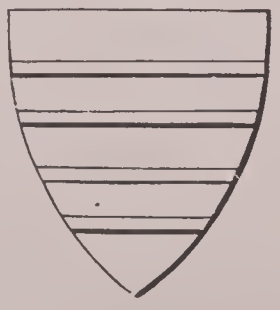

Baton.

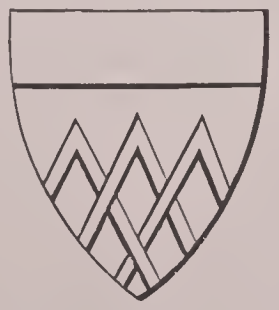

Fess humetty.

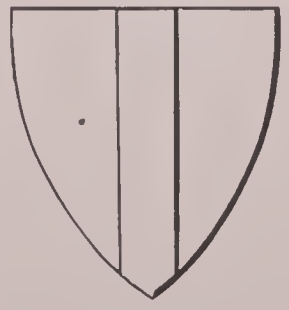

Closet.

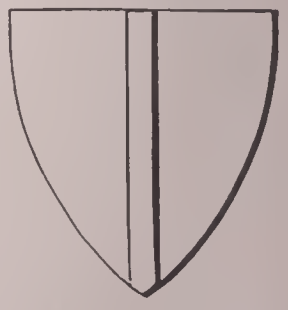

Barrulet.


Two bars.

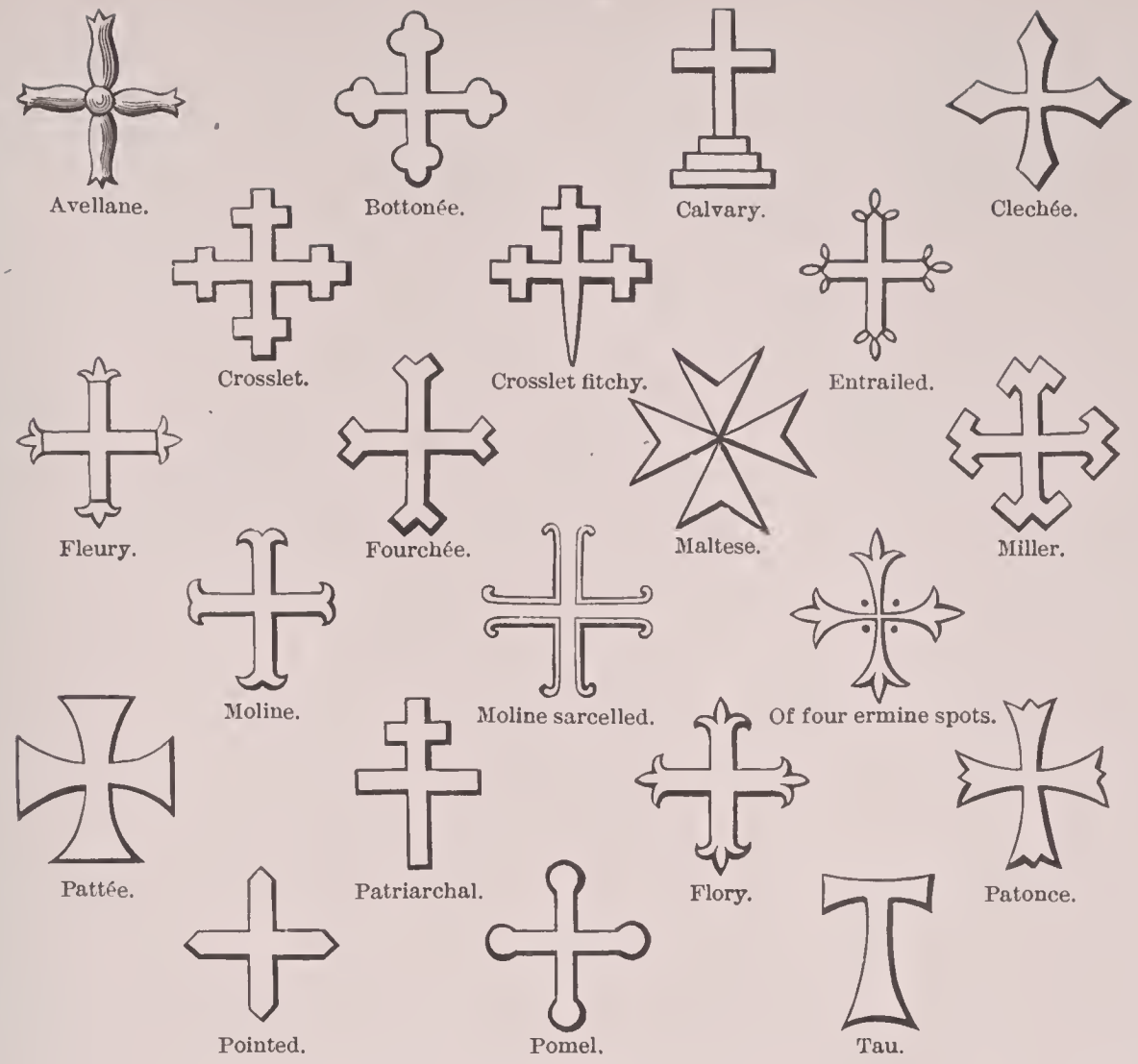

Two bars gemels.


Three chevrons braced.

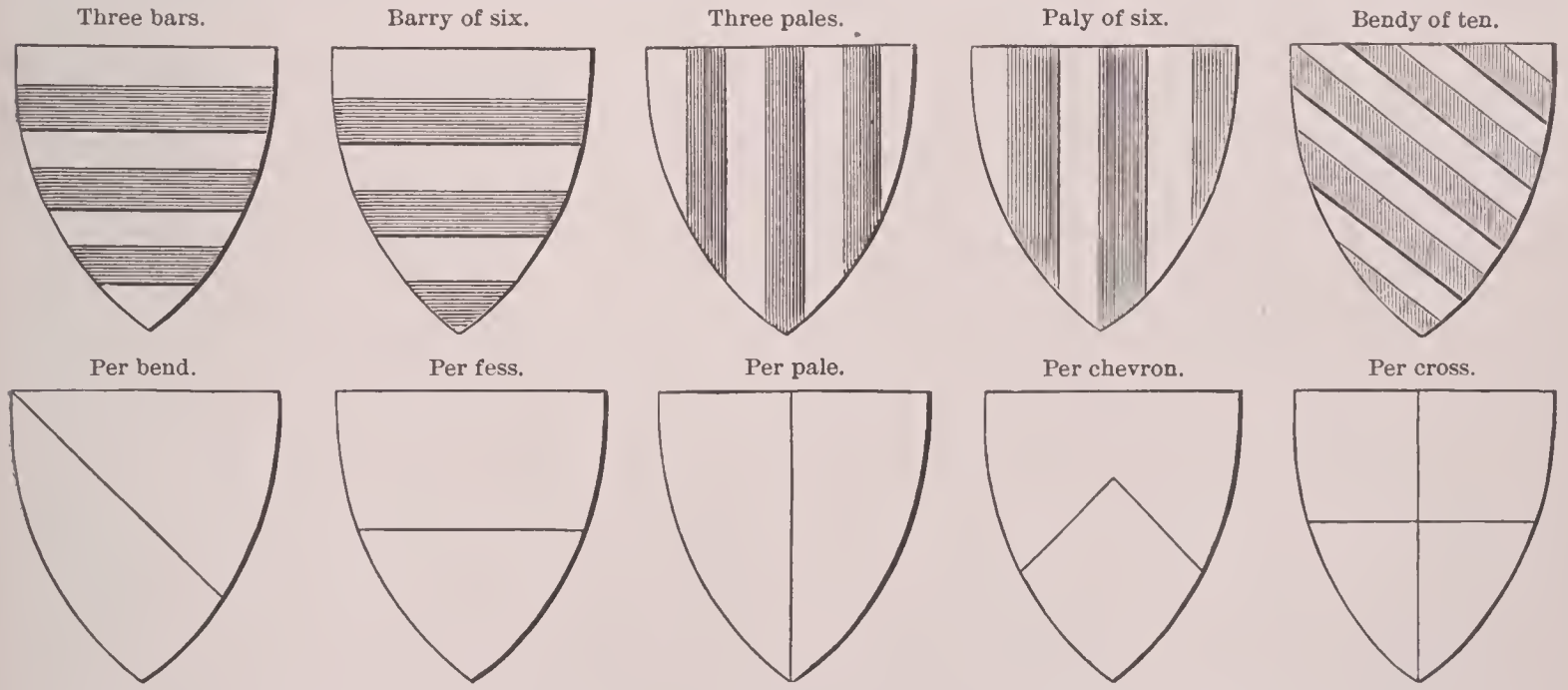

Pallet.


Indorse.

Crosses.



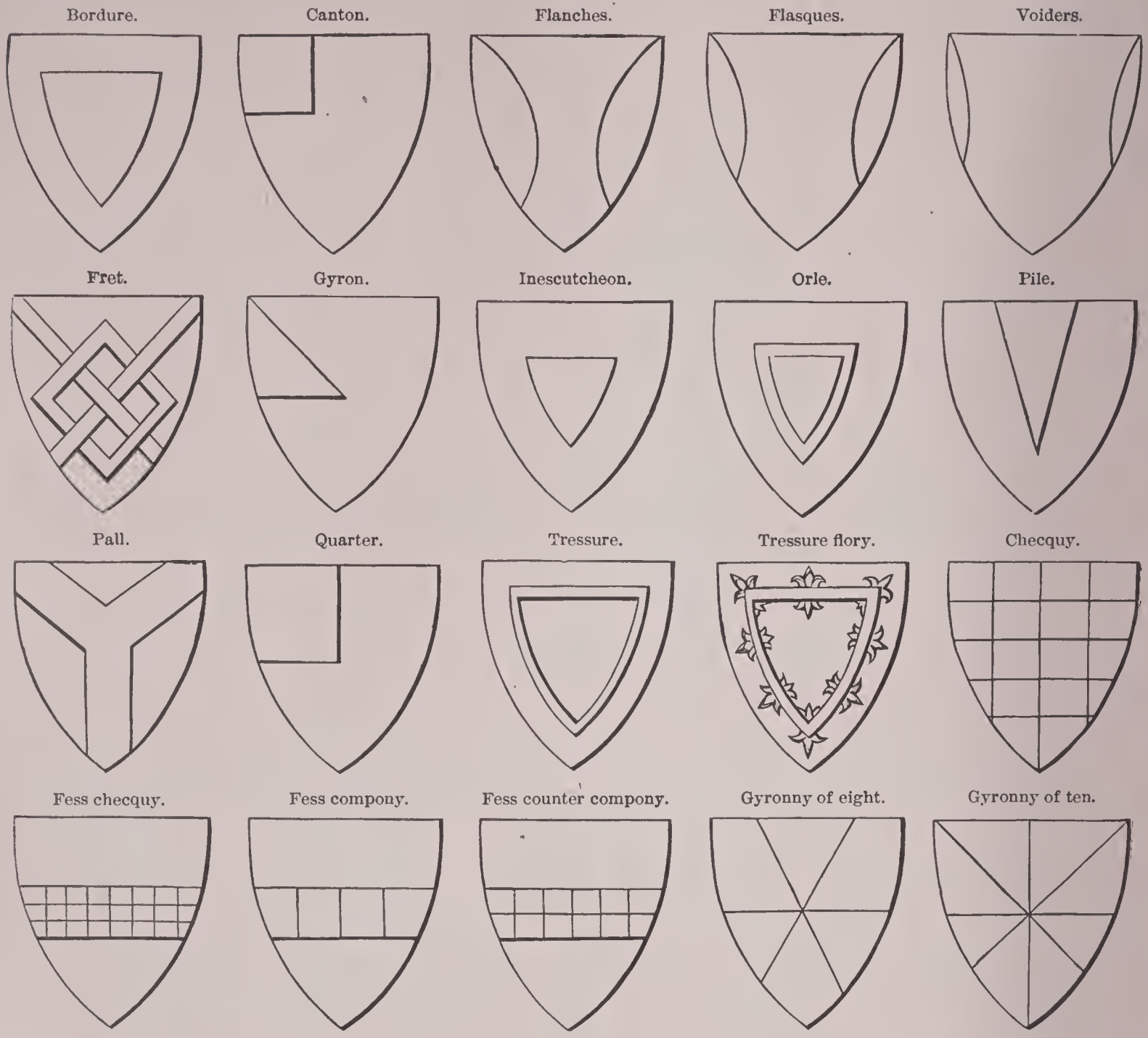

the bend. A bend borne between two cottises, or narrow figures like itself, is said to be cottised, and the same word is applied to other ordinaries in like positions. If the tincture of the field be a metal, the ordinary must be color, and the reverse; but furs may be combined with either metal or color. The same rule applies to other charges. The ordinaries also admit of certain variations of form. Except the chief, they may be humetty—i. e. they may have the ends cut off. The chevron may be rompu or couched, and the bend may be enhanced, i. e. borne in the upper part of the shield, instead of the middle. The field may also be divided by lines derived from the ordinaries, and is then said to be paly, bendy, barry, etc.; it is apparently filled with many little pales or bends, alternately of metal and color. There is a distinction to be observed between an escutcheon which is paly or bendy, for instance, and those which contain several palets or bendlets. In the former case the number of divisions is even, and if the first be a metal the last is a color; in the latter the number of divisions is unequal, and the first and the last are alike. Thus paly of six argent and azure, given by Burke to a family of Gorney, is to be carefully distinguished from argent three pales azure, the arms of Thornton. The sub-ordinaries are the bordure, the canton, the flanches (with their diminutives, flasques, and voiders), the fret, the gyron, the inescutcheon, the orle, the pile, the pall, the quarter, and the tressure; and these in their turn lead to new divisions of the shield, such as pily, checquy, compony, counter-compony, fretty, some of which, like barry pily, bendy pily, are extremely complicated. A detailed account of



these must be sought in heraldic manuals and grammars.

Charges may be anything in nature, or indeed out of it. A charge is a figure borne either upon the field or upon another charge, as often upon an ordinary. The variety of figures used as charges is very great, and there appears to be no limit to the choice. Lions, eagles, wolves, tigers, and antelopes are generally drawn conventionally, and not naturally, though some modern painters seem disposed to depart in this respect from the ancient rules. Other animals, fruits, and flowers, commonly follow nature, but the heavenly bodies do not. Fishes do, except the dolphin. Artificial figures are drawn as they appear. There are also definite terms employed to describe the position of animals and other charges, as a lion rampant, a lion passant gardant. The former is called by the French heralds a lion, the latter a leopard. Ignorance of this simple fact has led to prolonged discussions whether the arms of England, gules three lions passant gardant in pale, or, gave lions or leopards. Charges are generally readily understood, but some few, like the fleur-de-lis, the clarion, and the fylfot, are obscure, and are called doubtful charges.

Besides the above there are certain figures peculiar to heraldry, and of very frequent occurrence. The roundle is supposed to be derived from the gold coin of Byzantium, and therefore when it is or is called a bezant. When gules, it becomes a torteau; azure, a hurt; vert, a pomey; sable, a pellet or ogress; purpure, a golpe; argent, a plate; tenné, an orange; and sanguine, a guze. A roundle barry wavy argent and azure is a fountain or sykes, and is borne by a family of the latter name. When the field is sprinkled with pointed figures resembling



Lion rampant.

Eagle displayed.

Lion salient.

Rampant crowned.

Rampant double queuée.

Lion rampant gardant.

Rampant regardant.

Passant.

Passant gardant.

Sejant.

Couchant.

Dormant.

Demilion.

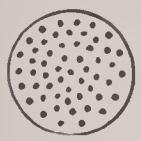
Lion's head.

Gamb.

Tail.

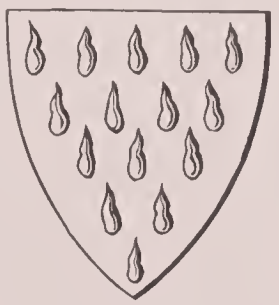
Stag's head caboshed.

drops, it is said to be gutté, and a single drop is called also a gutté. If the drops be white, the field is gutté d'eau—filled with drops of water. Guttés de larmes, blue drops, represent tears; de poix, sable, drops of pitch; de sang, red, drops of blood; d'huile or d'olive, green, drops of oil; d'or, gold, drops of gold. A lozenge is the common figure of that name: the horizontal diameter is equal to one of the sides, but the perpendicular diameter is longer; a masele is a lozenge voided—i. e. having the middle removed, so that the field is visible through it, and marking the outline by two slender lines, one within the other. Ordinaries also may be voided. The fusil was originally the spindle, and in some old arms is borne in its original form; it is now merely the lozenge elongated. These charges give rise to the divisions of the shield known as lozengy, maseuly, and fusilly, with their combinations. When lines like those of the fret are extended throughout the field or eover an ordinary, it is said to be fretty. The annulet is a ring; the millrind or fer-de-moline, the iron of a millstone; the pheon, an arrowhead; the ealtrop, an iron instrument formerly strewn in a field of battle to entangle the feet of horses, and so eonstrueted that a sharp point was always uppermost. For other eharges it is neeessary to refer the reader to some manual of heraldry.


Bezant.

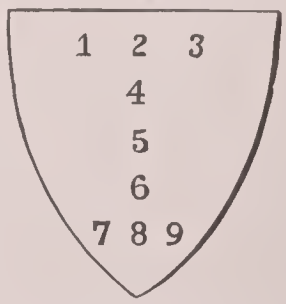
Fountain.

Guttés.

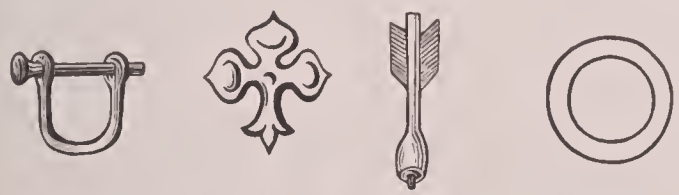


Blazoning is the art of so deseribing arms that a drawing can be made from the deseription. It is neeessary first to understand the points of the escuteheon, whieh are: (1) the dexter chief point; (2) the middle ehief; (3) the sinister chief; (4) the honor point; (5) the fess point; (6) the nombril point; (7) the dexter base; (9) the sinister base; and (8) the base or middle base point. The terms of art must next be learned; not only the heraldic names of things, but the various attitudes of animals and the position of charges. Beasts of prey are blazoned rampant, passant, passant-gardant, sejant, rampant-gardant, couehant, dormant, ete.; and when at rest, statant, though this is generally understood. Beasts of chase, however, are not rampant, but springing; not passant, but trippant; not eouehant, but lodged. A griffin is not rampant, but segreant. Lions are always langued and armed. If the field or the lion be gules, the tongue and elaws are azure; if of any other tineture they should be gules. Stags, ete., are attired and unguled, horned and hoofed. Birds are displayed rising, volant, or at rest. Fishes are naiant when in fess, or hauriant when in pale.

Points of escutcheon.



Lozenge. Fusil. Mascle. Billet. Caltrop.


Shackbolt. Trefoil. Bird-bolt. Annulet.

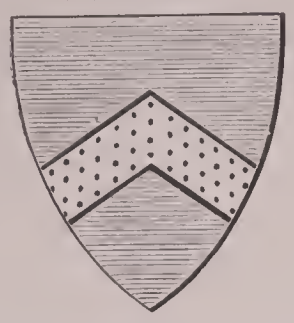
Fer-de-moline. Pheon. Cinquefoils.

Sun.

Trunk.

Flowers are often slipped, and trees eradicated or torn up by the roots. Certain charges, also, are blazoned in a peculiar manner. The sun, surrounded by rays and or, is said to be in his splendor; the full moon, argent, in her complement. Both are drawn conventionally, with a human face. When sable, the moon is said to be eclipsed. A crescent has its horns toward the chief, an increscent toward the dexter, and a decrescent toward the sinister side of the escutcheon. A peacock with his tail extended is said to be in his pride, and is depicted proper. A pelican in her nest, feeding her young, is said to be in her piety. In blazoning care must be taken to use language with extreme accuracy, since the least departure from correctness may produce an entirely different coat from that which it is intended to describe; to use as few words as possible, and to avoid repetition, particularly of the name of a tincture or of numbers. The tincture of the field must first be mentioned, then the bearing and its tincture, as, Azure, a chevron or (see D'Aubernoun). The field must be blazoned first, as, argent, or Paly of six argent and gules. Next to the ordinary, if there be one, other charges placed upon the field are named, as, Ermine, a chevron azure between three garbs or. Garbs are wheat-sheaves. If the ordinary and charge be of the same tincture, it need be named but once, as, Azure, a chevron between three garbs or (see Fitz-Neele). If the ordinary be charged, it must be next mentioned, Azure on a bend ermine three mullets sable (see Gay). Lastly, the bordure or chief must be mentioned, with its charges, if any, Azure, on a chevron or between three bells argent, an eagle displayed between two lions rampant gules, all within a bordure ermine. If there be no ordinary, but a charge, it is to be treated in the same way, as, Sable, a lion rampant or, Azure, a lion rampant between three crosses crosslet or. The repetition of the names of tinctures is avoided by using the expressions, "of the field," "of the first," "of the second," etc., as, Argent, a fess checquy or and gules, in chief three crosses crosslet fitchée of the third (i. e. gules). The repetition of numbers may be avoided thus: Sable on a chevron or between three estoiles of the second, as many crosses pattée fitchée gules. Finally, the difference and the baronet's badge, if there be any, the crest and the supporters, are to be described. The difference is a small charge employed to distinguish the arms of the sons of a house, from the first to the ninth.

D'Aubernoun.

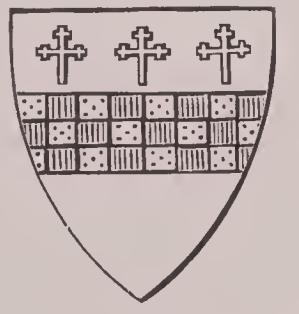


Fitz-Neele.

Crescent. Decrescent. Increscent. Estoile. Mullet. Pierced.

Gay.

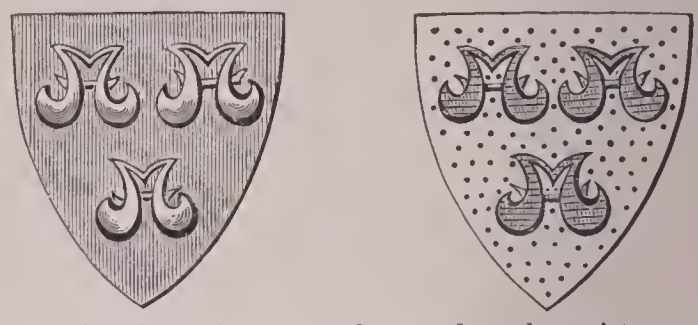
Borges.



Differences.

Modern differences, or marks of cadency, are the label, the crescent, the mullet, the martlet, the annulet, the fleur-de-lis, the rose, the cross moline, and the double quatrefoil, which are given to the sons in that order. They appear to have been in use since the fourteenth century as differences, but have been longer employed as charges. Ancient differences were much more conspicuous, and consisted in a variation of the tinctures (see arms of the Roos family), or even in the addition of a charge. The baronet's badge is Argent a sinister hand, erect, open, and couped at the wrist or, and was given in commemoration of the purpose of the institution of that order by King James I. in 1611, to encourage plantations in Ulster. The badge of the Nova Scotia baronets appears to have been laid aside since 1629. As borne by the celebrated William Alexander, first Earl of Stirling, it was, Argent on a saltire sable, an escutcheon charged with the arms of Scotland, and was borne in an inescutcheon ensigned with the royal crown.

Arms of Roos family.



Above the arms the helmet is placed, which varies in form and material according to the degree of the wearer. This, in a complete achievement, is covered by the lambrequin or cover of the helmet, which is slashed or jagged, and often arranged in elaborate scroll-work. Above the helmet is placed the wreath, in form like two cords twisted together; the tinctures of the wreath are properly those of the principal color and metal of the arms. Sometimes a cap of maintenance is substituted for the wreath. Above all is the crest. Below the shield is the motto in a scroll. This is a brief sentence or a single word, frequently breathing some pious sentiment or vigorous thought, but often alluding to the arms, the name, or the crest. Of the former character are "Dum spiro spero," "Garde la foy"; of the latter, "Pie repone te" (*Pierrepont*). That of Livingston, "Spero meliora," is an elegant allusion to the crest, a ship tossing in a stormy sea. It is the modern custom, however, to give only shield, crest, and motto, omitting the helmet and lambrequin. The term mantling is sometimes applied to the lambrequin, but the mantle or mantling is generally a large mass of drapery disposed behind and around the achievement in the case of royalty or the higher nobility.

Supporters are figures of men or animals placed one on each side of the shield, and so called because they appear to support and hold it up. They are borne in England by the sovereign and the princes of the blood, by peers and Knights of the Garter, and Grand Crosses of the Bath, and, either by patent or prescription, by some baronets and private gentlemen.

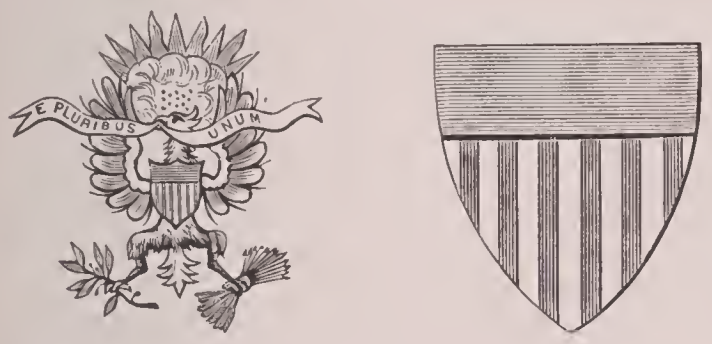
It is right to add that the foregoing is the merest outline of the rules of blazoning. It is only possible to learn to blazon well by acquiring a correct knowledge of the terms of art and by the careful study of examples. It is not necessary to do more here than to allude to the methods of blazoning by planets and precious stones adopted by some heralds. Briefly, in blazoning the arms of sovereigns, they substituted the names of planets for those of the tinctures as they are now employed. Thus or is Sol; argent, Luna; azure, Jupiter; gules, Mars; purpure, Mercury; sable, Saturn; vert, Venus. By this method the royal arms of England would be disguised as Mars three lions passant gardant in pale Sol. The arms of peers were blazoned by precious stones. Or is topaz; argent, pearl; azure, sapphire; gules, ruby; purpure, amethyst; sable, diamond; vert, emerald; sanguine, sardonyx; and tenné, jacinth.

Marshaling is the art of arranging arms with the externals in an achievement. The mode of doing this when there is only one coat in the shield has been explained. Marshaling includes also the arrangement of several coats-of-

arms in a shield, as when a man having a right to arms marries an heiress or a woman of very high rank, and wishes to bear her arms with his own.

The correct placing of many coats-of-arms in one shield is called quartering, and the rules which govern it are included among those of marshaling. There are several methods of marshaling arms. Those of a husband and wife are impaled, or placed side by side in one shield, and divided by a perpendicular line. Formerly, arms were occasionally dimidiated—i. e. only half of each coat was drawn—but this practice has been long abandoned, except in the case of bordures, orles, and tressures, the inner half of which is omitted in impaling or quartering. The arms of a bishop and his see are also impaled, those of the see occupying the dexter or baron's side, and are ensigned with a miter. Those of a Knight of the Garter and his wife are usually placed in two shields set side by side, and the former only is encircled by the garter. Unmarried women bear their arms in a lozenge instead of a shield as do widows, but the latter may impale their arms with those of their husband. Arms descend to all the sons and their posterity forever, but according to the rules of English heraldry women are only entitled to them during their life, unless they be heiresses, in which case they descend to their posterity. An heiress, in heraldry, does not necessarily inherit property, but represents a name; she is, in fact, a woman without brothers. Her arms, together with those which she may have inherited from female ancestors, other heiresses, descend to her children, who quarter them with their paternal coat. If but one coat-of-arms be thus inherited, it is placed in the second and third quarters, reckoning in rows from right to left, and the paternal arms in the first and fourth.

Arms of the United States.




The arms of the U. S. are what are called arms of dominion. They are borne in rather an unusual way. The following is the blazon: Argent, six palets gules, a chief azure, borne on the breast of the American eagle displayed proper, in his dexter talon an olive branch, in his sinister thirteen arrows, also proper; above his head a sky azure charged with as many mullets 5, 4, 3, 1, argent and environed with clouds proper, and beyond rays or; in his beak a scroll with the words "E Pluribus Unum." This blazon is from a painting in St. Paul's chapel, New York. As an illustration of a gentleman's achievement borne in the modern manner, without helmet or mantling, the arms of Sigismund Hugget are given from a mural tablet in the same chapel. They are, Argent, a chevron gules, on a chief azure, two fleurs-de-lis of the first. Crest, two wings expanded, per fess gules and argent. Motto, "Dene agendo vel cavendo." This is an evident mistake for "Bene," but it is literally copied from the mural tablet. These arms may be Dutch.

Hugget.

Funeral achievements or hatchments, though familiar in Great Britain, are little known in the U. S. They are usually hung on the fronts of houses or placed in churches. They follow the usual rules of marshaling, but are commonly drawn very large, and the arms, crest, and motto are placed on a ground in the form of a lozenge. If the hatchment be in memory of an unmarried person, the ground is all black, and the arms of a maid or widow are drawn in a lozenge and ensigned with a cherub instead of a crest. If the husband be dead and the wife living, his arms are placed on a black ground and hers on a white. If the wife die first, her arms are on the black ground, and her husband's on the white; but if both be dead, the ground is all black. The arms of a deceased bishop are impaled in the usual way with those of his see, and the latter are on a white ground.

As regards the use of heraldic devices in the U. S., it is to be observed that very few persons know exactly what arms they are entitled to, if any, and that by far the greater number of crests, escutcheons, etc., used on plate, note-paper, carriage-doors, and the like, have been simply assumed, without authority, either by the present wearer or one of his predecessors. There is no such thing as "the arms of a family." Arms are borne by an individual and by his male descendants after him, his oldest son bearing those arms unaltered, the other sons bearing the same escutcheon *differenced*. Therefore, if one finds that an English or French family of his name has in use a certain shield, this fact gives him not the slightest right to assume it. If he finds that his great-grandfather bore a certain escutcheon, he must still ask: 1. Had my grandfather a right to it? 2. Am I descended from the eldest son in each generation? for, if not, I must find out what differences I ought to add to the escutcheon. That his granduncle or a cousin has had certain arms regularly granted to him gives no one any right to use them, or any part of them; direct descent alone or direct grant by proper authority can justify any one in assuming a coat-of-arms. The crest is somewhat more doubtful; it is certain that in old times it was changed often; but it is especially to be observed that a crest used alone, without the escutcheon, is of the nature of a Badge (*q. v.*), and may be taken and used freely, not being a true heraldic device at all.

The choice of an emblematic or other device, badge, or cognizance, motto, etc., is open to every one. Let us suppose that a book-plate, or *ex-libris* is required, and that no ancestral arms exist. One may perhaps obtain a grant of arms from the Heralds' College in London; but "fire-new" arms do not seem very precious possessions. A better way is to think out an emblematic scheme of some sort, and an appropriate motto, and to have them drawn by an artist of fanciful taste, and etched or engraved. The same device, or a part of it, with the motto, may be painted, carved, engraved on metal, and the like. Thus suppose that the name is Hart or Harte, and that the owner of it adopts the well-known device of Jacques Cœur, two or more hearts, grouped in almost any way, with or without a scroll, and the motto *Aux cœurs vaillans rien impossible*; perhaps even the second motto as well, *En boucheclose n'entre mousche* (flies do not enter the shut mouth). It will be the business of the decorative artist to make a good design of these elements in any use they may be put to; and there will have been no unwarranted use of heraldic devices.

Bibliography.—This is extensive. Among old and well-known works are Leigh's *Accidence of Armory*, Ferne's *Blazon of Gentry*, published in 1586, and Peacham's *Complete Gentleman* (1622). These are entertaining and historically useful, but their authors belong to the mystical school, which tries to discover recondite meanings in the simplest matters, and their works must be used by the student with caution. Guillim is high authority; his *Display of Heraldry* (editions of 1610 and 1724) marks the beginning of the transition from the mode of treatment which allies heraldry with nearly everything, and the stricter scientific method of the modern writers. Among old French works on the subject is de la Colombière's *Science Héroique* (1669). Clark's *Grammar of Heraldry*, published in 1776, which has passed through fourteen editions, is the precursor of the modern method. Porny's *Heraldry* (by Porny, French master at Eton College and an accomplished scholar), published first in the *Encyclopædia Britannica*, and afterward in a volume by itself, is a very good but not very complete treatise. Of recent works Boutell's *Heraldry, Historical and Popular* (1864), contains almost all that one need know of the art, but lacks completeness of arrangement, cross-references, etc. The same author's smaller work, *English Heraldry*, Clark's *Introduction to Heraldry*, Cussan's *Handbook of Heraldry*, Planché's *The Pursuivant-at-Arms*, and Worthy's *Practical Heraldry*, are useful books for the beginner. See also Whitmore's *Elements of Heraldry* (Boston, 1866). Of French works, Bouton's *Nouveau Traité de Blason* (1863) and d'Eschavanne's *Traité complet de la Science du Blason* may be consulted, but they lack indices and other conveniences for reference. Berry's *Encyclopædia of Heraldry* should

be used by one who wishes to make a serious study of the matter. See also *A Treatise on Heraldry, British and Foreign*, by Rev. John Woodward and George Burnett, Lyon King-at-arms (2 vols., 1892), and Woodward's *Ecclesiastical Heraldry* (Edinburgh and London, 1894).

Revised by RUSSELL STURGIS.

**Heralds' College**, or **College-of-Arms**: a corporation instituted in 1464 by Edward IV., chartered in 1483 by Richard III., confirmed by Edward VI. in 1549, and rechartered by Philip and Mary in 1554. Its office is in Queen Victoria Street, London. Its president is the Duke of Norfolk, hereditary earl-marshal of England. The three English kings-of-arms, Garter, Clarencieux, and Norroy, the heralds, Chester, Windsor, Lancaster, York, Somerset, and Richmond, and the pursuivants, Portcullis, Bluemantle, Rouge Croix, and Rouge Dragon, are members of the corporation, whose business it is to decide what heraldic bearings are properly borne, to grant new ones, etc. All the members of the college have salaries. The Lyon Office in Scotland and the Office-of-Arms in Ireland perform similar functions. See HERALDRY.

**Herat'**: an important city in Western Afghanistan; on the Heri-rud, in lat. 34° 22′ N. and lon. 62° 9′ E. (see map of Asia, ref. 5–D). It is fortified and situated in a fertile and highly cultivated country. It has large bazaars, and, besides its own manufactures of carpets, woolens, and leather, it has a considerable trade with China, India, and Persia. On account of its position it may become the point of contention between Great Britain and Russia in their Asiatic rivalries. Its population is estimated at between 20,000 and 30,000.

**Hérault**, *ā′rō*: department of Southern France, on the Mediterranean. Area, 2,393 sq. miles. The nothern part is traversed by branches of the Cévennes, which inclose fine valleys. The coast is low and marshy. The mountains are rich in minerals—coal, iron, lead, copper, and marble; the valleys produce wheat, wine, and fruits. In the marshes much salt is manufactured, and the lakes and the sea furnish large quantities of fish. Other important industries are the cultivation of olives and the breeding of silkworms. Capital, Montpelier. Pop. (1896) 469,684.

**Herba'rium** [= Mediæv. Lat. *herbarium*, neut. of Lat. *herba'rius*, botanist, deriv. of *her'ba*, herbage, plant, grass], or **Hor'tus Sic'cus** [Lat., dry garden; *hort'us*, garden (: Eng. *yard*) + *siccus*, dry]: a botanist's collection of specimens of plants for study and reference. Such collections are now to be found in connection with nearly all the larger colleges and universities in the U. S., and in the National Museum in Washington is the National Herbarium. In Europe among the greatest collections are those at Kew (Kew Gardens), London (British Museum), Paris (Jardin des Plantes), Geneva (de Candolle), and Berlin (University). In the preparation of herbarium specimens it must be remembered that the specimen is valuable only as it furnishes materials by which we may make out its structure. Most specimens are dried under enough pressure to prevent wrinkling. Sheets of heavy blotting-paper or soft "carpet-paper," 12 by 18 inches, and called "driers," are used to absorb the moisture, and a stone or a few bricks weighing from 10 to 20 lb. may supply the pressure, which must vary with the number of specimens treated. Nearly all green and red algæ must be floated out in water and arranged on heavy cards of paper; a damp cotton cloth must be laid over each card before it is put between the driers, in the press. After a few hours, or at most a day, the driers, now moist, must be removed and fresh ones used. When the specimens are dry, the cloth may be removed by carefully peeling it off from one side, the specimen adhering to the paper. Usually the brown algæ may be preserved by placing them between the driers, and applying pressure, changing the driers frequently. The smaller fungi may be lightly pressed in small envelopes, or where too fragile must be at once placed in shallow pill-boxes (a quarter of an inch high). The parasitic leaf-fungi may be preserved by drying the leaves under pressure. The larger fungi may be cut into slices and then dried under pressure.

Mosses and liverworts (which must be in fruit) should be freed from dirt as much as possible, and then separated and dried under some pressure. Fernworts also must be in fruit and the specimens must include the roots, stems, and leaves (except, of course, in case of very large species). In drying them some of the leaves should show the upper face, and others the lower. Specimens of flowering plants should include the whole plant, or as much of it as possible. In most cases they must show the flowers, flower-buds, fruits, seeds, leaves, stems, and roots. They should be carefully spread out and dried between the driers with enough pressure to keep all parts from wrinkling. In all cases great care must be taken to change the driers frequently enough to avoid blackening or moulding.

Many fruits, cones, seeds, samples of woods, etc., are simply dried in the open air, and preserved in proper drawers. Fleshy fruits and flowers and other parts of plants may be preserved in diluted alcohol (25 to 50 per cent.).

All the ordinary specimens for the herbarium should be mounted upon sheets of heavy white paper (36 lb. paper), cut 11½ inches wide and 16½ inches long. The cards to which the algæ are attached are fastened by a few drops of mucilage, as are the envelopes containing fungi, lichens, mosses, seeds, etc. All other plants, however, are fastened to the sheets by means of white glue prepared by heating in water in the usual way. The under side of the specimen is coated with glue, and it is then laid carefully upon the sheet and kept there under a light pressure until dry. The label, including the scientific name of the specimen, date, and place of collecting, name of collector, etc., should be attached to the lower right-hand corner of the sheet. Specimens so mounted are preserved in herbarium cases, consisting of sets of pigeon-holes 18 inches deep, 12 inches wide, and 4 inches high. All the species of a genus are put into a "genus cover" of heavy Manilla paper, and these genus-packets (properly labeled) are arranged in their families in regular order. Tightly fitting doors cover the pigeon-holes to exclude dust and insects, while the latter are still more effectually guarded against by poisoning the specimens with an alcoholic solution of corrosive sublimate.

CHARLES E. BESSEY.

**Herbart**, JOHANN FRIEDRICH: philosopher; b. at Oldenburg, Germany, May 4, 1776; studied in the gymnasium of his native town; entered the university at Jena in 1794. Here he studied under Fichte, his philosophical interests having been aroused in the gymnasium. He soon wrote a critique on some of Schelling's positions, and laid the foundation for his own future system. In 1797 he became a tutor in a private family at Berne, where he began the elaboration of his educational theories. In 1802 he became docent in Philosophy and Pedagogy at Göttingen, and in 1805 professor extraordinarius. In 1809 he was called by Wilhelm von Humboldt to Königsberg to succeed Krug, the successor of Kant, as professor ordinarius. Here he also founded a pedagogical seminary. In 1833 he was recalled to Göttingen, where he remained until his death. His chief philosophical works are *Lehrbuch zur Einleitung in die Philosophie* (1813); *Lehrbuch zur Psychologie* (1816); *Psychologie als Wissenschaft, neu gegründet auf Erfahrung, Metaphysik und Mathematik* (1824–25); *Allgemeine Metaphysik nebst den Anfängen der philosophischen Naturlehre* (1828–29); *Kurze Encyclopädie der Philosophie, aus practischen Gesichtspunkten entworfen* (1831). The complete works of Herbart have been edited in 12 vols. by G. Hartenstein (Leipzig, 1850–52).

*Philosophy.*—Herbart's philosophy is one of the offshoots from the great system of Kant, and lies at the opposite pole from the Idealism of Fichte and Hegel. Its prevailing characteristic is a metaphysical realism, which reminds one strongly of the Monadology of Leibnitz, except that the monads, or *reals*, as Herbart calls them, have no inherent principle of development. There is a return to the eleatics for the notion of being, and to the atomists for that of multiplicity of being. The idealistic aspect of Kant's system is wholly rejected, so that internal self-realization and transcendental freedom of will are dismissed as fictions. Yet Herbart takes his system from Kant, explaining that metaphysics must consist in elaborating our notions so as to free them from contradictions. Any metaphysical assumption is freely made which appears to assist in doing this, no matter what difficulties may be involved in the assumptions themselves. The result of his deductions is that behind the known world of phenomena, as its active metaphysical cause, there lies a world of monads, or *reals*—metaphysical atoms. They are simple in quality, and possess the power of self-preservation against all disturbances from other reals. Instead of regarding the monad as a self-developing unit, as Leibnitz did, every real is regarded by Herbart as dependent upon other reals for any occurrence that may take place within it. The reals are conceived to be in a state of

partial interpenetration, and as capable of creating "disturbances" in one another. The soul itself is one of these reals, perhaps of a higher order, and is in reciprocity with other reals, preserving itself against the annihilation which they threaten. Each of these "self-preservations," or internal states, arising from the disturbance of other reals, is an idea. When not under "arrest," i. e. when not suppressed by other ideas, it is in consciousness. The nature of the soul as a unit (which is shown by the blending of ideas) makes it impossible to have all the ideas which the soul possesses present in consciousness at one time; yet ideas endure in the soul as states striving for representation. The soul monad, or real, has its seat in the brain, being in close relation with a multitude of other reals. Any excitation upon the peripheral ends of the nerves is conveyed to the brain, and reaches the soul through the medium of the reals in immediate juxtaposition or in partial interpenetration with it.

These inner states of the soul, the ideas, are conceived as becoming forces which further or resist one another, according to their nature and composition. In so far as they are similar they blend or fuse, thus accounting for association; but in so far as they are opposed in nature they tend to arrest one another, or to drive one another out of consciousness. Where several ideas are present in consciousness at once there is a "sum of arrest" which is shared by the separate ideas inversely as their strength; hence the weaker an idea is the more it suffers from the arrest. The assumption that ideas become forces in virtue of their relations, and that, like other forces, they are subject to law, makes it possible to apply mathematics to psychology. It may now be seen how Herbart's claim of founding psychology upon metaphysics, mathematics, and experience is justified. The doctrine of reals is metaphysical, that of the statics and dynamics of ideas as forces is mathematical, while the fact that the soul develops no life from within, but depends wholly upon excitations coming from without, points to the conclusion that experience is the sole source of knowledge.

*Apperception.*—Of special importance and interest is Herbart's doctrine of apperception, or mental assimilation, since this is the key to his important contributions to pedagogy. Apperception with Kant is the organization of knowledge through the self-active agency of the mind; but with Herbart, who acknowledges no such mental constitution, it is plain that the process must be explained from another standpoint, viz., that of experience. Ideas already obtained become forces, with which any newly entering idea must deal. It follows naturally that, aside from the original receptivity of the soul for impressions, i. e. its power of self-preservation, it is the ideas already gained from experience that constitute the apperceiving forces for each new idea. It takes ideas, therefore, to apperceive ideas. This gives rise to the distinction between that which apperceives and that which is apperceived. Each newly entering sensation (perception) serves as a stimulus to older and related ideas, thus calling them and their associates into consciousness. At first the new sensation is the dominating force; but as arrest of opposing and fusion of kindred elements proceed, the older and more established ideas assert their superiority, adjusting the new experience to themselves, i. e. apperceiving it. In this way knowledge increases in complexity and force, and consequently in apperceiving power. In a similar way, elements of former experience coming simultaneously to consciousness will undergo the apperceiving process, the weaker ideas yielding ultimately to the greater apperceiving power of the stronger. Herbart's theory of apperception is therefore *a posteriori*, whereas Kant's is *a priori*. The latter makes the original constitution of the mind the synthesizing power whereby experience is possible; while Herbart, neglecting this aspect of the subject, fixes his attention upon the influence which acquired experience has upon that which is being acquired. His theory, now generally accepted as essentially true, has been extended and largely freed from contradictions by Lazarus, Steinthal, and Wundt. Non-Herbartian psychologists have treated the same phenomena of mind under a number of heads, such as sensation, perception, association, and the like.

As a philosopher Herbart can hardly be said to have left a school, but the importance of his thought when applied to education has given rise to a distinct body of educational followers in Germany, the members of which, though not numerous, are distinguished by earnestness and vigor. The most important names among the educators are Ziller, Rein, Lange, Stoy, Frick; and among the psychologists, Volkmann, Waitz, Lazarus, Steinthal. Since experience is the chief source of knowledge, and since the experience we have acquired is largely determinative of that which we acquire, it follows that the best standpoint from which to examine the problems of teaching is the growing apperceptive power of the child. All the problems of instruction, such as the studies to be selected, the amounts of each to be taught, the order of topics in each subject, and their correlation in different branches, together with all questions of method, are to be investigated in the light of the child's power of mental assimilation, as determined by his knowledge, tastes, interests, and disposition at any given time. As a guide to teaching, the logical order of developed systems of knowledge must give way to the psychological order of apperception. The application of Herbart's principles to education was first made by his successors. His most noteworthy pedagogical works are accessible to English readers in translation, as is also his text-book on psychology. Not only is the process of apperception a guide to instruction, but it also shows how to reach with each child the grand aim of all education, which Herbart conceives to be the development of a strong moral and religious character. But character, like knowledge, is a resultant of the experience of the individual—not a few of his experiences, depending it may be upon moral maxims or dogmatic religious instruction, but all his experience resting upon the whole complex of knowledge, desire, and volition. With Herbart it is the whole child that is to become moral. It has consequently been one of the main purposes of Herbart's successors to show how those branches of knowledge usually considered secular or non-moral may materially aid in the development of moral character. CHARLES DEGARMO.

**Herbelot**, BARTHÉLEMY, d', dăr'blō': Orientalist; b. at Paris, Dec. 4, 1625; studied at the University of Paris, and became well versed in the Oriental tongues; sojourned much in Italy; was patronized by Fouquet and Colbert; was royal secretary and Oriental interpreter, and in 1692 became professor of Syriac in the College of France. D. in Paris, Dec. 8, 1695. His *Bibliothèque Orientale* (1697), a storehouse of facts regarding Eastern literature, is still highly valued.
Revised by C. H. TOY.

**Herbert**, EDWARD, Baron: usually styled Lord Herbert of Cherbury; soldier, statesman, philosopher, and author; b. of an ancient family at Eyton in Shropshire, in 1583; educated at University College, Oxford; served with renown in the Netherlands; became a gentleman of the court of James I.; was ambassador to France 1618–24; entered the Irish peerage in 1625, and the English in 1630. His deistical *Tractatus de Veritate* appeared in 1624, and the *De Religione Gentilium* was added in 1645. His philosophical writings are somewhat obscure, but he maintained the existence of innate ideas and of a personal Deity, and taught that the mind of the devout seeker for truth may become illuminated by an inward light. The indistinctness of his expressions and the somewhat mystical subtlety of his notions have caused him to be little read or understood. D. in London, Aug. 20, 1648. His autobiography, brought down to 1624, was published in a new edition by Sidney L. Lee in 1886, and his poems, edited by Churton Collins, appeared in 1881.

**Herbert**, GEORGE: religious poet; brother of Lord Herbert of Cherbury; b. at Montgomery Castle, April 3, 1593; was educated at Trinity, Cambridge, where he received a fellowship in 1615 and proceeded M. A. in 1616; was university orator 1619–27, and seemed destined for civil promotion, which was promised by the king and courtiers; took holy orders in 1625; became a prebendary under the Bishop of Lincoln 1626, and in 1630 rector of Bemerton, where he died of a quotidian ague Feb., 1632. Herbert was a man of profound learning and sincere piety. His poetry, and especially *The Temple* (1632), with its rich imagery and quaint expressions, somewhat marred as it is by forced *concetti*, after the fashion of his times, includes some of the finest sacred lyrics in our language. The most popular of his prose-writings has been his *Character of a Country Parson* (1647).
Revised by H. A. BEERS.

**Herbert**, HENRY WILLIAM: novelist; a son of the Dean of Manchester and grandson of the Earl of Carnarvon; b. in London, Apr. 7, 1807; educated at Eton and Oxford; settled in New York in 1830, where he was for a time a highly successful teacher of Greek. He published a successful series of historical novels, including *Cromwell* (1837), *Sherwood Forest* (1855), etc., and some translations from the French and other languages, including a poetic version of the *Prometheus* and *Agamemnon* of Æschylus (1849). He

was also author of the "Frank Forester" series of sporting volumes, partly tales of out-door life, but also including *My Shooting-box* (1846), *Field-sports of the United States* (1849), *The Fish and Fishing of the United States* (1850), *The Horse and Horsemanship of America* (1857), and other works of this character. He also produced some well-written historical works, such as *The Captains of the Old World*, *Henry VIII. and his Six Wives*, etc., besides performing much editorial and other literary labor. D. in New York, by suicide, May 17, 1858. Revised by H. A. Beers.

**Herbert**, Hilary Abner: Secretary of the U. S. navy; b. at Laurensville, S. C., Mar. 12, 1834; removed with his father at the age of twelve years to Greenville, Butler co., Ala.; was educated at the universities of Alabama and Virginia; studied law and was admitted to the bar of the Supreme Court of Alabama; served in the Confederate army as captain and colonel of the Eighth Alabama Infantry; was disabled at the battle of the Wilderness May 6, 1864; after the war resumed the practice of law at Greenville till 1872, when he removed to Montgomery, where he has practiced since; was elected to the 45th, 46th, 47th, 48th, 49th, 50th, 51st, and 52d Congresses, and declined renomination for the 53d; was chairman of the committee on naval affairs in the 49th, 50th, and 52d Congresses; was appointed Secretary of the Navy, was confirmed by the U. S. Senate Mar. 6, 1893, and held the office till Mar. 4, 1897.

C. H. Thurber.

**Herbert**, Maj.-Gen. Ivor Caradoc: soldier; b. at Llanarth, Monmouthshire, England, July 15, 1851. He entered the Grenadier Guards Nov. 5, 1870, and became colonel Aug. 18, 1889. He was brigade-major of the expedition sent to Egypt from Aug. 4, 1882; brigade-major of the home district 1882–83; commandant of school for auxiliary forces at Wellington barracks 1885–86, and in the latter year was appointed military *attaché* at St. Petersburg. He served with distinction in the Nile expedition of 1884–85, and was appointed major-general commanding the militia of Canada Nov. 20, 1890.

Neil Macdonald.

**Herbert**, Sidney, Baron: statesman; b. at Richmond, England, Sept. 16, 1810; a younger son of the eleventh Earl of Pembroke; studied at Harrow and Oriel College, Oxford; entered Parliament in 1832; secretary to the admiralty 1841–45; Secretary at War 1845–46, 1852–55, and 1859; privy councilor 1852; raised to the peerage as Lord Herbert of Lea 1861. He was an able and popular Conservative leader, a liberal patron of art, and a man of great political ability and industry. D. at Wilton, Aug. 2, 1861. His eldest son became in 1862 the thirteenth Earl of Pembroke.

**Herbert**, Victor: violoncellist and composer; b. in Dublin, Ireland, Feb. 1, 1859; the grandson of Samuel Lover; went to Stuttgart when six years old, and, after completing his studies, went on a concert tour through Europe. He settled in New York in 1886. He is an excellent violoncello-player, an able conductor, and a fine composer. His cantata *The Captive* was produced at the Worcester (Mass.) festival of 1891. He has also composed several pieces for his favorite instrument, with and without orchestra, besides songs and other pieces. D. E. Hervey.

**Herbort von Fritzlar**: priest and poet of the Middle Ages; lived at the court of Landgraf Hermann von Thüringen, and early in the thirteenth century wrote a German version of the Trojan war, in rhyme, under the title *Liet von Troie*. The style is artificial and stilted, and is little more than a paraphrase of the French *Roman de Troie* by Benoit de Sainte-More. See K. F. Frommann, *Herborts von Fritzlar Liet von Troie* (1837), and Dunger, *Die Sage vom Trojanischen Krieg in den Bearbeitungen des Mittelalters* (1869).

**Hercher**, hăr'cher, Rudolf: Hellenist; b. at Rudolstadt, Germany, Jan. 11, 1821; studied in Jena, Leipzig, and Berlin; professor at the Joachimsthaler Gymnasium in Berlin. Editor of *Epistolographi Græci* (1873); *De fluviis*, which he proved not to have been written by Plutarch (1851); *Scripta Minora* of Arrian (1854; 2d ed. 1885); *Erotici Scriptores Græci* ((2 vols., 1859); Ælian, Artemidorus, Plutarch's *Moralia* (vol. i., 1872); *Apollodori bibliotheca* (1874); and author of valuable articles on the Homeric question, especially in connection with the topography of Ithaca. D. Mar. 26, 1878. Alfred Gudeman.

**Hercula'neum** [Lat., liter., the town of Hercules (sc. *oppidum*, town), neut. of *Hercula'neus*, pertaining to *Hercules*]: a city of ancient Italy, on the Mediterranean, at the foot of Mt. Vesuvius, much frequented in the later days of the Roman republic and in the early empire by the wealthy families of Rome, because of its beautiful location and its mild and healthful climate. In the year 63 A. D. it was shaken violently by an earthquake, which seems to have wrought damage from which the city had not entirely recovered in 79 A. D., when it was completely overwhelmed by the eruption of Vesuvius, which also destroyed Pompeii. The mass of ashes, lava, and other volcanic matter was increased by subsequent eruptions, and, under the influence of moisture, it has become transformed into a soft tufa, covering the ancient city to a depth varying from 50 to 100 feet. Upon the soil deposited on this formation have arisen the villages of Portici and Resina. In the early part of the eighteenth century attention was called to frequent finds of rare and unusual kinds of marble made by the inhabitants of the villages mentioned, and an excavation for a well, somewhat deeper than usual, led to the discovery of a number of beautiful and perfectly preserved statues.

But it was not until the year 1738 that systematic exploration was begun on the site of these discoveries by the architect Alcubierre, working under the direction of Charles III., King of the Two Sicilies. These excavations soon revealed something of the extent and character of the buried city, and brought to light new treasures in marble and bronze. The building in which the first statues had been discovered was identified as a theater, the size of which was at first very greatly overestimated, so that it was believed to have provided places for more than 30,000 people. Its capacity did not, however, exceed 3,000. In 1750 the famous Villa Suburbana, the library of which contained nearly 2,000 papyrus rolls or volumes, a considerable number of which have been opened successfully and in part deciphered, was discovered. Of the works thus recovered the most important are fragments of the *Ethics* of Epicurus and a number of treatises of philosophical and rhetorical character by a certain Philodemus, a contemporary of Cicero. The character of the works discovered indicates that their owner was an enthusiastic Epicurean. (For the literature of this subject, see E. Hübner, *Bibliographie*, Berlin, 1889, p. 47.) In 1755 the Academia Ercolanese, which had been formed for the purpose of investigating and making known the remains of the ancient city, began the publication of its famous description of the results of the excavations. At the time this work created a great sensation as being the first detailed account of the wonderful discoveries which had been reported from Herculaneum, although it was by no means free from gross errors of ignorance and of method, as was to be expected in the infancy of archæological science. To this period belong the most remarkable discoveries that excavations at Herculaneum have yielded—such marbles, for instance, as the equestrian statues of the Balbi and the figure called Aristides, as well as nearly all of the magnificent bronzes from this site, which are among the chief ornaments of the museum at Naples. The excavations of the nineteenth century (1827–37 and from 1868 on) have not been so rich in discoveries of works of art as the earlier ones, but they have laid bare for the first time (since the older work was prosecuted entirely by underground tunnels) a portion of the city, and have disclosed some of the most perfect examples of the Roman house. The exact extent of the city has not been determined, so that it is difficult to estimate its probable population in antiquity. In general its remains are found in a better state of preservation than those of Pompeii.

Literature.—J. J. Winckelmann, *Sendschreiben von den herculanischen Entdeckungen* (1764); Fernow, *Werke*, vol. ii., p. 1, ff.; Robert A. MeLeod, *Can Herculaneum be Excavated?* in *Atlantic Monthly*, 1877, p. 641; D. Comparetti and G. de Patra, *La villa ercolanese dei Pisoni* (Turin, 1883); M. Ruggiero, *Storia degli scavi di Ercolano* (Naples, 1885).

G. L. Hendrickson.

**Herculano de Carvalho e Araujo**, Alexandro: poet and historian; b. in Lisbon, Portugal, Mar. 28, 1810; studied modern languages in Paris; allied himself to the liberal party in Portugal; edited *Panorama* (1837–43); was city librarian at Oporto; transferred in 1845 to the royal library at Ajuda. Among his works are the poems *A voz de propheta* (1836); *A harpa do crente* (1838); the historical novels *Eurico o presbytero* (1847); *O monasticon* (1844–48); the histories *Historia de Portugal* (1845–52); *Da origem e estabelecimento da inquisição em Portugal* (1854–59); *Estudos historicos* (1876); *Opusculos* (1873–79). See de Serpa

Pimentel, *Herculano e o seu tempo* (1881). D. near Santarem, Sept. 13, 1877.

**Her'cules** [= Lat., from Gr. Ἡρακλῆς], or **Her'acles**: the most famous hero in the Greek mythology; a son of Zeus and Alemene. He was possessed of most extraordinary physical strength. While a babe in the cradle he strangled two serpents sent by Hera to kill him. When full grown he upheld the dome of the heavens while Atlas was away in the gardens of the Hesperides. He was sensual, but good-hearted, straightforward, and just. He happened to intoxicate himself and make an unseemly noise in the house of Admetus, but when he heard that his friend mourned the death of his wife, shame at once made him sober, and according to some writers he descended into Hades and brought back Alcestis. He killed the eagle and unchained Prometheus, whom Zeus had unjustly bound to the rocks. But Hera hated him, and struck him twice with insanity. During the first fit he slew his three children, and in order to expiate this horrible crime the Delphic oracle sent him to serve Eurystheus. While here he performed the twelve famous labors: (1) Slaying the Nemean lion; (2) killing the Lernæan hydra; (3) catching the Arcadian stag; (4) hunting the Erymanthian boar; (5) cleansing the Augean stable; (6) destroying the Stymphalian birds; (7) capturing the Cretan bull; (8) carrying away the mares of Diomedes; (9) fetching the girdle of the queen of the Amazons; (10) chasing the oxen of Geryon; (11) stealing the apples of the Hesperides; and (12) seizing Cerberus and carrying him up into the daylight. During the second fit he killed his good friend Iphitus, and in obedience to the Delphian oracle he now went and served Omphale, the Queen of the Lydians, as her slave. His death was tragical, and more purely sublime than any part of his life. Believing that it was a philter, Deianira, his wife, tinged his garment with a poison she had received from Nessus. When Hercules put on the garment the poison attacked his body, and, tearing the flesh from his bones, he fled from place to place in frightful agony. At last he could bear it no longer. He heaped up a huge pile of wood and, setting fire to it, he placed himself on its top. But when the flame began to lick his tortured body a cloud came down from the sky and carried him up to heaven. There is perhaps no name in the whole Greek mythology around which myths cluster so thickly as around that of Hercules, and although most of these tales are gross, many are genuinely humorous, and some exquisitely beautiful and sublime. Hercules was also a favorite subject in epics and dramas and with sculptors. In art Hercules is represented with the skin of the Nemean lion and a club cut from a Nemean olive-tree. The Farnese statue is the most widely known; it represents the tired Hercules leaning upon his club, whose small end is placed under his left armpit, his right arm is thrown behind his back and his head droops slightly toward the left. See Roscher, *Lexicon*, under *Herakles*, and Baumeister, *Denkmäler*, under *Herakles*.

Revised by J. R. S. Sterrett.

**Hercules-beetle**: a giant beetle (*Dynastes hercules*) of the family *Scarabæidæ*; a native of Brazil. It is about 6 inches long, and the male has a huge horn upon the head and a smaller one upon the thorax.

**Hercules, Pillars of**: the name given by the ancients to Calpe (Gibraltar) and Abyla (now Ceuta), two rocky promontories, one on each side of the Strait of Gibraltar. It was fabled that Hercules found them one mountain, but tore them asunder, thus making a connection between the ocean and the Mediterranean Sea. In heraldry they figure as the supporters of the Spanish national arms. They are seen with the motto *Ne plus ultra* (No more beyond), indicating that the pillars are at the end of the world, as anciently believed. These are the well-known pillars on Spanish coins, and the sign $, standing for "dollar," is thought by some to represent these pillars with the fillet for the motto across them.

**Hercyn'ian Forest** (*Hercynia silva*): a name employed by Greek and Roman writers to denote the great central and southern forest-region of ancient Germany. The term was always a vague one. In its widest sense it seems to have included the Bohemian Forest, the Harz (a name which seems to be connected with the ancient designation), the Black Forest, and others.

Revised by G. L. Hendrickson.

**Her'der**, Johann Gottfried, von: one of the founders of modern German literature, and one of the most powerful and wholesome influences of modern German civilization; b. Aug. 25, 1744, at Mohrungen, East Prussia, where his father kept a small school and held a subordinate position in the Polish Church. He was educated in his home till his fifteenth year, after which time he spent a couple of years in a position midway between a secretary and an errand-boy in the house of a clergyman, which he left to go to Königsberg and study medicine. While here he had to maintain himself, but through the influence of Kant, who took a great interest in the youth, his situation became more comfortable. He abandoned the study of medicine, and when he left the university his knowledge of theology, philosophy, languages, art, and literature was very extensive, and his intellect was as bright and vigorous as comprehensive. In Königsberg he also made the acquaintance of Hamann, whose teachings concerning the origin of poetry and language exerted the greatest influence on Herder's mind. In 1765 he went to Riga, where he occupied until 1769 a position as teacher and clergyman. Here he published his famous *Fragmenten über die neuere deutsche Litteratur*, a book which placed him at once as a literary critic in the same rank with Lessing, and which in fact may be considered the beginning of the Storm and Stress period of German literature. Annoyed by the literary conflicts into which he was drawn by this book and the subsequent publication of the *Kritische Wälder*, he left Riga and went on an extended journey, which also took him to Strassburg, where, in 1770, he met young Goethe, whose intimate friend and teacher he became. While being treated here for an eye disease he wrote his famous treatise, *Ueber den Ursprung der Sprache*. He then accepted the position of a court-preacher at Bückeburg, which he held until 1776, when, through Goethe's influence, he was called to Weimar. Here he was not only a member of the great literary circle composed of Goethe, Schiller, Wieland, etc., but he also filled with the greatest success the influential and responsible positions of a court-preacher, superintendent of the schools, and president of the consistory. In Weimar also he produced his greatest literary achievements. There is, with the exception of the natural sciences, no department of learning in Germany which is not indebted to Herder for its later development. He may not be called a great scholar, but he possessed a power of intuition which must be considered in many cases as prophetic, and which made him a pathfinder whose traces are followed up to the present day. As a theologian he was a forerunner of the great Schleiermacher and the critical school of the nineteenth century, for it was he who by his excellent book, *Vom Geiste der Ebräischen Poesie*, showed the way to a truly historical and critical understanding of the Bible. He was not a philosopher of a systematic turn of mind, but in the greatest of all his books, in his *Ideen zur Philosophie der Geschichte der Menschheit*, he outlined a philosophy of history which exerted a powerful influence on later philosophers, as, e. g., on Hegel. The same book revolutionized historiography, the science of geography, and ethnography, by teaching the idea of evolution, and by directing the attention to new unexplored fields in all these various sciences. For his greatest achievements we must, however, look in the domain of literature and literary criticism. Not that he was a great poet himself or a critic of Lessing's ability. His was, however, a poetic susceptibility and intuitive power of feeling which penetrated into the very sanctuary of the genius. Thus he continued Lessing's critical work, inaugurated the Storm and Stress period of German literature, by his discovery of *Volkspoesie* and by his æsthetic doctrines, and enriched the literature of his people by exquisite translations from the poetry of all nations (*Volkslieder*, *Cid*, etc.). It is now generally known what an immense influence he exerted upon the poetic development of Goethe and on the efforts of the later Romanticists. Back of the great life-work of Herder, in every field of his marvelous activity, we notice, however, the noble idea of attempting to penetrate into the very nature of man in order to advance the true ideal of what he called "humanity." See R. Haym, *Herder nach seinem Leben und seinen Werken*, one of the best biographies in the German language. D. Dec. 18, 1803.

Julius Goebel.

**Herd's-grass**: See Timothy.

**Heredia**, *ā*-rā-dee'ăa: a central province of Costa Rica; between Alajuela, San José, and the Comarca of Limon; area about 1,000 sq. miles. The surface is mountainous in great part, the Desengano peak being 6,308 feet above the sea; the valleys are very fertile, adapted for coffee-planting, which is the principal industry, and there are excellent pas-

ture-lands. Pop. (1888) 29,409. Heredia, the capital, is on a plain at the southern base of the extinct volcano of Barba; it is well built and attractive, with a considerable trade; pop. 7,500. Barba, Santo Domingo, Santa Barbara, and San Rafael are towns of some importance.

HERBERT H. SMITH.

**Heredia**, PEDRO, de: soldier; b. in Madrid, Spain, about 1500. He was of noble family, but, owing to an affray in which he killed three men, he was obliged to fly to Hispaniola; subsequently he was acting governor of Santa Marta, and made several expeditions in the interior of the region now called Colombia. In 1529 he returned to Spain and obtained the privilege of colonizing and governing Nueva Andalucia, between the Magdalena river and the Gulf of Urabá or Darien. He took out 150 men and added many experienced colonists at Hispaniola. With these he sailed to the South American coast, and, after a fight with the Indians, founded the city of Cartagena, Jan. 14, 1533, as the capital of his new domain. Shortly after he marched overland to the Magdalena, and obtained an immense amount of gold from the Indians; other expeditions were hardly less successful. Owing to quarrels with the authorities of Panama and to various irregularities, he was imprisoned and sent to Spain in 1537, but was restored to his governorship in 1539. In 1542 he encroached on the territory of Benalcazar, and was again imprisoned for a time. Cartagena was sacked by the French pirate Baal in 1544, and Heredia was forced to pay a heavy ransom. In 1548 and again in 1554 he was forced to return to Spain to answer charges against him. On the last voyage he was shipwrecked and drowned on the Spanish coast near Cadiz, Jan. 27, 1554.

HERBERT H. SMITH.

**Heredia y Campuzano**, ee-kaăm-poo-zaa′nō, JOSÉ MARIA: Spanish-American poet; b. at Santiago de Cuba, Dec. 31, 1803. With his family he lived successively in Florida, Santo Domingo, and Venezuela; returning to Cuba, he graduated in law at the University of Havana 1819. Taking part in the attempted revolution of 1823 he was banished, and lived in the U. S. for two years. In 1825 he went to Mexico, where he was naturalized, and held various civil and judicial positions; he was also connected with several journals. His first collection of poems was published at New York in 1824; it contained many of his finest productions, including his magnificent *Ode to Niagara*, which has been translated into many languages. Heredia is generally conceded to be one of the most brilliant of the Spanish-American poets, and he is surpassed by few of those of the peninsula. His style is elegant, without stiffness, and he excels in descriptive passages. D. at Toluca, Mexico, May 7, 1839. Of the many editions of his works, one of the best is that by Ponce de Leon (New York, 1875).

HERBERT H. SMITH.

**Heredit'aments**: in law, all those kinds or articles of property which on the death of an individual owner, without a disposition by will, pass to an heir. By the English common law all the property of an intestate must devolve either upon his administrator or his heirs; personal property passing to the administrator, and real to the heirs. The word "hereditaments" thus becomes one of the most comprehensive terms in the law to indicate real property or landed interests. The distinction between "hereditaments" on the one hand, and "chattels" (as indicating personal property) on the other, is thus of great practical importance, as the two classes of property are governed by distinct sets of rules. (See PROPERTY.) Hereditaments are of two kinds —*corporeal* and *incorporeal*. Under the term corporeal hereditaments are included the land itself and heirlooms. See LAND and HEIRLOOMS.

*Incorporeal hereditaments* are tangible, and are rights claimed by one person in the land of another. The right in legal phrase is *dominant*; that is, it is superior to the claims of the owner of the land over which it is exercised. The land to which the right is attached is said to be *servient*. In other words, the right of the owner of it is subordinate to that of the owner of the incorporeal interest, as in the case of a highway where the rights of the owner of the land are subservient to the power of the public to use it for the purposes of travel, etc. The Roman lawyers, regarding the subject principally from this point of view, used the term "servitutes" to indicate this class of rights. See SERVITUDES.

There are a number of rights in Great Britain that are deemed to be incorporeal estates which have no existence in the U. S., such as *advowsons*, or a right of presentation to a church; *tithes*, a right of an ecclesiastical nature to take a portion of the profits of land for the use of the church (see TITHES); and certain public *offices*, of which an example is the office of a sheriff. *Dignities* or titles of nobility, and *annuities*, belong to the same class. In the U. S. incorporeal hereditaments are divisible into three principal classes—*profits à prendre*, *easements*, and *rents*. *Profit à prendre* is a phrase derived from the Norman-French language, indicating a profit which consists in taking something from the land of another, such as a right to take fish, petroleum, or minerals. Rights of this kind in Great Britain are also known as "rights of common." These have been divided into four principal classes—pasture, piscary, turbary, and estovers. The first signifies a right of one or more persons to pasture cattle upon the land of another; the second, to take fish from another's land; the third, to take turf, coal, or minerals; and the fourth, to take necessary wood or timber for the purpose of repairs of buildings. These rights, so far as they refer to pasturage or fishing or repairing of buildings, are not frequently under consideration before the courts of the U. S. The right to take minerals is of great importance in certain districts. It is not uncommon in these localities to find grants by the owners of land conferring upon grantees the right to take specified minerals, or to sink wells to obtain salt or other substances, and if a grant of this kind be unrestricted, the owner of the land must submit to the disturbance of the soil in order to reach the minerals, and may, perhaps, be debarred from all profitable use of the land. A distinction must be carefully taken between the right to mine and a grant of the minerals. In the latter case there would be two ownerships—one of the surface land, and the other of the minerals beneath it; and it would not necessarily follow that the owner of the minerals could disturb the surface.

An easement (called in Scottish law a servitude) differs from a *profit à prendre* in the fact that nothing is taken by the owner of the incorporeal right from the land over which it is exercised. This class of rights has already been considered. (See EASEMENT.) A special instance of the application of this branch of the law may be found in the interest which the public may acquire in the land of an individual by an act termed "dedication." The meaning of this word is the act of giving up one's land to public use, as for the purposes of a highway or park. The public, *as such*, can not be a grantee, as it is a fluctuating body of persons. An easement is, however, acquired over the land of the dedicator by the doctrine of estoppel. The theory of the case is that there is a representation by the owner to the public that they may make use of his land for a special purpose, and an act done by them on the faith of the representation. A dedication may be implied in cases where the public encroach on the rights of the owner, and he makes no resistance for a length of time sufficient under the circumstances of the case to raise a presumption of an offering by the owner and acceptance by the public. Under these doctrines the public must take that which is dedicated according to the intent of the owner as expressed by his acts. Thus if he should dedicate land for a highway in which there is an open pit he would be under no obligation to fill it up or make the place convenient for travel. The owner after dedication may still use the land in any way not inconsistent with his action toward the public, and must be regarded in all respects as owner, except so far as the public have claims upon him by virtue of the dedication.

The third class of incorporeal hereditaments is that of rents. By a rent is meant that which one person pays to another periodically as a return for the use of land. It differs from a *profit à prendre* in the fact that it is no part of the land. The details of this subject will be stated under RENT.

There is an important class of incorporeal rights termed franchises, which can not be strictly included under either of the three principal classes of hereditaments already considered. See FRANCHISE.

When an incorporeal right is enjoyed in connection with the ownership of an estate, it in general follows the ownership as that passes from one to another. A sale transfers it to a purchaser. An example is a right of way over the land of another as incidental to the ownership of adjoining land. On the other hand, the right may be a mere personal privilege, having no connection with the ownership of land, when it would be termed a right "in gross."

Revised by F. STURGES ALLEN.

**Heredity**: a term applied to that law of living things whereby the offspring resembles the parent, the characteristics of one generation being repeated in the next. When the word is used one is apt to recall only those striking instances of inheritance of genius (e. g. of musical ability in the Bach family), or of physical peculiarities (like the repetition of the "Bourbon nose" in successive generations of the former royal family of France). It includes not only the fact that six-toed cats are apt to have six-toed kittens, but the really more wonderful fact that cats have kittens rather than some other form of animal life. In other words, it is through the action of heredity that all the structural features of the parent are repeated in the offspring, and that in the development of the individual these are outlined and matured in certain fixed and definite ways.

The scientific mind is not satisfied with the statement that this is so because it is "natural"; it seeks for explanations and for a knowledge of the methods by which it is brought about, and as a result several theories of heredity have been formulated, a few of which are outlined below. A satisfactory theory must fulfill, among others, the following conditions: (1) It must be in full accord with the facts learned by embryology. (2) It must allow not only for the reappearance of general form and structure, but of individual peculiarities as well. (3) It must, at the same time, allow for individual congenital variation. (4) It must permit of the inheritance of at least certain variations and modifications. (5) It must explain the reappearance of peculiarities after they have been dropped for several or many generations (atavism). (6) It must, at the same time, admit of the participation of both parents in the formation of the germ (fertilization), and permit, in certain instances, unfertilized eggs to develop (parthenogenesis). (7) It must, in the cases of fertilization, allow both parents to perpetuate their peculiarities in varying degrees.

The earlier theories ignored one or more of these conditions. Thus Democritus (about 400 B. C.) claimed that all parts of the body contributed to the "seed" (cf. Darwin's theory of pangenesis, below), and as a result the offspring was similar to the parent. In the eighteenth century came the older "evolution" theories of Bonnet and Haller (or as they may be termed, in order to avoid confusion with the later use of the word evolution, preformation theories), by which it was held that in the egg or spermatozoön was contained a minute but perfect repetition of the parent, and that the development of the embryo was but the expansion or "evolution" of this germ. Space will not permit a review of the controversy between the "ovulists" and "spermists," but the above statement, as far as it goes, covers both sides. This theory of preformation of course accounts perfectly for heredity, but it is self-destructive, for it logically follows that in this minute but perfect germ there must be the germs of the next generation, and so on, *ad infinitum*. The advocates of the theory in the eighteenth century figured out that there must have been 200,000 million germs in the ovum of Mother Eve. The theory became a veritable box-in-box conception, and would have fallen from its own weight were it not that it was soon shown by the observations of the earlier embryologists that it was contrary to fact. They showed that there was no such expansion of a minute germ, but that the embryo was gradually built up from apparently homogeneous materials. Nor is the process a direct one. It is not merely the laying down of foundations and then adding other parts, as a builder constructs a house. There is rather a constant building and tearing down, with a rearrangement of parts and changes in the shape and function of those that persist.

After these early attempts no theory of heredity was advanced until the last half of the nineteenth century. During these hundred or more years every one was content to regard the phenomena as "simply natural," without any attempt to explain the method in which they were brought about. Soon after the publication of Darwin's *Origin of Species* several theories were advanced to account for heredity, among which may be mentioned Spencer's *Physiological Units*, Darwin's *Theory of Pangenesis*, the "plastidule" theories of Elsberg and Häckel, and Jäger's "flavor-and-odor-substance" theory. As these all resemble one another in certain features, and are all based upon the assumption of infinitesimally minute particles, it will be sufficient to give a brief outline of Darwin's theory.

In his *Provisional Theory of Pangenesis* (1868) Charles Darwin for the first time takes into consideration all the limitations outlined above, as well as the other view, then accepted without question, that the effects of use and disuse, etc. (Weismann's "acquired characters"), may be transmitted to subsequent generations. (See Evolution.) He assumes that minute particles—"gemmules"—are constantly thrown off from every cell of the body, not only in the adult but in every stage of growth; and that these gemmules retain the impressions not only of the cells from which they come, but of the various conditions to which they have been exposed. These gemmules circulate freely through the system, and by their union are formed the sexual elements. "Hence, speaking strictly, it is not the reproductive elements nor the buds which generate new organisms, but the cells themselves throughout the body."

Assuming the existence of these gemmules, this theory as expanded by Darwin would account for most of the phenomena of heredity. It would allow of parthenogenesis, alternation of generations, atavism, and it would account for the inheritance of acquired characters, mutilations, and the like. It was soon tested in a practical way by Francis Galton. He proceeded upon the idea that if these gemmules are constantly given off by the cells, if they circulate freely through the system, and if the reproductive elements are formed from their union, then the introduction of gemmules of another kind will necessarily modify the offspring. He therefore infused into the bodies of eighteen silver-gray rabbits—a variety which breeds true as to color—the blood of other kinds of rabbits, in some instances replacing half the blood. These eighteen rabbits produced eighty-six young, and in not one was there any tendency toward the other varieties, but all were pure silver gray.

To avoid this and other difficulties, Prof. W. K. Brooks proposed certain modifications of the theory. He assumes (1) that the egg is an accumulation of characteristics which are represented by minute particles (Darwin's gemmules) derived from the ancestors, and these, unless something prevents, will reproduce the parent in all particulars. (2) All cells of the body have the power of throwing off these gemmules, but exercise it only when placed in unusual conditions as in the process of change from use or disuse, in alteration of environment, or the like. (3) These gemmules may penetrate the ovum, but their main seat is the spermatozoön, a view which explains the fact that in many cases the male is the variable factor. As will be seen, this theory avoids the difficulties of Galton's transfusion experiments, and it explains or accounts for the variability of the male; but like Darwin's theory it is weak, in that it assumes the existence of gemmules of the existence of which we have no other evidence.

In 1883 Prof. August Weismann began to publish a series of articles in which are included a new theory of heredity, differing in almost every feature from all its predecessors. It is based upon the facts recently discovered regarding the structure and physiology of the cell; and to understand and appreciate it one needs a knowledge of the wonderful series of facts presented by cells in division and by the reproductive products in the processes of maturation and union. (See Mitosis.) In the briefest outline Weismann's views are as follows: Inheritance in the many-celled animals (Metazoa) and multicellular plants takes place through the germ-cells—the egg and spermatozoön in animals, the corresponding cells, known under various names, in plants. Since the offspring may inherit from either parent, the means for transference of ancestral traits must be the same in both the male and the female sexual products. Careful analysis of these products shows that, apparently, there is but a single substance present in them which fulfills all conditions, and which can serve as the physical basis of heredity. This is that peculiar substance known to science as chromatin, or chromoplasm, so called from its property of taking up the coloring-matter of certain staining fluids (Gr. *χρῶμα*, color). Chromatin forms an essential part of the nucleus, not only of the sexual cells, but of all cells of both animals and plants. In all cases of the division of cells (mitosis) the chromatin is divided between the daughter nuclei by a peculiar process, which is apparently adapted to secure an equal division, so that each half shall exactly resemble the other. The impregnation of the egg, on the other hand, is the reverse of this. There is a union of the chromatin of the male and female cells to form nuclear material for the germ which is about to develop. Hence it follows that when development begins each cell of the body shares equally in the chromatin of the germ-cells of both parents, because all of those cells are derivations by equal division of the compound or impregnated cell. In the whole process of develop-

ment there is a constant division of nuclear material, and at no time, except in impregnation, is there a union of chromatin from two cells. The diminution of chromatin, which is the consequence of division, is made good only by the assimilation and metabolization of nonchromatin material. It therefore follows that the chromatin of the germ-cells (the germ-plasm of Weismann) is not and can not be derived from any part of the body, but is rather a direct descendant of the germ-plasm of the parent germ-cells. This view receives further confirmation from the fact that in many animals the tissue which later is to give rise to ova and spermatozoa is differentiated in the earliest stages of the egg before the outlining of any other organs or tissues. These cells are therefore set apart from all other cells of the body for the perpetuation of the species. They can transmit nothing to the next generation except what they have received from their parents, or what may originate in themselves.

This so far forms a theory of heredity as complete as that of Bonnet and Haller, in that it accounts perfectly for the repetition of all the characteristics of the ancestor in the succeeding generations. It reduces the whole question of heredity to one of growth. The germ-cells form a continuous line from which at intervals the body grows up, lives its life and dies, in a manner analogous to the development of the fronds of the fern from the underground rhizome. Weismann's theory has a corollary of the greatest interest. If the facts upon which he relies be true, it necessarily follows that there can be no inheritance of those variations caused by use and disuse, environment, mutilation, and the like. For since these variations occur during growth or in the adult, that is, *after* the separation of the germ-cells from all the other cells of the body, there is no conceivable way in which the germ-plasm can participate in these modifications. The changes affect the cells of other parts, but there is no way in which the germ-plasm of the germ-cells can be correspondingly modified.

Yet variations constantly occur in both animals and plants which are transmitted to succeeding generations. Weismann points out that there are two kinds of variations to be recognized, those proceeding directly or indirectly from external causes, and those which arise within the germ-plasm itself. The variations of the first class (which produce what he terms "acquired characters") are, he claims, never transmitted; those of the second class—"congenital variations"—are the sole factors in evolution. They alone can be transmitted to succeeding generations, and it is by the cumulative effects of the continued inheritance of these, under the action of natural selection, that new varieties, species, and higher groups have been brought into existence.

Space will not allow any discussion of the causes of congenital variation. We can only say that Weismann points out the bearings of the wonderful phenomena connected with the maturation and impregnation of the germinal cells, and attempts to show that here lies an efficient cause. He claims, in fact, that there is no essential difference between the male and female sexual cells, and that the sole reason for this union is that variations may occur. He further takes up and explains, as in full accord with his views of the germplasm, the phenomena of reversion, parthenogenesis, similar and dissimilar terms, and the like. He also analyzes the cases of superfœtation, inheritance of acquired characters and of mutilations, and claims to show that there is not sufficient evidence to require their acceptance, but we must refer the reader to his works for details on these and other points.

Weismann's theory has been productive of more discussion than any biological speculation since the appearance of Darwin's *Origin of Species*. The denial of the possibility of the inheritance of acquired characters (the whole of the evolution of Lamarck) was by many deemed only less iconoclastic than would be the denial of evolution itself. The question must be regarded as far from being settled, and the philosophical naturalists are arranged in two hostile camps, the neo-Darwinians, and the neo-Lamarckians. At present the burden of proof seems to be in favor of the former side, and it is incumbent upon the neo-Lamarckians to show some way in which acquired characters may be transmitted, or some flaw in the logic of Weismann. On the other hand, they can point out many facts, chiefly from the fields of botany and palæontology, which are seemingly easiest explained upon the hypothesis of the transmissibility of acquired characters. It is worthy of being pointed out that in not a few cases the failure to accept Weismann's views results from a failure to appreciate the limitations which Weismann gives to the term which has been rendered by the rather unfortunate expression "acquired characters." Still it must not be understood that either side denies the truth of evolution. Both fully believe that all existing forms of life have been evolved by the action of variation, inheritance of variation, and the survival of those forms best fitted by variation for the conditions in which they are placed. The sole dispute is as to what kinds of variation can be inherited.

The reader is referred to the articles CELL, DARWINISM, EVOLUTION, MITOSIS, and PARTHENOGENESIS. The literature of heredity is already large, most of it being in German. Many of Weismann's essays have been collected and translated in his *Essays on Heredity* (2 vols., London, 1888–92); *The Germ-plasm* (London, 1893). Also see Darwin, *Variation of Animals and Plants* (1868); Brooks, *Heredity* (Baltimore, 1883); Galton, *Natural Inheritance* (London, 1889); Eimer, *Organic Evolution*; and numerous essays in *Nature*, *The Popular Science Monthly*, and *The American Naturalist* since 1883. J. S. KINGSLEY.

**Her'eford**: city of England; the county town of Herefordshire, on the Wye; 144 miles by rail W. N. W. of London (see map of England, ref. 11–F). It has a noble cathedral begun in 1079 and finished in 1248, but with numerous additions belonging to the next five centuries, a hospital, a grammar school, a free library, a corn exchange, some manufactures of gloves and flannels, a large trade in agricultural produce, and a large cattle-fair. Pop. (1891) 20,267.

**Hereford**, HENRY JAMES: See the Appendix.

**Herefordshire**: county of England; situated between South Wales and the counties of Worcester and Gloucester. It contains 534,823 acres, consisting of a heavy red loam, and has an undulating surface, which toward the west rises into the Black Mountains (2,631 feet), and toward the east into Malvern Hills. Wheat, barley, oak-bark, and apples are the principal products; 20,000 hogsheads of cider of superior quality are made annually, and there are quarries of limestone, sandstone, and marble. Herefordshire belonged to the old province of Mercia, and is rich in interesting ruins dating back to the times of the Saxons. The county is famous for its fine breed of cattle. Two members are sent to the House of Commons. Pop. (1901) 114,150.

**Herero**: another name for Damara. See DAMARALAND.

**Heresy** [M. Eng. *heresie*, from O. Fr. *heresie* > Fr. *hérésie*: Ital. *eresia* < Lat. *hæresis* = Gr. *αἵρεσις*, heresy, sect, liter., a selecting, taking; deriv. of *αἱρεῖν*, take, mid. *αἱρεῖσθαι*, take for one's self, select, choose]: choice, preference, chosen way of life, of belief, doctrine, or teaching; a sect, school, party in philosophy, medicine, literature, or religion; the doctrine of such a party; hence discord, separation, faction as the result of such views. In the New Testament *hairesis* means sect and faction. The *hairetikos* (Tit. iii. 10) is a fomenter of divisions, whether by false doctrines or factious practices. Nearly all the languages of Christian nations have terms derived from the Greek *hairesis*. In its later sense, heresy involves an idea unknown to the classic religions. In this now universally prevalent sense, heresy is a doctrine in conflict with what is believed to be important truth. In the Church it is a doctrine perversely held by nominal Christians in conflict with one of the ARTICLES OF FAITH (*q. v.*). *Blackstone*: "Heresy consists not in a total denial of Christianity, but of some of its essential doctrines, publicly and obstinately avowed." (*Comm.*, iv., 4.) *Carpzov*, the jurist: "A pertinacious error in articles of faith." *Sir Matthew Hale*: "An opinion concerning divine things devised by the human mind, publicly taught, and pertinaciously defended." *Jäger*: "In its broader sense, every doctrine which indeed on one side still retains the Christian religious character, but on the other embraces elements which logically carried out destroy the principle of Christianity and its absolute force." (Herzog's *R. E.*, v., 453.)

As the term is relative, all enumerations of heresies are relative. That is considered heresy on one standard which is accepted as sound belief on another. Heresy may be the opinion of individuals unorganized, or it may be the doctrinal basis of *heretical sects*. Such were the GNOSTICS and MANICHEANS (*qq. v.*). That is heresy by the general judgment of the great body of the Christian world which is in conflict with the three general creeds. (See CREED.) The Roman Catholic Church and Greek Church consider as heresy all doctrines conflicting with the general creeds and their own confessional standards. *Hilgers*: "Heresy is a dogma or sys-

tem claiming to be Christian, in opposition to the definitively expressed, universal faith of the Catholic Church." (J. Aschbach, *Kirchen-Lexicon*, iii., 172.) Among evangelical Protestants the term heresy is used to mark all doctrines in conflict with FUNDAMENTALS (*q. v.*), as defined in the confessions of particular Protestant bodies. A heretic is a fundamental errorist. The term is less and less used. From fixing odium, it has, by reaction produced by its abuse, become odious. Men dislike the term, and have become careless about the thing. Heresy is allied to heterodoxy, but is a narrower and harsher term. Infidelity rejects and SCEPTICISM (*q. v.*) doubts revealed truth. Schism or sectarianism rends the Church on questions which really belong to her liberty. Heresy corrupts what it professes to accept. Schismatists separate from the Church, and heretics are cast out of it. Simple error may be no more than a mistake of the intellect; heresy involves a voluntary and persistent perversion of the truth; blasphemy is reproachful language against God or divine things. *Gerhard*: "Four things are necessary to constitute heresy: (1) Error in the understanding; (2) in conflict with the faith, for not every error is heresy; (3) conjoined with pertinacity in the will; (4) membership in the Christian Church by baptism." (*Loci* (ed. Cotta), xi., 231.) The heresies of an age are usually the shadows of its characteristic truths. The entire body of opinions seems to need shaking to bring truth to the top. When the human mind is attempting to settle in some finality of decision, all the theories which can test that decision or help to make it up become prominent. When God was manifest in the flesh the crisis of demon-power was also manifest in the flesh. The ultimata of orthodoxy and the con ter-assertions of heterodoxy came to ripeness together. In the same age arose Arius and Athanasius, Pelagius and Augustine.

The infirmities of the human mind and character, the vast and profound problems involved in religion, the obscurities of the language interpreted and of the language interpreting, the extravagant development of isolated parts of a truth, the tardiness of pace on the part of some who remain behind in a position once general, but afterward abandoned (such was MONTANISM, *q. v.*), the influences of education, of special mental types, of speculative and practical systems, the passions of men, the love of novelty, and the overbearing of a blind conservatism, and many of the best principles of our nature, mistaken, distorted, or perverted, are among the causes of heresies. Many heresies are mere blunders of phraseology, and the wars in them have been wars of words.

The *treatment* of heresy in the Church has been very varied. In the early Church, not merely from the necessity of her condition, but from principle, the means of correcting it were purely moral. Not until admonition, reproof, and instruction were exhausted did the Church resort to excommunication and anathema. The early Church was averse to capital punishment in general. Irenæus (d. 202) and Tertullian (d. before 240) were among the earliest authors of treatises against heresies. NOVATIANISM (*q. v.*) was punished by deposition (251). With the conjunction of Church and state heresy came to be regarded as also a civil offense, in the nature of a double treason, and was punished by the magistracy with forfeiture of office and dignities, deprivation of the right of bequeathing and receiving bequests, with confiscation of property and death. The first instance of the infliction of death on heretics was the beheading of Priscillian and two of his adherents (385). It was brought about by some of the Spanish bishops, but was offensive to the larger part of the Church, and was protested against, among others by Pope Siricius (384–398), though he had been specially active in repressing Priscillianism. From the twelfth and thirteenth centuries the treatment of heresy was one of general persecution, leading to bloody wars. Courts for the trial of heresy were established throughout Western Christendom, with a body of *judges* of heresy, presided over by *masters* of heresy. These courts formed the INQUISITION (*q. v.*). They made decisions involving the property, freedom, and life of all who were charged with deviation from the faith of the Roman Catholic Church. The first great official voucher for an important change from this state of things was the Peace of Westphalia (1648), according to which the three Confessions, the Roman Catholic, the Lutheran, and the Reformed, were acknowledged as in all civil respects non-heretical. The pope issued a bull declaring the provisions of the instrument of this peace null and void. In Rome, on Thursday of Holy Week, there was until Clement XIV. (1769–74) a public reading of the bull IN CŒNA DOMINI (*q. v.*), in which there is an enumeration and anathematizing of heresies. A similar document is read in the Greek Church by the Patriarch of Constantinople on Quadragesima (hence called Orthodox) Sunday. In the Church of England the third collect for Good Friday embraces a prayer for all heretics.

In the earlier Reformed views of the treatment of heresy there was a concurrence in general with the principle that it should be dealt with by the civil magistracy. Calvin (1554) and Beza wrote in defense of the right and duty of putting heretics to death, and this was almost unchallenged among the earlier Protestant divines. It is the influence of association with this style of thought which accounts for the fact that Melanchthon, contrary to his gentle spirit and the judgment of all the German divines, concurred in the righteousness of the execution of SERVETUS (*q. v.*). In England under the statute "De hæretico comburendo" (1401), many of Wielif's followers were burned to death. Under Henry VIII. offenses against the see of Rome ceased to be heresy, but (1539) the Six Articles, all of them asserting distinctive parts of the Roman Catholic doctrine, were set forth, and the penalty of death attached to the rejection of any of them. They were repealed in the first year of Edward VI. (1547). The law under which heretics were burned to death was abolished under Charles II. (1676). The last person put to death in Great Britain for heresy was Thomas Aikenhead, a young student of divinity, executed in Edinburgh (1696), under a statute against blasphemy. (See Macaulay's *History of England* (New York, 1856), iv., 621, and Hugh Miller's *Macaulay on Scotland*, a critique from *The Witness*.) The statute was repealed under George III. The Arminian divines of Holland favored the milder judgment and treatment of heresies. (See Curcellæus, *Opera* (1675), 81, 579–595, 830.) It may now be regarded as a fixed principle of nearly the entire Protestant world that civil government has no right to interfere with the mere holding of religious opinions, however wrong, nor to repress any publication of them or acting upon them which does not interfere with the civil order and law of the land.

Heresy has given us a number of terms: *Heretic*, one who holds a heresy; *heretical*; *heresiarch*, a leader in heresy; *arch-heretic*, one who is prominent as a representative of heresy; *heresio-mastix*, a scourger of heresy; and the now obsolete *hereticate*, to stamp as heresy.

The literature of heresy embraces works on its general character (see Danz, *Universal-Wörterbuch*, s. v. Ketzerei); heresiology, the polemical works which discuss the various forms of heresy (see POLEMICS); works on its general history (such as Mosheim, 1748–50; Walch, 1762–85; Baumgarten, 1766; Fuessli, 1770–74; Von Einem, 1789); history of particular heresies (see under the special articles ALBIGENSES, APOLLINARIS, ARIUS, etc.). The best histories of the Church and of dogma in general also embrace the history of heresies (see CHURCH HISTORY). The bibliography will be found in Buddeus's *Isagoge*; Walch's *Bibliotheca Th. Sel.*; Winer, *Handbuch d. Theol. Lit.*; and in Hagenbach, *Encykl. u. Methodol.* (9th ed. 1874; 244, 275–277; 12th ed. 1889, p. 330, *sq.*).

In the Protestant world the most interesting trials for heresy have been in the Presbyterian Church, and have turned upon the question whether a professor of theology could hold the so-called critical views as to the Bible and still retain his ministerial standing and his professorship. In the Free Church of Scotland Prof. William Robertson Smith was tried by the Assembly of 1880 and acquitted by a majority of 7 in a court of nearly 600 members, but was removed from his chair by the Assembly of 1881; in the Presbyterian Church in the U. S. Prof. Charles Augustus Briggs was tried by the Assembly of 1893, and condemned by a vote of 379 to 116, whereupon he was suspended from the ministry.

Revised by S. M. JACKSON.

**Hergenröther**, hār'*ch*en-rö-ter, JOSEPH: author and theologian; b. at Würzburg, Bavaria, Sept. 15, 1822. He studied theology in his native town, at Rome, and at Munich, and was in 1852 appointed Professor of Canon Law and Church History in the University of Würzburg. In 1867–69 he published the classical work *Photius Patriarch von Konstantinopel*. He was one of the German divines invited by Pius IX. to take part in the various labors preparatory to the Vatican Council, and after the promulgation of the dogma of papal infallibility he took an active part in its defense, vehemently attacking Dr. Döllinger. His *Antijanus* (a defense of this doctrine) was translated into English (1870), also his *Catholic Church and Christian State*, a series of essays on the re-

lation of the Church to the civil power (2 vols., London, 1876). His *Church History* (3 vols., 3d ed. 1884) is looked on by Roman Catholics as the best modern work of the kind. He is the author of the ninth volume of the second edition of Hefele's *History of the Councils*, and began the *Leonis X. Regesta*, interrupted by his death. On May 12, 1879, he was made a cardinal. D. at Bregenz, Switzerland, Oct. 7, 1890. Revised by J. J. KEANE.

**Her-Hor**, or **Hir-Hor** (the *Smendes* of Manetho): the first king in the twenty-first dynasty of Egyptian history, and founder of the priestly line of sovereigns, about 1100 B. C. Under Ramses XIII., the last king of the twentieth dynasty, he was chief priest of Amon, and even during the lifetime of that king he succeeded in concentrating in himself a power superior to that of the monarch. Upon his accession to the throne he assumed the usual royal title, "King of both lands," Upper and Lower Egypt, and he boasted of his prowess in repulsing his enemies and of receiving foreign tribute. His activity as a builder was mainly in Karnak, where he extended the temple of Khonsu, leaving inscriptions which constitute the main materials for the reconstruction of the history of the time. His main service was his hiding of the remains of his predecessors so securely that they were not found till 1881, when the mummies of Aahmes I., Amenophis I., Thothmes I., II., III., Ramses I., II., Seti I., and other rulers and princes. were recovered by Emil Brugsch Bey from a subterranean chamber in the mountain W. of Thebes. CHARLES R. GILLETT.

**Hering**, hā'ring, EWALD, M. D., Ph. D., member of the Vienna Academy of Sciences: physiologist; b. in Neugersdorf, Saxony, Aug. 5, 1834; educated at University of Leipzig; practiced medicine in Leipzig 1860–65; tutor in Medicine, University of Leipzig, 1862–65; professor in Vienna 1865–70; Professor of Physiology in University of Prague since 1890. He has investigated especially psychophysics and the theory of color. The dominant theory of color-vision goes by the name of Hering, since in its original form it was proposed by him and rests principally upon his experiments. Among his principal works are *Beiträge zur Physiologie* (Leipzig, 1861–64); *Ueber den Bau der Wirbelthierleber* (*Proceedings* Vienna Academy 1866); *Die Lehre vom binocularen Sehen* (Leipzig, 1868); *Zur Lehre vom Lichtsinne* (six communications to the Vienna Academy 1872–74); *Beiträge zur allgem. Nerven- u. Muskelphysiologie* (*Proceedings* Vienna Academy 1879–84); *Der Raumsinn und die Bewegungen des Auges* in Hermann's *Handbuch der Physiologie* (1879); *Der Temperatursinn* in Hermann's *Handbuch der Physiologie* (1880); *Das Gedächtniss als eine allgemeine Funktion der organisierten Materie* (2d ed. 1876); *Von den Beziehungen zwischen Leib und Seele* (1875). J. MARK BALDWIN.

**Her'ing**, RUDOLPH: civil engineer; b. in Philadelphia, Pa., Feb. 26, 1847: graduated at the Polytechnic School in Dresden, Germany. He has been engineer in charge of surveys and preliminaries for water-supply of Philadelphia; chief engineer of Chicago drainage and water-supply commission; and consulting engineer for many cities on water-supply, sewerage, and paving. In 1881 he prepared for the National Board of Health a report on sewerage of European cities. In conjunction with J. C. Trautwine, Jr., he translated and supplemented Ganguillet and Kutter's *Flow of Water in Rivers and Channels* (1889).

**Her'iot**: See the Appendix.

**Heriot**, GEORGE: founder of the Heriot Hospital and Heriot Schools of Edinburgh; b. in that city in June, 1563. Having been appointed goldsmith to the king and the queen, he removed to London when James VI. became King of England, and here he accumulated a large fortune, of which he left the greater part on his death, Feb. 12, 1624, to the town council and ministers of Edinburgh, to found a hospital or school in that city for the maintenance and education of the sons of poor, deceased, or decayed burgesses. As in the course of time the revenues considerably exceeded the expenditures, several schools, in which free instruction is given to poor children, were added to the hospital in 1837. In 1885 the hospital was reconstituted as a science and technical school, and the free schools were closed. The Heriot-Watt College, providing the same kind of instruction for older students, at moderate fees, was also subsidized from the Heriot trust, the annual revenue of which yields over £30,000.

**Heriot**, JOHN: author; b. at Haddington, Scotland, Apr. 22, 1760; studied at the University of Edinburgh; entered in 1778 the Royal Marines, and became a lieutenant; was put on half-pay in 1791, and started, on the suggestion of Burke, *The Sun* in 1792 and *The True Briton* in 1793, which were published to counteract the influence of the French Revolution. In 1809 he received an office as paymaster, and in 1810 as controller at the Chelsea Hospital. D. June 30, 1833. He wrote also romances. Among them were *The Heart-broken* and *The Half-pay Officer*.

**Herisau**, hā'rĕē-sow: an old, beautifully situated town in the canton of Appenzell, Switzerland; 5½ miles by rail S. W. of St.-Gall (see map of Switzerland, ref. 3–I); capital of the Outer Rhodes; on the Glatt. Pop. 12,937.

**Herkimer**: village; capital of Herkimer co., N. Y.; on the Mohawk river, the Erie Canal, and the N. Y. Cent. and Hudson River and the Mohawk and Malone railways; 81 miles N. W. of Albany (for location, see map of New York, ref. 4–H). It is in a noted dairy and cheese region; is connected by street-railways with Mohawk, Ilion, and Frankfort; and contains 8 churches, 2 union schools, the Folts Mission Institute (founded in 1892), 2 banks, and 3 weekly newspapers. There are manufactures of knit goods, air-guns and rifles, office-desks, furniture, spring beds and mattresses, and paper. Pop. (1880) 2.359; (1890) not separately returned; (1894) estimated, 4,450; (1900) 5,555.
EDITOR OF "HERKIMER CITIZEN."

**Herkimer**, NICHOLAS: soldier; b. about 1720; became a militia lieutenant 1758, and commanded at Fort Herkimer on the Mohawk (now in German Flats, N. Y.) in that year, at the time of the French and Indian attack. He soon afterward lived in the Canajoharie district, now in Montgomery County; became colonel of militia for Tryon County 1775; appointed brigadier-general by the State convention 1776; marched against Sir John Johnson's Tories and Indians 1776; led an expedition to the relief of Fort Stanwix (now Rome, N. Y.), then besieged by St. Leger; was ambuscaded by the Indians, defeated, and wounded in the leg, at Oriskany Aug. 5, 1777; suffered unskillful amputation, and died in consequence Aug. 17, 1777, at Danube, N. Y., where he resided. Congress voted (Oct., 1777) to erect a monument to "Brigadier Harkemer," but the monument was not erected until 1884, when it was completed by the efforts of the Oneida Historical Society of New York.

**Herkomer**, hār'kō-mer, HUBERT: portrait and genre painter; b. at Waal, Bavaria, May 26, 1849. He was taken to the U. S. by his father, a wood-carver, in 1851, but returned to Europe in 1857 and entered the art school at Southampton, England; became a pupil of Frederiek Walker at the South Kensington Art Schools in 1866; member British Institute of Water-color Painters 1871; Royal Academician 1879; took the medal of honor, Paris Exposition, 1878; first-class medal, Paris Exposition, 1889; became Slade Professor of Art, Oxford University, 1885; is a member of the Berlin Academy 1885; an etcher of decided ability, and has some reputation as a writer on art and other subjects. He established an art school at Bushey, Hertfordshire, England, in 1881, and is a popular instructor. His best work is *The Last Muster—Chelsea Hospital*, painted in 1875, which attracted much attention at the Paris Exposition of 1878. He visited the U. S. in 1882–83, and again in 1885, painting portraits in New York, Boston, and other cities. Studio at Bushey.
WILLIAM A. COFFIN.

**Hermandád** [Span., brotherhood, deriv. of *hermáno*, brother < Lat. *germa'nus*, full brother]: a general name for the leagues entered into by the Spanish cities in the Middle Ages for the preservation of public order and the defense of private property. The most celebrated (called Santa Hermandád, or Holy Brotherhood) was organized in Aragon about the middle of the thirteenth century, and was established in Castile in 1282. Another, of thirty-five towns in Castile and Leon, was organized in 1295. Kindred societies throughout Spain soon followed. Their laws were codified in 1485, and published in 1527. In 1488 the Holy Brotherhood was reorganized, and in 1496 it was extended over a great part of Spain. Ferdinand and Isabella, in their policy of consolidating and centralizing the Spanish state, allied themselves with the Holy Brotherhood against the nobles, but in 1498 they reduced it from its high office of conservator of the peace and defender of popular rights against the feudal nobility, and it became an organized police force or militia. In 1520–21 the Hermandád of Valencia rose in insurrection against the Government.

**Hermann**: town; capital of Gasconade co., Mo. (for location of county, see map of Missouri, ref. 5–H); on the Missouri river and the Mo. Pac. Railway; 81 miles W. of St. Louis. It is in a noted viniculture region, and manufactures wine, beer, cigars, flour, saws, knives and wrenches, and foundry products. It has three weekly newspapers. Pop. (1880) 1,314; (1890) 1,410; (1900) 1,575.

**Hermann** [whence Lat. *Armi'nius*, whence Eng. *Arminius*]: a German chieftain of the Cherusci; a son of Sigimer; b. 18 B. C.; entered the Roman service, and became an equestrian. In 9 A. D., when Germany was groaning under the oppression of Varus, Hermann ambuscaded the Romans in the Teutoburger Forest, and almost all the Romans, Varus included, lost their lives. He fought Germanicus (14–16 A. D.), with disadvantage; defeated Marbodacus, King of the Suevi, 17; and was probably put to death by his own kinsmen in 19 A. D., on the ground that he was aiming at absolute power, but his name continued to live on among the German tribes as a symbol of independence.

**Hermann** (Germ. pron. hăr'măăn), Friedrich Benedict Wilhelm, von: political economist; b. Dec. 5, 1795, at Dinkelsbühl, Bavaria; studied at the Universities of Erlangen and Würzburg, and became privat docent in the former in 1823; afterward taught mathematics at the gymnasium and polytechnic school in Nuremberg, and a few years later became Professor of Political Science in the University of Munich. In 1832 he published his chief work, *Staatswirthschaftliche Untersuchungen* (*Economic Researches*), a contribution of high value to the science of pure economics. He rose in the state service of Bavaria to a position of high rank, and in 1848 sat as member for Munich in the Frankfort Assembly, where he was one of the organizers of the "Great German" party. His active life gave him little time for the further study of the theory of economics, but essays by him on the practical questions of the day appeared in the *Münchener Gelehrte Anzeigen* from 1835 to 1847, and his annual reports as head of the bureau of statistics of Bavaria are valuable, especially as showing the growth of population. D. Nov. 23, 1868. F. M. Colby.

**Hermann**, Johann Gottfried Jakob: Greek scholar; b. in Leipzig, Nov. 28, 1772. Instructed by Ilgen and Reiz, he matriculated at Leipzig at the early age of fourteen and devoted himself originally to the study of law and Kantian philosophy, but soon exchanged this for the study of the classics. He was privat docent at Leipzig in 1794; professor extraordinary of Philosophy 1798; full professor of Eloquence 1803, of Poetry 1809. An unusually inspiring teacher, an eloquent lecturer, and a brilliant Latin stylist, he exerted an incalculable influence which lasted long after his death. Hermann is the foremost representative of the grammatico-critical school of philology, which regards the complete understanding of the authors themselves as its chief, if not its only aim, laying special stress upon a thorough knowledge of grammar and versification as a means to this end; the other side, known as the historico-antiquarian school, is headed by P. A. Böckh. They and their respective followers were long engaged in polemical encounters, but the two great antagonists finally became reconciled on recognizing that neither method is exclusive of the other, but that both must go hand in hand, each being indispensable to the other. Of the very numerous of Hermann's contributions to philology, almost wholly confined to Greek poetry, the following only can be here mentioned: *Elementa doctrinæ metricæ* (1816), in which the ancient theory of versification was evolved not out of historical evidence, but upon the basis of the Kantian theory of categories. He edited nearly all of the plays of Euripides, Sophocles, Aristophanes's *Clouds*, the Orphic and Homeric hymns, Æschylus (a posthumous publication issued by M. Haupt), Plautus's *Trinummus* and *Bacchides*, and Aristotle's *Poetics*. His theories on criticism, hermeneutics, grammar, etc., are contained in numerous reviews and dissertations collected in his *Opuscula* (8 vols., 1877). See H. Köchly, *Gottfried Hermann* (Heidelberg, 1874); Bursian, *Gesch. der class. Philol. in Deutschl.* (p. 575 ff., 665–687). D. at Leipzig, Dec. 31, 1848. Alfred Gudeman.

**Hermann**, Karl Friedrich: classical scholar; b. in Frankfort-on-the-Main, Aug. 4, 1804; studied in Heidelberg and Leipzig; privat docent in Heidelberg 1826; professor ordinarius in Marburg 1832; librarian 1833; called to Göttingen in 1842, where he died Dec. 31, 1855. Author of a standard work on Greek antiquities (*Staatsalterthümer*, 1875, 5th edit.; *Gottesdienstliche Alterthümer*, 1858, 2d edit.; *Privatalterthümer*, 1882, 3d edit.), and a complete edition of Plato with scholia (6 vols., 1839), of Juvenal and Persius (1854). See C. Halm, in *Allgem. deutsch. Biographie*, xii., 182 ff. Alfred Gudeman.

**Hermann**, Ludimar, M. D.: physiologist; b. in Berlin, Oct. 21, 1838; professor in University of Zurich since 1868; author of *Grundriss der Physiologie* (10th ed. 1892); *Lehrbuch der experimentallen Toxikologie* (1874); *Untersuchungen zur allgemeinen Muskel- u. Nervenphysiologie* (1867–68); *Handbuch der Physiologie* (with others, 1879–83).

C. H. T.

**Hermann-Léon**, Charles: animal and genre painter; b. at Havre, France, July 22, 1838. Pupil of Fromentin and Philippe Rousseau; third-class medal, Salon, 1873; second-class medal, Salon, 1879; paints hunting scenes with fine vigor and solid technical methods. *Action* (1878) is in the Morlaix Museum; *Wolf!* (1881) is in the Havre Museum. Studio in Paris. W. A. C.

**Her'mannstadt**: town; in the province of Transylvania, Hungary; on the Zibin; 370 miles S. E. of Pesth (see map of Austria-Hungary, ref. 8–L). It is a beautifully situated and well-built town, the residence of the governor of the province and of a Greek archbishop, metropolitan of Transylvania. Pop. 21,500.

**Hermaph'rodism**, or **Hermaph'roditism** [deriv. of *hermaphrodite*, from Lat. *Hermaphroditus* (*q. v.*)]: the union of the characteristic organs of each sex in one individual. This union of the male organs (producing sperm-cells) and female (producing germ-cells) in one and the same organism is the normal condition in the great majority of plants and in many of the lower animals. Though the higher forms of radiates, mollusks, and Arthropoda all have the sexes quite distinct, except in abnormal instances, many of the inferior types of each are always hermaphrodites. Such, for instance, are the common snail and the earthworm. No insect hermaphrodites (unless the Tardigrades are insects) are known, except in abnormal instances. Siebold found hermaphrodites among honey-bees, but he records the fact that the workers threw them out of the cells, and that they speedily perished. It has been suggested that this hermaphrodism in bees may exist normally in some slight degree, and that it may give rise to the parthenogenesis of male bees, for it is well known that queen bees will produce male offspring without coitus with the male.

Hermaphrodism has not been observed with certainty in vertebrates, except perhaps in eels and fishes of the family *Serranidæ*. It has been stated with considerable force that the homologies existing between the male and female organs prevent any possibility of hermaphrodism in the higher vertebrates; but there is no apparent reason why of bilateral or double organs one side should not assume the male and the other the female development. Thus there might, it would appear, be one ovary and one testis—a condition analogous to what is often seen in the lower animals; but, as a matter of fact, there is not yet a single recorded case of true hermaphrodism in the human species—that is to say, functionally active sexual glands of opposite sexes in one individual. Dual development of the rest of the genital apparatus is by no means unknown. For a classification of these cases, see Teratology.

Many of the lowest forms of hermaphrodite plants and animals are self-fertilizing—that is, reproduction takes place without the sexual union of two individuals. But in very many plants which have both kinds of reproductive organs in one flower, fertilization is accomplished by means of insects, which carry the pollen of one flower to the pistil of another, nature having prevented self-fertilization by wonderfully ingenious yet often very simple means. Many bisexual animals, like the snail, conjugate for mutual fertilization. Spurious hermaphrodism, in which the characteristic organs of one sex assume, from incomplete or abnormal development, something of the appearance of those of the opposite sex, has been often observed. Under this head must be placed all of the recorded instances of hermaphrodism in the human species. The true hermaphrodism is *double* sex; spurious hermaphrodism is *doubtful* sex.

Revised by Barton C. Hirst.

**Hermaphrodi'tus** [Lat. = Gr. Ἑρμαφρόδιτος; Ἑρμῆς, Hermes + Ἀφροδίτη, Aphrodite]: a son of Hermes and Aphrodite, who inherited the beauty of both of his parents. Once, when he was bathing in the fountain of Salmacis, near Halicarnassus, in Caria, Asia Minor, the nymph of the fountain

fell in love with him and prayed to the gods that she might remain united with him forever; and when he ascended from the bath he was changed so that he was neither man nor woman, but both. The idea of this myth is of Asiatic origin. In the Hellenistic period Greek sculpture often represented Hermaphroditus, the upper part of the body female, the nether male. He is represented either as standing or as lying asleep upon his right side with his arms beneath his head, and his face turned toward the right. The best standing statue was unearthed at Pergamon, and is preserved in the museum of Constantinople. The sleeping Hermaphroditus is voluptuous and sensual. A number of such statues exist: in Rome, Paris (two), St. Petersburg, Florence, Athens, etc. A large number of monuments represent Hermaphroditus grouped along with the Bacchic train. Revised by J. R. S. STERRETT.

**Hermas**: the author of a religious romance, *The Shepherd*, which was for two hundred years widely read among Christians, quoted as "Scripture" by Irenæus (*Adv. Haer.*, iv., 20); by Clement of Alexandria accepted as inspired (e. g., *Stromata*, ii., 1, 9, iv., 9); as also by Origen (in Rom. xvi. 14; in Matt. xix. 7, and frequently), and by Eusebius (*H. E.*, iii., 3) stated to have been publicly read in the churches. Origen hazarded the guess that he was identical with the Hermas mentioned in Rom. xvi. 14, and Eusebius repeats it (*H. E.*, iii., 3), but there appears to be no better proof of it. Another opinion which counts the author of the so-called "Muratorian Fragment" in its favor is that Hermas was the brother of Pius, Bishop of Rome (142–157), for he says: The *Pastor*, "moreover, did Hermas write very recently in our times, in the city of Rome, while his brother, Bishop Pius, sat in the chair of the Church of Rome. And therefore it also ought to be read; but it can not be made public in the Church to the people, nor placed among the prophets, as their number is complete, nor among the apostles to the end of time." A third opinion is that Hermas was a contemporary of Clemens of Rome, and therefore lived about the end of the first century, because he says that he was told to write two books and "send one to Clemens and the other to Grapte" (book i., vis. ii., 4), which Clemens is identified with Clemens Romanus. The latter opinions agree in giving Rome as the place of composition. As for the book, it is called *The Shepherd*, or in Latin *Pastor*, and divided into three parts, "Visions," "Commandments," and "Similitudes." The visions were apparently in part real dreams, but the rest of the book is plainly a deliberate composition. The third part is an allegory, which made it the *Pilgrim's Progress* of the early Church, but to a modern reader the whole book is dull and stilted. It is probable that it was originally written in Greek and in Latin, as the citation already quoted (i., ii., 4) seems to show. The Greek text was, however, early lost, and until the nineteenth century the Latin text alone was known to the Western Church. In 1860, at Leipzig, an Ethiopic translation was published (cf. G. H. Schoddt, *The Ethiopic Version of Pastor Hermas Examined*, Leipzig, 1876). The Greek text has been edited by A. Hilgenfeld (Leipzig, 1887); Eng. trans. in *Ante-Nicene Christian Library*, vol. ii. (New York); cf. S. P. Lambros, *Collation of the Athos Codex of the Shepherd of Hermas* (Cambridge, 1888), translated by J. A. Robinson. Of treatises, see that by T. Zahn, *Der Hirt des Hermas* (Gotha, 1868).
SAMUEL MACAULEY JACKSON.

**Hermeneu'tics** [plur. of *hermeneutic*, from Gr. ἑρμηνευτικός, pertaining to interpreting or to an interpreter; deriv. of ἑρμηνευτής, interpreter, deriv. of ἑρμηνεύειν, interpret]: the science and art of interpretation, or of ascertaining the meaning of an author from his language. It is closely allied to grammar, logic, and rhetoric, and presupposes them. Its aim is to reduce interpretation to fixed laws and principles, and to the precision of an exact science, so far as the elastic nature of thought and language will permit. The business of *ex*position often has been confounded with *im*position, whereby all sorts of arbitrary subjective fancies are introduced into the text of which the writer never dreamed. The work of interpretation requires intellectual and moral qualifications, natural and acquired—viz., a full knowledge of the author's original language, historical situation, mental status, and range of ideas, and an appreciating sympathy with his spirit and aim.

*Biblical hermeneutics* is general hermeneutics applied to the sacred Scriptures. It has been most cultivated on account of the vast importance and general interest of these books. It may be traced to the Jews and to Philo of Alexandria, who reduced the allegorical method of interpretation to a system, which through Origen (d. 254) passed into the Christian Church. Origen of Alexandria distinguished a threefold sense of the Scriptures, corresponding to the tripartite nature of man (a somatic or literal, a psychic or moral, and a pneumatic or mystical sense). The grammatical school on the other hand, which was best expressed among the Fathers by Chrysostom and Jerome (though by no means consistently), adhered to the natural and literal sense as the only one which the writer had in view. Assuming the last principle to be correct, there are still three legitimate kinds of interpretation, which, however, must harmonize with each other, and together give the one full meaning of the text: (1) The *philological* (also called *literal* or *grammatico-historical*) exegesis is concerned with the body or letter of the text, with verbal, critical, and antiquarian questions. It brings out the meaning of words and phrases according to the general rules of grammar, the particular idiom and vocabulary of the author, his age, nation, and country, and clears up all references to contemporaneous history and antiquities. It deals with the literary and human aspects of the Scripture, with the earthly form into which its divine contents are cast. It is the basis of all sound exegesis. It has been successfully cultivated during the nineteenth century in Germany and England by Winer, de Wette, Lücke, Bleek, Meyer, Ewald, Dillmann, Alford, Ellicott, and Lightfoot. (2) The *theological* (or *doctrinal* and *ethical*) interpretation deals with the divine thoughts and spiritual truths of the Bible, and explains them in connection with its general teaching and according to the analogy of faith; but it ought not to be fettered by dogmatic prejudice or made subservient to sectarian interest, as was done in the scholastic periods of theology during the Middle Ages and the seventeenth century, when the Bible was used simply as a repository of proof-texts for certain tenets of orthodoxy and against heretical opinions. Among the most distinguished theological expounders are Augustine, Luther, Calvin, Olshausen, Tholuck, and Hodge. (3) *Practical* and *homiletical* exegesis applies the text to the wants of the human heart, and draws from it lessons of wisdom and comfort for the battle of life. It belongs properly to the pulpit and to popular works. Of this character are the exegetical homilies of Origen, Chrysostom, Augustine, and other Fathers, and the commentaries of Matthew Henry, Burkitt, Doddridge, and Starke.

LITERATURE.—J. A. Ernesti, *Principles of Biblical Interpretation* (in Latin, 5th ed. Leipzig, 1809; Engl. transl. by C. H. Terrot, London, 1843); C. G. Wilke, *Hermeneutik des N. T.* (2 vols., Leipziz, 1844); J. L. S. Lutz, *Biblische Hermeneutik* (2d ed. Pforzheim, 1861); J. E. Cellerier, *Manuel d'Hermeneutique* (Paris, 1852; abridged Eng. trans. by C. Elliott and W. J. Harsha, *Biblical Hermeneutics*, New York, 1879); Patrick Fairbairn, *Hermeneutical Manual* (Edinburgh, 1859); H. A. Immer, *Hermeneutics of the N. T.* (Wittenberg, 1873; Eng. trans. by A. H. Newman, Andover, 1877); M. S. Terry, *Biblical Hermeneutics* (New York, 1883; rev. ed. 1892).
PHILIP SCHAFF.

**Her'mes** (in Gr. Ἑρμῆς, Ἑρμέας, Ἑρμείας): son of Zeus and Maia, a daughter of Atlas. He was born in a cave of Mt. Cyllene, and while still an infant went to Pieria and stole the cattle of Apollo and invented the lyre. Apollo knew who had stolen the cattle, and, as he failed to get satisfaction from the baby thief, he carried him to Olympus and accused him of the theft before his father Zeus, who compelled him to restore the cattle to Apollo. While on the road to the place where he had hidden the cattle he showed his lyre to Apollo, who was so pleased with its music that he presented Hermes with the cattle in return for the lyre. Later on, when Hermes had invented the flute, he gave it to Apollo in return for the golden caduceus and prophetic powers. The story of Hermes's birth and his early adventures is told by Apollodorus, but more delightfully in the Homeric hymn to Hermes. Hermes was worshiped all over Greece. He had a number of widely different attributes, as might be expected from the many-sidedness of his character. He was the go-between in all the intrigues of the gods; it was he who guided the souls of the dead down to the house of Hades; he was the swift and trusty messenger and herald of the gods; he invented weights and measures and taught how commerce might bring gain and how to lie and steal; his readiness of speech and his plausibleness made him the inventor of oratory and the patron of orators; besides the lyre and the flute he also invented the syrinx, and, according to some, also lan-

guage, mathematics, astronomy, and writing; he was the patron of gymnastics and agonistics; he was the promoter of fertility in plants and animals; he was the god of chance. He is represented in art with the caduceus (herald's staff), the petasus (winged hat) and winged feet, both indicative of his swiftness. This manifold nature of Hermes has been explained in a variety of ways, although Roscher's interpretation of him (*Hermes der Windgott*, Leipzig, 1878) as the wind-god bids fair to gain the day. The Greek artists never tired of making statues of Hermes, and they were used as landmarks, they stood in eaves, on mountains, at fountains, by the roadside, at the city gates, in the streets, in front of houses, in houses, in the agora, in the gymnasium and palæstra, on graves. The finest statue of him is that found by the Germans in their excavations at Olympia. It is an original work of Praxiteles.

LITERATURE.—Roscher, *Hermes der Windgott* (Leipzig, 1878); Scherer's article in Roscher's *Lexicon*; Baumeister, *Denkmaler*, under *Hermes*; Preller-Robert, *Griechische Mythologie* (Berlin, 1888). J. R. S. STERRETT.

**Hermes**, hār'mes, GEORG: a German theologian who endeavored to carry out the doctrine of unity by forming a common basis for Protestantism and Roman Catholicism; b. in Dreierwald, Westphalia, Apr. 22, 1775: studied theology at Münster; became professor there in 1807 and at Bonn in 1819. D. at Bonn, May 26, 1831. "He had found," says Binder, "the futility of the attacks of Kant and Fichte on Christianity, and the truth of Roman Catholicism." He busied himself for many years, however, in trying to base the principles of the latter on those of the former, setting forth his views in the *Einleitung in die Christ-katholische Theologie* (Introduction to the Catholic Christian Theology, Münster, 1819) and *Christ-katholische Dogmatik* (Münster, 1834). His work was not in any respect heretical, but confined itself to negativing the arguments of those who declared the instability of the Catholic dogma. He founded a school or doctrine termed Hermesianism, and his followers, the Hermesianer, occupied many important positions as preachers and teachers in Germany. He maintained that the principle of *pure reason*, which, as Kant teaches, is innate in every soul, enabling it to decide on all principal truths, should be applied to religion; or rather that the Church should teach its doctrines on this basis; but this principle was disapproved of at Rome, and a papal letter was directed against it (Sept. 16, 1835) by Pope Gregory, beginning with the words *Dum acerbissimus*. During the life of Hermes his school had great influence and made many converts. Binder attributes the delay in proceeding against it to the usual system of formalities followed at Rome in such cases. The fundamental principle of the Hermesian doctrine is that human reason can grasp the truth, and that religion, being true, is or may be based on this "natural sense"; but the Roman Church holds a directly different doctrine, and does not look up to philosophy or science to authorize her doctrines, as the Roman Catechism declares "the mysteries which are contained in God's holy Church are to be understood only by faith, and not by reason." Hermes did in fact quite unconsciously seek to put the Catholic Church on that Protestant foundation of independent reason which from Luther to Döllinger has been so strongly characteristic of the Teutonic mind. Among the principal works referring to Hermesianism are the following: *Hinweisungen auf den Grundcharakter des Hermesischen Systems*, by J. B. Baltzer (Bonn, 1832, 8vo); *Blätter zur Orientirung in Sachen des Hermesianismus* (Treves, 1838), by F. X. Biunde and J. J. Rosenbaum; *Acta Romana*, by J. W. J. Braun and P. J. Elvenich (documents relating to the condemnation by the pope of G. Hermes (Hanover, 1838, 8vo); *Acta Hermesiana*, by A. J. Elvenich (Göttingen, 1836); *Novæ Annotationes*, by F. Lange (Mainz, 1839); *Apologie des Hermesianismus*, by J. B. Lutterbeck (Münster, 1835); *Ueber Glauben*, by J. J. Rosenbaum (Treves 1838, 8vo); *Der Hermesianismus und Joh. Perrone* (Breslau, 1844). Revised by SAMUEL MACAULEY JACKSON.

**Hermes**, JOHANN TIMOTHEUS: author; b. at Petznick, near Stargard, Prussia, May 31, 1738; studied theology at Königsberg; became superintendent and Professor of Theology at Breslau. He was an ardent admirer of the English novelist Richardson and of Wieland, and imitated their styles. His most popular works were *Geschichte der Miss Fannie Wilkes* (1766; 3d ed. 1781); *Sophiens Reise von Memel nach Sachsen* (1770–75; 3d ed. 1778); *Für Töchter edler Herkunft* (1787). D. in Breslau, July 24, 1821. B. B. H.

**Hermesi'anax**: poet; b. at Colophon, Asia Minor; lived in the times of Philip and Alexander the Great, and died before the destruction of his native city by Lysimachus in 302 B. C. Of his elegiac poem in three books to his mistress Leontium, a large part of the third book has been preserved by Athenæus (lib. xiii.), in which the wildly fabulous love-stories of poets and sages are not ungracefully told. It has been separately published by J. Bailey (London, 1839), together with a critical epistle by G. Burges. Text in Bergk's *Anthologia Lyrica*. See Couat, *La Poésie Alexandrine* (pp. 80–98); Susemihl, *Geschichte der griechischen Litteratur in der Alexandrinerzeit* (vol. i., pp. 184–187).

Revised by B. L. GILDERSLEEVE.

**Hermesianism**: the religious philosophy taught by GEORG HERMES (*q. v.*).

**Her'mes Trismegis'tus** [Lat. = Gr. Ἑρμῆς Τρισμέγιστος; Ἑρμῆς, Hermes + τρίς, thrice + μέγιστος, greatest, superl. of μέγας, great, mighty: Eng. *may, might*]: the name applied by the Greeks to the Egyptian god THOTH (*q. v.*) of Hermopolis as early as the time of Plato. The title *Trismegistus* is variously explained. Probably it was derived originally from the form in which the name of Thoth appears in the hieroglyphic writing as "twice-great" or "thrice-great," the latter being found especially in Nubia. Thoth was the reputed author of the secret sacred books of the Egyptians. In the second and third centuries after these books were lost, others were prepared which pretended to be reproductions of the originals, and, being in Greek, were put forth under the name of Hermes. For the most part they were mere jumbles of crude philosophical and theosophical ideas. Later writers also continued this new application of the name, and imposed fanciful explanations which accorded with the changed usage. Since Thoth was the patron of literature and the inventor of writing, Hermes, the Greek equivalent, was chosen as a sort of pseudonym under which a considerable literature appeared during the second and succeeding centuries, which from its general nature has been called "Hermetic," and which is almost entirely Egyptian in its origin. In general these books contained matter of a religio-philosophical sort, and under the influence of Neo-Platonism their purpose was to crush the rising Christianity. But later the name was applied to a large range of writings which endeavored to use the neo-Platonic philosophy, some of the doctrines of Gnosticism, Philonic Judaism, and cabalistic theosophy to form a substitute for Christianity either directly or indirectly, by introducing modifications of it while ostensibly defending its tenets. Much of it appears to be a modified Judaism. The main works extant are *Asclepius, or Dialogue concerning the Nature of the Gods*; *Poemander* (the Shepherd of Men), *concerning the Power and Wisdom of God*. The number of astrological books is quite large. A number of works written in the Middle Ages by alchemists, and in later times perhaps by the Rosicrucians, profess to have been written by Hermes Trismegistus. The Zabians of the East have writings in Greek which they ascribe to Hermes. See Pietschman, *Hermes Trismegistos* (1875), and any of the various books on Egyptian mythology. For translations, L. Menard (Paris, 1867); Chambers, *Works of Hermes Trismegistos* (Ante-Nicene Library, Edinburgh, 1882); lists of books. Fabricius, *Bibliotheca Græca*, i., pp. 46–94, 1790; and Baumgarten-Crusius, *De Libr. hermeticorum* (Jena, 1827). CHARLES R. GILLETT.

**Hermi'as** (in Gr. Ἑρμείας): a eunuch and slave in the household of Eubulus, tyrant of Atarneus and Assus, in Mysia, Asia Minor. He gained his master's confidence, was made free, traveled to Athens, where he heard Plato's lectures in company with Aristotle, and succeeded Eubulus on the throne of Atarneus in 347. Aristotle spent several years at his court, but had to flee when Artaxerxes, King of Persia, sent an army to reduce all the petty tyrants in Asia Minor. Hermias was captured and sent to the Persian court, where he was crucified, but Aristotle raised a statue at Delphi in honor of him, and married his daughter.

**Herminyard**, AIMÉ L.: See the Appendix.

**Hermi'one** (in Gr. Ἑρμιόνη): in Greek mythology, the daughter of Menelaus and Helen. While still under the walls of Troy Menelaus promised her in marriage to Neoptolemus, in spite of the fact that she had been betrothed to her cousin Orestes before the Trojan war. After the return of the heroes from Troy Neoptolemus married her in Sparta, and when Orestes, whom Hermione loved, demanded her, he was rudely repulsed. Hermione, the barren wife,

hated Andromache (Hector's widow), the fruitful concubine of Neoptolemus, and sought to kill both mother and son when Neoptolemus was absent in Delphi, whither he had gone to consult the oracle with reference to the cause of Hermione's barrenness. She was hindered by Peleus from carrying her design into execution, and Molossus lived to become King of Epirus. But Neoptolemus was slain by Orestes in Delphi, and Hermione willingly married her first love, though he was the murderer of her husband.

J. R. S. STERRETT.

**Hermip'pus** [Lat. = Gr. *Ἑρμίππος*, having a Hermes-horse, or a horse swift as Hermes; *Ἑρμῆς*, Hermes, *ἵππος*, horse]: (1) Of Athens; a writer of comedies, in which he attacked Pericles and Aspasia, whom he accused of atheism. One of his comedies contained many parodies on Homer. (2) Of Smyrna; a pupil of Callimachus, and hence called the Callimachean, in order to distinguish him from Hermippus of Berytus. As a sequel to the great work of Callimachus (*Πίνακες τῶν ἐν πάσῃ παιδείᾳ διαλαμψάντων καὶ ὧν συνέγραψαν*, i. e. a list of all Greek writers, giving the exact titles of their works, the number of pages, and their date), he wrote a similar work (*Βίοι τῶν ἐν παιδείᾳ διαλαμψάντων*) containing the biographies of all the Greek philosophers, historians, and poets. The work itself is lost, but it is frequently quoted by subsequent writers, and seems to have enjoyed a great reputation in antiquity. The fragments of his work may be seen in Müller's *Historicorum Græcorum Fragmenta* (Paris, 1868–83). (3) Of Berytus (Beirut), in Syria, and called the Berytian in order to distinguish him from Hermippus of Smyrna. As a sequel to the work of the Callimachean Hermippus, he wrote a similar work (*Περὶ τῶν ἐν παιδείᾳ διαλαμψάντων δούλων*) containing the biographies of slaves who had become prominent in literature.

J. R. S. STERRETT.

**Hermit** [M. Eng. *hermit*, from O. Fr. *hermite* > Fr. *ermite* < Low Lat. *eremita* = Gr. *ἐρημίτης*, hermit, deriv. of *ἐρημία*, desert, wilderness, deriv. of *ἔρημος*, desolate, solitary]: a person who retires from human society and dwells alone; a title given especially to religious recluses, and particularly to those who do not live in common with others. So also the Augustinian monks, though living in monasteries, are called hermits, being accustomed to spend a part of their time in solitude. There are many other monastic congregations called hermits, notably certain lay members of the third order of St. Francis, who, being married before taking their vows, can not be received in full into the order.

**Hermit-crab**: See CRAB.

**Hermodac'tyl** [liter., Hermes-finger; from Gr. *Ἑρμῆς*, Hermes + *δάκτυλος*, finger]: a bulbous root formerly used in medicine. Some hermodactyls are produced from *Iris tuberosa*, and others from *Colchicum variegatum*, European and Asiatic plants. The ancients used hermodactyls for gout, but they are nearly or quite inert.

**Hermog'enes** [= Gr. *Ἑρμογένης*, born of Hermes; *Ἑρμῆς* + *-γενης*, born]: orator and rhetorician; b. at Tarsus in Cilicia; flourished at Rome in the reign of Marcus Aurelius. He was noted for the early development of his oratorical powers, so that he attracted the attention of the emperor, who listened to his extemporaneous discourses with great pleasure. When seventeen he became a public teacher of rhetoric, and at eighteen or twenty composed his rhetorical system, which was for centuries the standard text-book. Hermogenes was no genius, but he had the sense to make use of good authorities, and his works retain, and will always retain, a certain value for the student of oratory and of literary style in general. In his twenty-fifth year he lost his memory, and sank into imbecility, but survived his faculties many years. Five of his works, forming a *τέχνη ῥητορική* (System of Rhetoric), are extant: (1) On points at issue in lawsuits; (2) on invention; (3) on the forms of oratory; (4) on the method of acquiring effectiveness in oratory; (5) preparatory exercises (*προγυμνάσματα*). This last work was abridged by Aphthonius (A. D. 315), and was thus in time superseded. The extant works of Hermogenes may be found in the *Rhetores Græci* of Walz (Stuttgart, 1832–36) and of Spengel (Leipzig, 1853–56, 3 vols.). See Nicolai, *Griechische Litteraturgeschichte*, vol. ii., p. 441 foll.

B. L. GILDERSLEEVE.

**Hermon, Mount**: the highest elevation of the whole Syrian system of mountains, and the northern boundary of the land of Israel. It is formed by a spur from Anti-Lebanon, which, separating the valley of Cœle-Syria from that of the Jordan, unites to the W. with the range of Lebanon. Great Hermon, or Mt. Hermon proper, is 9,200 feet high. Its top is generally covered with snow, and is visible from Tyre and Damascus. Its sides are clad with white poplars. The Psalms speak of the "dew of Hermon," and modern travelers say that during the night their tents become as wet with dew as by a rainstorm. The summit is a plateau covered with snow during winter and spring, but bare in summer and autumn, the snow melting away even in the ravines. The foot of the mountain is occupied by luxuriant vineyards and orchards; the middle belt of the slope by dense forests. The view from Mt. Hermon is very extensive, embracing all Lebanon and the plains E. of Damascus, with Palestine as far as Carmel and Tabor. On a clear day Jaffa may be seen. It was probably the scene of the Transfiguration (Matt. xvii.). To the Druses it is a sacred mountain, and by them called "Mountain of the chief" (head of the Druses).

Revised by SAMUEL MACAULEY JACKSON.

**Hermon'this** (Greek name of *On*, distinguished from On-Heliopolis, as the city of the god *Mont*; modern *Erment*): an Egyptian city of the Old Kingdom; located on the west bank of the Nile, 9 miles S. of Thebes, in the third nome of Upper Egypt. It existed and was an important center before Thebes became the national capital, and it regained its importance after the fall of Thebes. It contained a temple 195 feet long, most of whose stones have been used in the construction of a modern sugar-factory. In early times it was, with Heliopolis, a seat of the sun-worship, and hence was of importance in Egyptian mythology. The deity of Hermonthis was Mont, the god of war, a local form of Amon, who was at a later date conceived as united with Ra, the sun-god, as Mont-Ra. A local belief is said to exist according to which Hermonthis was the birthplace of Moses.

CHARLES R. GILLETT.

**Hermop'olis Mag'na** [Lat. *Hermo'polis* (= Gr. *Ἑρμόπολις*, city of Hermes or Thoth; *Ἑρμῆς*, Hermes + *πόλις*, city) + *Mag'na*, great, mighty: Eng. *might*, *may*]: an ancient city, called *Chmunu* (modern *Ashmunen*); capital of the fifteenth (Hermopolitan) nome of Upper Egypt; existing as early as the time of Khafra in the fourth dynasty; situated in 27° 45′ N. lat. It was one of the places at which Pianchi, the Ethiopian invader, achieved a victory over the Egyptian forces in the twenty-fourth dynasty. Legend locates there the delivery of the "children of the rebels" to the sun-god, Ra, after he had victoriously assumed the rule of the world. It was the "City of the Eight" aboriginal divine powers of the world with Thoth at the head, whose sanctuary was here. At the beginning of the nineteenth century there were at Ashmunen remains of a Ptolemaic portico 125 feet long, containing two rows of six columns each, 55 feet high. Later the material was used for building purposes. The necropolis of Hermopolis was opposite at Bersheh.

CHARLES R. GILLETT.

**Hermosillo**, hăr-mō-see'yō [Span., dimin. of *hermoso* < Lat. *formo'sus*, beautiful]: capital and principal city of the state of Sonora, Mexico; near the confluence of the rivers Sonora and San Miguel; on the Sonora Railway, and 90 miles by that line N. of the port of Guaymas (see map of Mexico, ref. 2–C). It is in a beautiful and fertile plain, nearly surrounded by mountains, and is the center of an important wheat, corn, and wine district. The climate is warm, but dry and healthful. Hermosillo is the old *presidio* of Pitic. The city has a mint and assay office, established in 1803. Pop. (1889) about 15,000. HERBERT H. SMITH.

**Hermou'polis**: the chief town on the island of Syra, one of the Cyclades, Grecian Archipelago. It is on the east coast of the island, and is a stopping-place for steamers from the west or south going to Smyrna or Marseilles. Pop. (1889) 21,998. M. W. H.

**Hernandez de Cordova**, FRANCISCO: See CORDOVA.

**Hernandez de Oviedo y Valdés**, GONZALO: See OVIEDO Y VALDÉS.

**Her'nia** [= Lat. *her'nia*, rupture > Fr. *hernie*]: the protrusion of a viscus from the cavity to which it normally belongs; but the term is generally used to express the protrusion of an abdominal viscus; and when we speak of other forms of hernia we express it thus: hernia cerebri, hernia corneæ, etc. The common term for hernia is rupture. The predisposing cause of hernia is a weakness of some portion of the abdominal walls, and there are certain parts which are naturally weaker than others, as the inguinal, umbilical, and femoral regions. This weakness very often exists congenitally, and may be increased or produced by injury, dis-

ease, or pregnancy. Among the exciting causes may be mentioned violent muscular exertion, jumping, straining from lifting heavy weights or at stool, playing on wind instruments, etc. The same causes may, however, when less decided, act as predisposing causes, by gradually inducing changes in the abdominal walls or in the mesentery. The usual contents of a hernial sac form a portion of the small intestine, or the omentum, but portions of any of the viscera may be found in it, especially when the abdominal walls are congenitally weak. The sac is formed of peritoneum, which is covered by the integument and subjacent fasciæ.

Hernia is generally divided in two ways: 1, according to its situation, as inguinal, femoral, umbilical, phrenic, etc.; 2, according to the condition of the protruded viscus, as reducible, irreducible, and strangulated. Reducible hernia is that variety in which the contents of the sac may be returned into its normal cavity without recourse to a surgical operation. It sometimes disappears spontaneously when the patient seeks the recumbent position, but more often needs a greater or less amount of pressure made in the proper direction. The symptoms of it are the appearance of a soft and compressible swelling at some portion of the abdominal wall, which increases when the patient stands up and diminishes when he lies down; by placing the hand upon the tumor and directing the patient to cough a distinct impulse is imparted. The treatment usually adopted consists of the reduction of the contents, and the application of a suitable truss to prevent the reprotrusion. If the patient is young, this method will occasion changes in the tissues at the weakened portion, and may thus effect a radical cure in time, but in the adult recourse must be had to an operation to effect this.

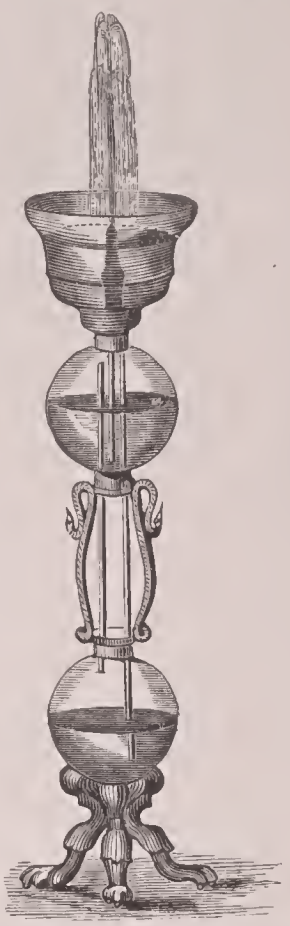
Irreducible hernia differs from reducible in that the protruded viscus can not be returned into its normal cavity. The general causes of it are adhesions between the sac and its contents, the growth of membranous bands across the sac, or inflammatory enlargement of the contents. It is much more troublesome than the preceding variety; in the first place, it is much more inconvenient, and is always exposed to the danger of strangulation; the patient suffers from indigestion, constipation, colic, flatulence, and dragging pains in the loins. In old men irreducible and neglected hernias of the inguinal region often grow larger and larger, until they reach enormous proportions. In such cases the hernial sac is formed by the cavity of the scrotum, which becomes excessively dilated. The treatment of this variety must be generally palliative, and consists of the patient's avoidance of all violent exercise; regulation of the bowels, which should never be allowed to become confined; and the wearing of a support to protect the tumor.

Hernia is said to be strangulated when it is constricted in such a way that the contents of the protruded bowel can not be propelled onward, and the circulation in it is obstructed by pressure at the opening in the abdominal wall through which the hernia projects. The causes of this condition are sudden enlargement of the contents of the sac by fæces or gas, or congestion or swelling of the neck of the sac. The symptoms are pain, flatulence, a desire to go to stool, constipation, nausea, and vomiting, the vomited matter after a time becoming stercoraceous. The tumor is hard, and can not be replaced in the abdominal cavity, and there is very little impulse transmitted to the hand when the patient coughs. The pain in the tumor continues to increase, and extends over the whole of the abdomen; the countenance assumes an anxious expression; the pulse becomes small and weak, and the skin cold and clammy. Should the pain cease, and the tumor feel doughy and crepitate when handled, we may be sure that the intestine has mortified; when this happens, there is very little hope for the patient. The object of treatment is to return the intestine into its cavity. When this can not be accomplished by manipulation, or manipulation combined with warm baths and the administration of ether—the patient having first been placed in such a position that all the parts in the neighborhood of the trouble shall be completely relaxed—recourse must immediately be had to an operation. This consists of enlarging the constricting portion, so as to allow of the return of the gut, and consists of cutting down to the sac, and then either opening it and dividing the stricture, dividing the stricture without opening the sac, or by merely incising the neck of the sac.

Revised by WILLIAM PEPPER.

**Hero**: See HEROIC AGE.

**He'ro**, or **He'ron** (in Gr. Ἥρων): an ingenious mechanical philosopher of Alexandria; pupil of Ctesibius; he lived about 285–222 B. C., famous for an acquaintance with the principles of pneumatics and hydraulics quite in advance of his age. He wrote a number of books and invented a variety of machines, two of which, the ÆOLIPILE (*q. v.*) and the fountain which bears his name, are still among the familiar forms of illustrative apparatus in the physical lecture-room. Hero's fountain is shown in the annexed figure, in which it is seen that the elastic force of a confined body of air, increased by hydraulic pressure and reacting upon the surface of water in a closed reservoir, produces a jet which may rise (theoretically) above that surface to a height equal to the effective height of the pressing column.



Hero's fountain.

Revised by J. R. S. STERRETT.

**Hero**: a priestess of the temple of Aphrodite at Sestos, on the coast of Thrace; loved by Leander, a native of Abydos, on the opposite shore of the Hellespont. Guided by the light of the torch which Hero planted on the cliffs of Sestos, Leander used to swim across the sea to meet her, but one night the storm put out the torch, and when next morning Hero discovered the corpse of her lover floating on the waves, in despair she threw herself from the cliff into the sea. There is a Greek epic poem by Musæus (translated by Sir Edwin Arnold and others), a ballad by Schiller, and a drama by Grillparzer on this subject, and it has been painted many times by the disciples of the school of David.

Revised by J. R. S. STERRETT.

**Herod**: I. HEROD THE GREAT, King of the Jews; b. at Ascalon, in Judæa, in B. C. 62; was of Idumean descent. When in B. C. 47 his father, Antipater, was made procurator of Judæa by Julius Cæsar, he himself received the government of Galilee, although only fifteen years of age, to which was shortly afterward added that of Cœle-Syria, and in B. C. 42 the tetrarchate of Judæa. He was expelled from Judæa in the next year by Antigonus, the nephew of Hyrcanus II. and the representative of the Asmonean dynasty, but in Rome, whither he fled, he succeeded in gaining the favor of Antony; not only were his claims recognized by the senate, but the title of King of Judæa was conferred on him (B. C. 40). He established himself by force in Jerusalem with Roman help (B. C. 37), was confirmed in his place by Augustus (B. C. 31), who enlarged his domains the next year by giving him the province of Trachonitis and the district of Paneas. He maintained his power by atrocious cruelty. All members of the old dynasty, even his own wife, Mariamne, the daughter of Hyrcanus II., and the three children he had by her, were executed. And the older he grew the more suspicious and atrocious he became. The slaughter of the infants at Bethlehem, of which we are told in Matthew ii. 16, was so common and insignificant an affair that Josephus does not mention it. Their number was not likely to have been more than a dozen, as Bethlehem was a small village. A few days before he died he had his son, Antipater, strangled. But, although cruel, his government was vigorous and brilliant. He was highly esteemed by Augustus. There was peace in Judæa; commerce and industry prospered; literature and art flourished. His buildings were especially magnificent; he founded Cæsarea, rebuilt Samaria under the name of Sebaste, and adorned Jerusalem with numerous splendid structures. Especially noteworthy was his rebuilding of the Temple. The Jews, however, found in his government a leaning toward Rome, which humiliated them, and a general tendency toward Roman civilization, which they hated; and the latter part of his life was much troubled by conspiracies and riots. He was ten times married, and died between Mar. 13 and Apr. 5, a few weeks after the birth of Christ, of a horrible disease, the same that killed Sulla and Philip II. of Spain.—II. His son, HEROD ANTIPAS, by his wife Malthace, a Samaritan, was by his will appointed tetrarch of Galilee and Peræa. He divorced his first wife, the daughter of Aretas, King of Arabia

Petræa, and married Herodias, the wife of his half-brother Herod Philip I., and when John the Baptist remonstrated against this incestuous connection, he had him put to death. Aretas revenged the insult to his daughter by a successful attack upon Antipas. During a visit to Jerusalem for the purpose of celebrating the passover, Christ appeared before Antipas, sent by Pilate as a former resident of his tetrarchate. In 42 A. D. he made a journey to Rome in order to obtain the royal dignity, but, through the intrigues of Herod Agrippa I., he was exiled by Caligula (39 A. D.) to Gaul (probably to Lugdunum Convenarum on the borders of Spain), where he died. It is much to her credit and shows her affection for him that his wife voluntarily shared his exile.—III. HEROD AGRIPPA I., son of Aristobulus, brother to Herodias, and grandson of Herod the Great; was educated in Rome, and received from Caligula the tetrarchate of Judæa with the title of king (37 A. D.), and after the banishment of Herod Antipas, Claudius gave him all the old provinces of Judæa. He was much liked by the Jews, especially for his vigorous measures against Christians; he had the apostle St. James the Greater beheaded and St. Peter thrown into prison. He died early (44 A. D.). Cf. Josephus, *Antiq.*, xix., 8, § 2, with Acts xii. 21–23.—HEROD AGRIPPA II., a son of the preceding, was, like his father, educated in Rome, and resided there, at the court of Claudius, at the death of Agrippa I. He did not inherit his father's dominions, however; they were made a Roman province, and Herod Agrippa II. obtained at first (50 A. D.) only the small kingdom of Chalcis. Abilene and Trachonitis were subsequently added. In 60 A. D., when he went down to Cæsarea to compliment Festus, the Roman governor, the apostle St. Paul appeared before him. In the Jewish war he sided against his countrymen, and after the destruction of Jerusalem (70 A. D.) he resided in Rome, where he died in 100 A. D. For Herod the Great's son, Archelaus, see ARCHELAUS.—IV. HEROD PHILIP I., son of Herod the Great and Mariamne; married Herodias, by whom he had a daughter, Salome. (See HEROD ANTIPAS.) He was remanded by his father's will to private life.—V. HEROD PHILIP II., son of Herod the Great and Cleopatra; became on the death of his father tetrarch of Iturea and Trachonitis (Luke iii. 1); ruled well, and seems to have been by far the best of the Herodian family. He built Cæsarea Philippi. He married Salome, the daughter of Herod Philip I., and died in Bethsaida, 34 A. D. Revised by SAMUEL MACAULEY JACKSON.

**Hero'des At'ticus**: Greek orator; b. at Marathon in 104 A. D., and died at Athens in 180. M. Antoninus was one of his pupils, and during his reign he held public offices. He was immensely wealthy, as was his father before him, who left an annuity to each Athenian citizen. Famous for his liberality, he was still more famous for his eloquence. He was called the "tongue of Greece," and his speeches were compared to silver streams running in golden beds. The only one of his speeches that has come down to us (*Περὶ πολιτείας*, edited by Bekker in his *Oratores Attici*, vol. v.; special ed. by Hass, 1880) is a poor thing, and it is a compliment to call it, as it has been called, a tenuous tissue of reminiscences from Demosthenes.

Revised by B. L. GILDERSLEEVE.

**Hero'dians**: a Jewish party in the time of Christ; first mentioned in Mark iii. 6. They were partisans of the Herod family, whose tyranny they preferred to that of the Romans. They appear to have been mostly Sadducees.

**Herodia'nus**: Greek scholar of the second half of the second century A. D.; son of APOLLONIUS DYSCOLUS (*q. v.*). Born at Alexandria, he went early to Rome, where he enjoyed the favor of Marcus Aurelius. Among the vast mass of his grammatical treatises, which were remarkable for their learning, accuracy, and system, especially conspicuous was his work on accent (*Καθολικὴ προσῳδία*). The only tract that has come down to us entire deals with anomalous forms (*περὶ μονήρους λέξεως*), but much of him survives in extracts and abstracts, and has been diligently brought together by Lentz in his *Herodiani technici reliquiæ* (3 vols., Leipzig, 1867). B. L. GILDERSLEEVE.

**Herodianus**: a Greek by birth; lived for a long time in Rome, and wrote in the Greek language a work in eight books on the history of Rome from the death of M. Aurelius (180 A. D.) to the accession of Gordianus III. (238 A. D.), narrating events, as he informs us, which had occurred in his own lifetime. Herodian is an honest soul, too much given to moralizing on the corruption of his times, but his lack of historic insight is not singular, and he tells his story in a very interesting way. Edited with copious notes by Irmisch in five volumes, 1789–95. Recent critical edition by Mendelssohn, 1883. B. L. GILDERSLEEVE.

**Herodio'nes** [Mod. Lat., from Gr. *ἐρωδιός*, a heron]: an order of birds containing the herons, storks, and ibises. The palate is desmognathous, basipterygoid processes are lacking. The nostrils are holorhinal in the herons and storks, schizorhinal in the ibises. Angle of the jaw truncate in herons and storks, produced backward in the ibises. The toes are long and but little webbed, the bill straight and pointed in the storks and herons, blunt and curved in the ibises. These last-named birds differ from the others in so many points that it would seem almost necessary to eliminate them from the order. Two curious, aberrant members of the group are the African shoebill, or whale-headed stork (*Balæniceps rex*), and the small shadow-bird (*Scopus umbretta*). The term is the equivalent of *Herodii*, *Pelargiformes*, and *Pelargomorphæ* of various naturalists. See BITTERN, BOATBILL, HERON, IBIS, NIGHT-HERON, SHADOW-BIRD, SHOEBILL, SPOONBILL, and STORK. F. A. LUCAS.

**Herod'otus** [Lat. = Gr. *Ἡρόδοτος*]: the Father of History, as he has been called since Cicero's time; son of Lyxes; b. in Halicarnassus, a Doric city of Caria, 484 B. C. He belonged to a wealthy and prominent family, and Panyassis, the restorer of the epos, was a kinsman of his. Lygdamis, either a grandson or more probably a younger son of the famous ARTEMISIA (*q. v.*), was a bitter enemy of the house of Herodotus, put Panyassis to death, and forced the future historian to withdraw, probably about 460 B. C. A few years afterward Lygdamis fell, and Herodotus, who had conspired against him, was restored; but, in consequence of new troubles at home, he again withdrew and joined the colony of Thurii in Lower Italy, where he died, probably about 424 B. C. Much of his life was spent in travel; in fact, at that time, travel was indispensable for the collection of material; and attempts have been made to trace his itinerary in his work. Asia Minor he must have known, and with Athens he was familiar, for it was at Athens that he read aloud a portion of his history and received a public reward for the praise of the city or the praise of its constitution. Lower Italy he knew, for it became his home, but the problem of his travels into still more distant lands has been seriously complicated by modern criticism, which declines to accept the statements of Herodotus as so many evidences of personal knowledge, and which limits his exploration of the Persian empire and his range of travel in Egypt. Something he owes to his predecessors beyond a doubt, but how much it is impossible to determine, so that some of the most important questions must remain in abeyance, with the balance on the whole in the historian's favor. Herodotus marks the passage from logography (see LOGOGRAPHERS) to history, and is recognized on all hands as the first true historian. What the logographers lacked, a developed prose style, organic unity of theme, critical spirit, all these were his, but in what degree is open to dispute. Of the beauty of his style, of its limpid clearness, its steady flow, its ineffable grace, there is nothing but praise—nothing but praise of his picturesque narrative, of his dramatic impersonation; and yet the impression is produced by this very praise that Herodotus represents a less perfect development of prose. His art has only too effectually concealed his art. It is true that when he wrote in Ionic he was writing in what might be called his own tongue, for Ionic had become the speech of the city of which he was a native; but it was, after all, a literary dialect that he wrote and not the speech of the people, so that his language is of itself an artistic problem almost hopeless of solution. Nor are we to accept without reserve the statement that he had not attained to the periodic structure of the sentence, that he could not go beyond the "strung on style" (*λέξις εἰρομένη*), in which the words follow each other like beads in a rosary. Here as elsewhere in Herodotus we find that he has not availed himself of all his resources, and has reserved his power in the interest of his art. In respect of the second element which distinguished his history from logography—unity—there is a diversity of views. To some scholars the unity of the work of Herodotus seems manifest enough. His history is the story of the long struggle between East and West, culminating in the liberation of West from East, of Greece from Persia. To others the references to stories that are never told, to persons that never recur, seem convincing proof that the work is a congeries of monographs that were never molded into a real unity. It matters little, however, whether the unity was an

after-thought or not; it is essentially there, and the introduction to the final struggle, long as it may seem, and all the episodes, however they may appear to diverge from the main theme, only serve to enhance the effect of the narrative of the Persian war, which from the seventh book on moves forward unhasting and unresting until the aggressive power of the Persian empire is broken. Whether the work is complete or not is another question. If not complete it at least makes a happy pause, and ends with a moral which sums up the meaning of the conflict and echoes in true Greek fashion the prophetic warning of the first great King of Persia. We may add here that the division into nine books, like so many of the traditional divisions of antiquity, is singularly inapt and confusing, and has done harm to the work, not compensated by the doubtless late compliment of calling each book after the name of a Muse. The critical spirit, the third element of historiography as distinguished from logography, is not fully accorded to Herodotus, in spite of the many proofs of that spirit he has given throughout the work which he himself has rightly entitled the *Setting Forth of Investigation* (*ἱστορίης ἀπόδεξις*), and in spite of his many discriminations between personal knowledge and mere hearsay. Even in antiquity his veracity was questioned, sometimes on points about which he was evidently right, and the indolent skepticism of the Greek Renascence classed him among the foremost liars of the world. Modern criticism has not spared him, and yet the worst outcome of modern criticism is that he was, as most Greek travelers were, at the mercy of dragomans; but in spite of that, such was his insight, such his power of observation, that he has often given the substantial truth, where those who had access to native documents have only woven about the facts a tissue of native absurdities. Exposed as he was to the currents of a skeptical age, Herodotus preserved his religious temper and preserved it in distinct antagonism to the spirit of his time. He believed in the gods; he believed in signs and wonders. To him there was a divine purpose that runs through the ages, and the principle of compensation that "resisteth the proud but giveth grace unto the humble" appears in him as the "envy of the gods." Nor does he make any concealment of his political views. An enthusiastic partisan of Athens, he pleaded the cause of popular government, and his politics as well as his religion tinge the current of his narrative. And yet he is not unfair. His view of the historian's calling was broad and penetrating, and his picture of the world as he saw it, or conceived it, is, for all the errors in drawing, beyond all price. Edited by Wesseling (Amsterdam, 1763); Schweighäuser (Strassburg, 1816), with a *Lexicon Herodoteum* by the same; by Gaisford (3d ed. Oxford, 1849); by W. Dindorf (Paris, 1844, in Didot's *Bibl. Græca*); by J. C. F. Bähr (2d ed. Leipzig, 1856–61); by Blakesley (Cambridge, 1854); by Krüger (1866); by Stein (critical ed. Berlin, 1869; school ed. in Weidmann's Collection, 5th ed. 1883); by Abicht (school ed. in Teubner's Collection, 4th ed. 1884); critical ed. by Holder in the Schenkl Collection (1888). Sayce's ed. of books i.–iii. (1883) is a formal indictment of the historian. Noteworthy is a valuable edition of the second book (on Egypt), with notes by A. Wiedemann (1890). Translated into English by Rawlinson, with valuable notes (2d ed. 1876), and by G. C. Macaulay (1890). Lange's German translation (Berlin, 1824) well reproduces the tone of the original in style. Saliat's fine French translation (1575) was republished with corrections by Eugène Talbot in 1864. B. L. Gildersleeve.

**Heroic Age**: the more than half-mythical age of Grecian history preceding the true historic period. In it the heroes, who were often of half-divine descent—great warriors, kings, navigators—are the central figures. "In these myths," says Ernst Curtius, "the people recalls to its mind, in their full life, those times when the monotonous existence of the old Pelasgians was interrupted, and new forms of worship, new openings for popular activity, new ways of life, continuing ever after with abundance of great fruits, were called into existence. These founders are figures like those of living men, but greater, nobler, nearer the immortals. They are no empty creations of the fancy, but in them the real deeds of the early times are illustrated and endowed with life. The tales of the heroes contain a certain documentary truth." In later times the heroic age furnished abundant material for dramatic and epic poetry, and the heroic character afforded many noble examples of fortitude, piety, purity, and justice which the Greek people too generally failed to imitate.



**Heroic Meter**: in English verse, the unrhymed iambic pentameter, known as blank verse. In Greek and Latin poetry it is the common hexameter verse, in which the *Iliad* and the *Æneid* are written. German and Italian heroic verse is of the same meter as the English. The French heroic is an iambic hexameter. The name is given because these meters are deemed appropriate to lofty themes.

**Herold**, ā'rōld', Louis Joseph Ferdinand: composer; b. in Paris, Jan. 28, 1791; studied with Cherubini, and with distinction at the Paris Conservatoire, and finally in Italy. His first pieces, which were comic and very successful in their day, are obsolete. *Zampa* (1831) and *Le Pré aux Clercs* (1832), his greatest operas, still hold the stage in Europe, but are unknown in the U. S. except by fragments. D. near Paris, Jan. 19, 1833.

**Heron** [M. Eng. *heroun*, from O. Fr. *heron* > Fr. *héron*, with augmentative suffix *-on* from O. H. Germ. *heigir*, heron]: any wading bird of the family *Ardeidæ*, a group containing the majority of species of the order Herodiones (*q. v.*). The heron has a sharp-pointed bill, longer than the head, the toes long, all on the same level, and fitted for perching. The wings are ample and rounded, and flight is performed with deliberate wing-beats. Herons nest as a rule in colonies, usually on trees and bushes in swampy localities, and feed on fish, frogs, small reptiles, young birds, and even small mammals. They are found throughout the temperate and tropical regions of the globe, in swamps, by the borders of lakes and rivers, and along the seashore. Herons are remarkable from the great development of the powder-down tracts, these being patches of downy, matted feathers, which grow continuously and are covered with a scurfy dust. Two patches of these feathers are immediately over the hips, two on the belly below the hips, and two on the breast. Their use is unknown. It has been suggested that they have some connection with the freedom of these birds from vermin, and it has also been asserted that they emit a pale phosphorescent light which attracts fish. Many species are adorned, during the breeding season, with crests and some with loose flowing plumes covering the back. These latter species are commonly termed egrets, but the name does not, as is sometimes supposed, have any exact signification. Some of the species have two distinct phases of plumage among the adults, as is the case with the little blue heron (*Ardea cærulea*), which may be pure white or slaty blue. The common European heron (*Ardea cinerea*) is gray above, white beneath, the breast is black with a white patch, and there is a crest of pendant black feathers. This bird was anciently esteemed for the table, and was the most noble game of the falconer, the more that the falcon was sometimes impaled on the sharp beak of his would-be quarry. The great blue heron of the U. S. is very similar to this European species. The great white heron of the Southern U. S. (*Ardea occidentalis*) is one of the largest and finest of the group. It has two phases of plumage, the one, as the name implies, pure white, the other, formerly known as *Ardea wurdemanni*, bearing a general resemblance to that of the great blue heron, except that the crest is white. The little green heron (*Ardea virescens*) is a small species about 18 inches long, of a general lustrous green above, ashy below, varied with white, and purplish-chestnut neck. It is found throughout the length and breadth of the U. S. The night-herons and the bitterns, which belong in the heron family, are described under their respective titles. Numerous genera, such as *Herodias*, *Garzetta*, *Dichromanassa*, *Florida*, etc., have been made for various species, but the tendency now is toward uniting the greater number in the one genus *Ardea*.

Purple heron.

Herons are often popularly called cranes, but they are only distantly related to those birds, from which they may be distinguished at a glance by having the top of the head completely feathered, and by having the hind toe long and on a level with the others. See Egret and Herodiones.

F. A. Lucas.

**Heron**, Matilda: actress; b. in Labby Vale, Drapers-town, Ireland, Dec. 1, 1830. Her parents emigrated to the U. S.

when she was a child, and settled in Philadelphia, where she studied for the stage, and in 1851 made her *début* as Bianca in *Fazio*. She performed in the principal cities of the U. S.; was married to Robert Stoepel 1857, and divorced 1862. Her principal *rôles* were Camille in *La Dame aux Camélias* and Ulah in *De Soto*. She left the stage in 1876 and became a teacher of elocution. D. in New York, Mar. 7, 1877. Revised by B. B. VALLENTINE.

**Herondas**, or **Heródas**: Greek poet of uncertain period, probably of the second half of the third century B. C., of uncertain locality, not improbably of the island of Cos. Up to 1891 only a few verses of Herondas were known (see Bergk's *Poetæ Lyrici Græci*, 4th ed., vol. ii., pp. 509–12), but in that year the publication of the mimes (*Mimiambi*) of Herondas, by F. G. Kenyon, after an Egyptian papyrus, revealed to the modern world not only a lost author, but also a lost department of Greek literature. Seven of the poems are tolerably complete, and give a clear view of the character of Herondas's poetry and his sphere of work. They are dramatic in form, and present scenes from every-day life in the most realistic fashion, too realistic sometimes for translation into English. The style of Herondas is hopelessly common as his themes are hopelessly common; and he may be called a Theocritus of the alley, though he is none the less interesting and valuable. The mimes are composed in choliambic verse and in the Ionic dialect, with dashes of Doric, and the language presents many difficulties and many traps into which scholars have fallen and are still falling. A provisional translation into Latin has been made by Bücheler (1892). Valuable contributions to the elucidation of Herondas by O. Crusius, *Untersuchungen zu den Mimiamben des Herondas* (1892). B. L. GILDERSLEEVE.

**Heroöp'olis**: an Egyptian city in the eastern Delta region; mentioned in the Septuagint version of the Old Testament (Gen. xlvi. 28) as the place where Joseph met Jacob. In the same passage the Coptic version reads *Pethom*, corresponding to the Hebrew *Pithom* (Ex. i. 11), one of the "store-cities" built for Ramses II. by the Israelites. It had been long known from Egyptian geographical lists that Pithom, "House of Tum," lay in the land of *Theku-t*, a name identified by Brugsch with Succoth, the second station in the Exodus route of the Israelites (Ex. xii. 37, xiii. 20). The city is mentioned by Strabo (*Geogr.*, xvi., iv., 2, xvii., iii., 20, xvi., iv., 4–5, xvii., i., 26) as being at the head of navigation on the Red Sea, one branch of which he calls the "Heroöpolitan Gulf." The statements of Philostorgius (*Eccl. Hist.*, ii., 6) and Epiphanius (*Adv. Haer.*, ii., p. 618) confirm the view. Maps made previous to 1880 frequently placed the city near the present Suez on the authority of this testimony. The excavations of Naville, under the auspices of the Egypt Exploration Fund, in 1883, resulted in the discovery of the site of Pithom and Succoth, and in the recovery of a mile-stone which gave the distance between Heroöpolis and Clysma as 9 miles. The mound thus excavated was at Tell el-Maskhutah, about 12 miles W. of Ismailiah, on the line of the Suez Canal. Here, then, was the store-city Pithom and the head of Red Sea navigation. It is necessary, therefore, to assume that down to the beginning of our era the Red Sea extended farther to the N. than now, and that the place of the crossing of the Israelites may have been far to the N. of the traditional place at Suez.

CHARLES R. GILLETT.

**Heroph'ilus** [Lat. = Gr. Ἡρόφιλος, liter., dear to Hera; Ἥρα, Hera + φίλος, dear, beloved]: surgeon; b. at Chalcedon, in Bithynia, about 300 B. C.; studied medicine under Praxagoras, one of the successors of Hippocrates; removed to Alexandria in Egypt, and was one of the founders of the famous medical school of that city; was a distinguished surgeon, and the most celebrated anatomist and zoötomist of antiquity. It is also stated (with probable truth) that he practiced vivisection upon human beings, probably condemned criminals. Tertullian says he dissected no less than 600 living persons. It is to be remembered that the ancients regarded the dissection of the dead body as something almost impious, because the soul was mutilated along with the body, while they had comparatively few scruples with regard to inflicting pain upon the living. His fame is commemorated by the *torcular Herophili* (the name of the place where the superior longitudinal sinuses of the *dura mater* join the lateral sinuses). He was one of the fathers of what is called heroic practice, in which excessive doses of powerful drugs were used; and he did much to introduce the useless compounding of many drugs in one prescription—a custom which lasted till the nineteenth century. Of his writings only fragments remain. See SURGERY.

Revised by J. R. S. STERRETT.

**Heros'tratus** (in Gr. Ἡρόστρατος): an Ephesian, who in 356 B. C., on the same night in which Alexander the Great was born, set fire to the temple of Diana at Ephesus, one of the most magnificent buildings of antiquity, in order to make his name immortal by destroying one of the Seven Wonders of the world. He succeeded, though the Ephesians passed a decree that he should never be named. His name was divulged by Theopompus.

Revised by J. R. S. STERRETT.

**Her'pes** [: Fr. *herpès* = Lat. *her'pes* = Gr. ἕρπης, liter., a creeping, deriv. of ἕρπειν, creep]: a name applied to several skin diseases, characterized by the development of a series of vesicles or clusters of vesicles, which generally run a definite, self-limited course. By far the most important of these diseases is *Herpes zoster*, *zona*, or "shingles," as it is called. This may surround one thigh or one arm with a band of vesicles, or more frequently it starts from the backbone and follows an intercostal space half round the body. More rarely it goes half round the neck or half across the face. Usually there is some neuralgic pain, and sometimes considerable fever. The disease must depend upon some abnormality in the nervous action, as it frequently maps out upon the surface the part of the integument supplied by some one branch of a nerve. The vulgar have a great dread of "the shingles," and believe that when it so extends as to completely girdle the patient he will die. But, in the first place, it almost never does go more than halfway around the body, and, what is more, there would be no danger if it should, for the disease is a self-limited or cyclical one, and the patient is sure to get well if let alone. A very common form of *herpes* is that which appears about the mouth, and is commonly called "fever blisters." There are usually seen a few vesicles containing clear or turbid fluid, which do not rupture, but after a short time dry up and disappear. They usually occur with slight fevers, "cold," or digestive disturbance. Similar herpetic eruption may accompany many of the severer fevers. Revised by WILLIAM PEPPER.

**Herpetol'ogy** [Gr. ἑρπετόν, creeping beast, reptile (deriv. of ἕρπειν, creep) + -λογος, describing, telling about, deriv. of λέγειν, say, tell]: that branch of zoölogy which is dedicated to the natural history of AMPHIBIA and REPTILIA (*qq. v.*). Referring to those articles for information respecting the characters of the several groups, this article will be confined to the indication of the growth of our knowledge and the best sources of information respecting them.

Little information existed among ancient or mediæval naturalists respecting the forms in question. In Aristotle are found isolated anatomical details respecting some species, but he did not recognize the group as a whole, combining the footed forms with mammals as oviparous quadrupeds, and isolating from them the serpents, with which he even, at least provisionally, combined some eels; he nevertheless appreciated the resemblance between the serpents and saurians, and once defines the former as land animals. Pliny, with less exact information, mixes much fable. No mediæval writer is worthy of mention. Gesner (1554), Aldrovandi (1640), and Jonston (1653) were compilers. Ray (1693) published the first attempt at a systematic arrangement, in which, although nominally confounding the reptilian quadrupeds with the mammalian quadrupeds, he recognized the serpents as related, and combined them in an unnamed group, distinguished by having a heart with a single ventricle. Linnæus (1735–68) first introduced an essential reformation, definitely combining the oviparous quadrupeds (tortoises, lizards, etc.) and serpents in a single class, which he called Amphibia, and placed between the birds and fishes. He distinguished this class by the naked or scaly body, acuminate teeth, and absence of rayed fins; and, subsequently and erroneously, by the unilocular and uniauricular heart. He distributed its members into two orders: (1) Serpentes, without feet, and (2) Reptilia, with feet. Later, he made the class more heterogeneous by the addition of the branchiostegous fishes, being misled by the erroneous observations of Dr. Garden, of South Carolina. He failed to notice any distinction between the true amphibians and reptiles, and even confounded the salamandroids and crocodilians with the typical saurians in one genus, *Lacerta*. His several combinations and divisions into forms without feet and with feet showed also an utter want of appreciation of the value of morphological characters in this group. Gmelin

(1788), in his edition of the *Syslema Naturæ*, removed from the class the branchiostegous fishes, and restricted it to the limits originally recognized by Linnæus. In the last edition of the *Systema Naturæ* published by Linnæus 213 species were recognized, distributed among the following groups: (1) *Testudo*, 15; *Rana*, 17; *Draco*, 2; *Lacerta*, 47 (not 49); (2) *Crotalus*, 5; *Boa*, 10; *Coluber*, 97; *Anguis*, 16; *Amphisbæna*, 2; and *Cæcilia*, 2. In the edition of the *Systema Naturæ* published by Gmelin, 365 species were recognized, apportioned to the same genera; many of the additional species are spurious. Laurenti in 1768 made a decided advance. He recognized a class, Reptilia, in which he included all the reptiles but the tortoises (which he did not mention) and amphibians. These he divided into three orders: (1) *Salientia*, including the frogs, toads, etc.; (2) *Gradientia*, including the salamandroids and saurians; and (3) *Serpentia*, including the serpents, as well as serpentiform saurians and pseudophidian amphibians. He recognized four genera of *Salientia*, 13 of *Gradientia*, and 15 of *Serpentia*. Lacépède in 1788 and 1790 divided the same animals into four "classes": (1) Oviparous quadrupeds which have tails; (2) those which have none; (3) reptiles with two feet only, which may be either in front or behind; and (4) serpents or footless forms.

Brongniart in 1799 made another decided advance: he characterized the class better than any of his predecessors, and apportioned its representatives among four orders: (1) Chelonians, including the tortoises; (2) Saurians, comprising the lizards and crocodiles; (3) Ophidians, comprising the serpents; and (4) Batrachians—i. e. the present class of amphibians, less the Cæcilians. He was doubtful respecting the systematic relations of the Cæcilians, but placed them provisionally with the Ophidians. The great advance in his work is evinced in his recognition of the orders, and more especially in the segregation of the forms combined under the name of Batrachians. This classification came into vogue particularly among French writers, Daudin (1802–03), Cuvier (1817–29), and Duméril and Bibron, among others, having made it the basis of their respective works.

Merrem in 1800 and 1820 published editions of a system of amphibians in which he recognized two classes: (1) Pholidota, equivalent to reptiles proper, and (2) Batrachia or amphibians. Among the Pholidota three orders were recognized—*Tesludinata*, *Loricata* (i. e. crocodiles), and *Squamata* (i. e. saurians and serpents). Among the Batrachia also three orders were established: (1) *Apoda*, (2) *Salientia*, and (3) *Gradientia*. De Blainville in 1816 recognized two classes among the amphibians of Linnæus: (1) the "Reptiles" or "Squamifères ornithoïdes," scaly; and (2) "Amphibiens" or "Nudipellifères," naked. The reptiles were divided into three orders: (1) Cheloniens, (2) Emydo-Sauriens or Crocodiliens, and (3) Saurophiens or Bipéniens, including two sub-orders: (A) "Sauriens" and (B) "Ophidiens." The amphibians were distributed among four orders: (1) the "Batraciens" (*Salientia*), (2) "Pseudo-Sauriens" (*Gradientia*), (3) "Sub-Ichthyens" (Proteus and Sirens), and (4) "Pseudophydiens" (*Cæcilidæ*).

Merrem and de Blainville thus advanced far ahead of their predecessors; they were also the first to include definitely the Cæcilians among the amphibians.

Thus the *general system* of herpetology had assumed nearly all the characteristics which now mark it. The details of the system were gradually improved by scientific zoölogists, with the aid of anatomical investigations; and among the most notable in this work may be mentioned Johannes Müller, Stannius, Owen, Cope, and Huxley. A discovery was made by Günther (1867) in a curious New Zealand lizard-like reptile (*Spheuodon punctatum*), which strongly illustrated the insufficiency of external characters as evidence of the relations of these forms. That animal very closely resembles in its external appearance the agamoid lizards; its anatomy, however, indicated that it was in nowise related to the *Agamidæ* or other typical lizards with which it had been associated, but that it was really the representative of a peculiar order of reptiles, for which the name *Rhynchocephalia* was proposed. It has also been demonstrated by Prof. Cope and others that to this same order belonged species which had lived in the older ages of the globe, and as far back as the Devonian period.

While these improvements in the system of the living reptiles were being effected, palæontological investigations were rapidly bringing to light many remarkable types of the past world, which were found to have remarkable relations with the living members of the class. The gigantic swimming reptiles of the Triassic seas were first confounded together in a peculiar order by geologists under the name *Enaliosaurians*, but subsequent observations indicated that they should be separated into two widely distinct orders, and several others were from time to time constituted for the reception of various species. The comparative examinations of the living and extinct forms naturally reflected mutual light upon each other. The herpetological system is thus now tolerably understood. Much, however, remains to be done to establish the exact mutual relations of the several orders. As yet, nothing can be predicated as to the degree of generalization of the known forms; and the sequence in the list of orders which is here appended must be considered entirely as a provisional arrangement, subject to great modifications hereafter.

The orders now generally adopted for the inclusion of all these various members of the classes in question, recent and fossil, are as follows:

Class Amphibia or Batrachia.

Order *Stegocephali* (extinct).
" *Urodela* (salamanders, etc.).
" *Anura* (frogs, toads, etc.).
" *Gymnophiona* (Cæcilians).

Class Reptilia.

Order *Ichthyopterygii* (extinct whale-like reptiles).
" *Testudinata* (turtles and tortoises).
" *Theromorpha* (extinct).
" *Plesiosauria* (extinct swimming reptiles).
" *Ornithosauria* (extinct flying reptiles).
" *Dinosauria* (extinct).
" *Rhynchocephalia*.
" *Crocodilia* (crocodiles).
" *Sauria* (lizards).
" *Ophidia* (snakes).

Investigations have rendered it more and more evident that the amphibians and reptiles, notwithstanding their external resemblances, have very little true affinity with each other, and that, indeed, the closest relations of such are with other types; thus (1) the amphibians are so closely connected with the fishes that by many (e. g. Huxley) they are combined in one peculiar group under the name *Ichthyopsida*; while, on the other hand, the reptiles and birds agree so thoroughly, and when the extinct forms are recalled differ in so few characters, that they are also united in a special group, the *Sauropsida*.

It only remains to add references to the principal authorities which the student can most advantageously use. The volumes and articles published have been very numerous, but only the following need be specially named: *Erpétologie générale*, by Duméril and Bibron (9 vols., Paris, 1834–55); *The Catalogue* of Shield Reptiles*, by Dr. J. E. Gray: (Part I., *Tesludinata*. London, 1855; Supplement, 1870; Appendix, 1872; Part II., *Emydosaurians*, *Rhynchocephalia*, and *Amphisbæuians*. London, 1872); *Catalogue of the Specimens of Snakes in the Collection of the British Museum*, by Dr. J. E. Gray (London, 1849); *Catalogue of Colubrine Snakes in the Collection of the British Museum*, by Dr. Albert Günther (London, 1858); *Catalogue of the Specimens of Lizards in the Collection of the British Museum*, by G. Boulenger (3 vols., London, 1835–37); *Catalogue of the Batrachia Salientia in the Collection of the British Museum*, by G. Boulenger (London, 1882); Boulenger, *Catalogue of Chelonians, Rhynchocephalians, and Crocodiles* (London, 1889). The principal authorities on the American reptiles and batrachians are Holbrook (*North American Herpetology* (5 vols., Philadelphia, 1836–43); Baird and Girard (*Catalogue of North American Reptiles*, Part I., *Serpents*, Washington, 1853, etc.); Agassiz (*Contributions to the Natural History of the United States of America*, first monograph, *Testudinata*, Boston, 1857); Garman (*Reptiles and Batrachians of North America*, Part I., *Ophidia*, *Mem. Mus. Comp. Zoöl.*, Cambridge, 1883); and Cope (*The Batrachia of North America*, *Bulletin United States Nat. Mus.*, No. 34, 1889; *The Snakes of North America*, *Proceedings U. S. Nat. Mus.*, xiv., 1892); and in numerous memoirs in the *Proceedings* and *Transactions of the Academy of Natural Sciences of Philadelphia*, etc.

Revised by Theodore Gill.

* The "catalogues" enumerated are really descriptive monographs of all the known species, whether in the museum or not.

**Herrera**, Fernando, de: Spanish lyric poet; b. in 1534 at Seville; d. in 1597. Almost nothing is known of his life beyond the fact that he was an ecclesiastic. He was a friend of Garcilaso de la Vega (*q. v.*), whose works he edited in 1580 with a learned contemporary. He seems to have been known and admired by all the best spirits of his time. He is called by Ticknor one of the two greatest lyric poets Spain has ever produced. We know that what is left us of his verse is far from being all he wrote. A number of longer poems in particular are probably irretrievably lost. He appears in what is left as distinctly under the influence of the Italian poets, often excessively so. When he is at his worst he has the vices of the rhetoricians of the Renaissance. At his best, however, he has a noble and truly imaginative style. Particularly fine are two or three of his sixteen *canciones*, especially that on the victory of Lepanto and that on the death of Sebastian of Portugal. Herrera's poems were first published by himself in 1582, then with some additions by his friend Pacheco in 1619. Another edition is in vols. iv. and v. of Ramón Fernández, *Poesías castellanas* (1808). The latest edition is in vol. xxxii. of the *Biblioteca de autóres españoles* (Madrid, 1872). A. R. Marsh.

**Herrera**, ār-rā'răă, Francesco: called the *old* to distinguish him from his son; painter; b. at Seville, Spain, 1576. He studied under L. Fernandez. His work is very bold and powerful; he had immense facility. His *Last Judgment*, painted for the Church of St. Bernardo, is an important work, showing anatomical knowledge and great power of color and of design. He was also a skillful worker in bronze. Being accused of forging money, he took refuge in the Jesuits' College, where he painted a St. Hermengilde. He was pardoned by Philip IV., who could not believe any ill of a man capable of painting such a picture. He then opened a school of painting at Seville, where Diego, Velasquez, and his own sons studied art; but being robbed by his son Francesco, he abandoned forever his native city, and went to Madrid, where he died in 1686.—His son Francesco (b. 1622 at Seville; d. 1685) also was a distinguished painter. W. J. Stillman.

**Herrera**, or **Herrera y Tordesillas**, Antonio: Spanish historian; b. in the village of Cuéllar, Segovia, in 1559 (other accounts say 1549 or 1565). He studied in Spain and Italy, and in the latter country became secretary of Vespasiano de Gonzaga, brother of the Duke of Mantua, whom he followed to Navarre. Gonzaga recommended him to Philip II., who made him *cronista mayór* or chief chronicler of America, and one of the chroniclers of Castile; he retained these positions under Philip III. and IV. Herrera received a liberal salary, and had access to all public documents. His greatest work, *História generál de los héchos de los castellános en las islas y Tierra Firme del Mar Oceáno*, was first published at Madrid in 1601 (4 vols. fol.). It is a general history of America from 1492 to 1554, in the form of annals, and on that account tedious and dull; but it is an almost inexhaustible mine of information, generally correct and well selected, and it has been the principal fount from which later writers on the subject have drawn their information. Herrera also published a *História generál del múndo del tiémpo del Señor rey D. Felipe Segúndo*, and various other historical works. D. at Madrid, Mar. 27, 1625. Herbert H. Smith.

**Herrick**, Robert: poet; b. in London, England, Aug. 20, 1591; was educated at Trinity Hall, Cambridge; took orders and became vicar of Dean Priors, Devon, 1629; and died there in Oct., 1674. He is one of the most charming of English lyric poets. He was ejected from his living by the Long Parliament in 1648, but restored in 1660. His chief publication was the *Hesperides* (1647–48), poems treating of love, rustic life, parish festivals, etc. Revised by H. A. Beers.

**Herrig**, Hans: poet; b. in Brunswick, Germany, Dec. 10, 1845; studied law in Berlin and Göttingen; took his doctor's degree in 1868 and began the practice of law, but soon dropped it for more congenial literary pursuits, and became associate editor of the *Deutsches Tageblatt*. His works show earnestness of purpose and fine literary taste, but are too pessimistic in their tone to strike the popular fancy. He published the dramas *Jerusalem* (1874); *Alexander der Grosse* (1872; 2d ed. 1879); *Kaiser Friedrich der Rothbart* (1873; 2d ed. 1880); *Der Kurprinz* (1876); *Konradin* (1881; 3d ed. 1885); *Drei Operndichtungen* (1881); *Nero* (1883); *Martin Luther* (1883; 3d ed. 1886); and the poems *Die Schweine* (1876); *Mären und Geschichten* (1879); *Der dicke König* (1885). D. in Weimar, May 4, 1892.

**Herring** [M. Eng. *hering* < O. Eng. *hæring*: O. H. Germ. *harinc* (> Mod. Germ. *häring*), whence Fr. *hareng*, herring]: the common name of the very important food-fishes of the genus *Clupea*. There are several species, the chief of which are the *C. harengus* of Northern Europe and America, and the *C. mirabilis* of the Pacific coast of North America. The celebrated whitebait is the young of the herring. The herring-fisheries of North America are prosecuted chiefly along the New England coasts, and especially in British American waters. In Europe the great herring-fisheries are those of Great Britain, Ireland, Scandinavia, the Netherlands, and the north of France. Herrings at tolerably regular periods visit extensive lines of coast. They are generally caught in gill-nets or scoop-nets. The annual catch of herrings must amount to many hundreds of millions. A large part of the so-called herring caught in the U. S. are alewives, which are in nowise inferior to the real herring, which they much resemble. Herrings are smoked and dried, pickled, or eaten fresh.

The most important herring of the Pacific coast of North America is *C. mirabilis*, which in size, appearance, and habits resembles the common herring. It can be taken in very large quantities, and its fishery may become an object of importance. The name herring is also applied to the alewife (*Clupea pseudoharengus*) and to other species of migratory *Clupeidæ*. The "herring" of the Great Lakes is *Coregonus artedi*, a sort of whitefish, having little in common with the true herring. See Fisheries and Whitebait. Revised by David S. Jordan.

**Herring-gull**: a large gull (*Larus argentatus*) common on the western shores of Europe, and occasionally found on the eastern coast of North America, although the common American herring-gull is a slightly larger variety, separated as a sub-species under the name *Larus argentatus smithsonianus*. The back and upper part of the wings are pearl blue, primaries crossed with black and tipped with white, head, neck, tail, and under parts pure white. Young birds are gray with blackish wings and tail. Length about 2 feet, spread of wings 54 to 58 inches. This gull breeds from New England and the Great Lakes northward, and is common along the Atlantic coast from fall to spring, where it may be seen flying along the shore or circling among the shipping in search of food. At or near low tide these gulls frequently gather in great flocks on some sand-spit, to rest and to preen their feathers. Closely related species are found in the North Pacific. F. A. Lucas.

**Herrnhut**, hārn'hoot [Germ., shelter of the Lord; *Herrn*, gen. of *Herr*, Lord + *hut*, shelter, protection]: town in the kingdom of Saxony, Germany; 18 miles S. E. of Bautzen, on the Löbau-Zittau Railway (see map of German Empire, ref. 5-G). It was founded in 1722 by a colony of Moravian Brethren, who were driven from their homes by the Jesuits, but were received and established here by Count Zinzendorf. The town has only 1,200 inhabitants, but is well built and enjoys a comparatively great reputation as the assembling-place or metropolis of the United Brethren, whose life commands respect for its simplicity, honesty, purity, and vigor. The colored paper and the linen fabrics manufactured here are celebrated.

**Her'ron**, Francis Jay: soldier; b. at Pittsburg, Pa., Feb. 17, 1837; graduated at the Western University of Pennsylvania 1853; entered the U. S. army Apr., 1861, as captain First Iowa Volunteers, and engaged in the battles of Dug Springs, Ozark, and Wilson's Creek; promoted to be lieutenant-colonel Ninth Iowa Volunteers, and in command of the regiment through campaigns in Missouri, Arkansas, and Indian Territory; engaged in the battle of Pea Ridge, where he was severely wounded. He was appointed brigadier-general of volunteers July, 1862, and in command of the Army of the Frontier at battles of Prairie Grove and Van Buren; for conduct at former promoted to be major-general of volunteers July 29, 1862, and was in command of the left wing of investing forces at Vicksburg, and of the army and navy expedition that captured Yazoo City. In May, 1865, he negotiated, and in June received, the formal surrender of the Trans-Mississippi army and all Confederate forces W. of the Mississippi. He was appointed one of the commissioners to negotiate treaties with Indian tribes July, 1865; resigned commission as major-general June 7, 1865, and Indian commissioner Aug., 1865; was U. S. marshal district of Louisiana 1867–69, and Secretary of State of Louisiana 1870–72.

**Herschel**, hėr'shel, Caroline Lucretia: astronomer; b. in Hanover, Germany, Mar. 16, 1750; went to England to

live in 1772. She was appointed assistant astronomer to George III. of England in 1781, with a moderate salary. She attended her brother, Sir William Herschel, in all his night-watches, which generally lasted till morning; wrote from his dictation, as he swept the heavens with his telescope, his observations; noted the clocks; reduced and arranged his journals; prepared the zone catalogues for his sweeps, and performed for him all the laborious mathematical calculations necessary for the reduction of his observations. She discovered independently eight comets, besides numerous nebulæ and clusters of stars. At the death of her brother in 1822 she returned to her native city, where she spent the remainder of her life with her only remaining brother, honored and beloved by all. She was elected member of the Royal Astronomical Society in 1832, and received a gold medal from the King of Prussia in 1846. D. in Hanover, Jan. 9, 1848. See *Memoir and Correspondence of Caroline Herschel* (1876).

**Herschel**, Sir JOHN FREDERICK WILLIAM: astronomer; the only son of Sir Frederick William Herschel; b. at Slough, England, Mar. 7, 1792. He was educated at home under the guidance of his parents and his aunt. He went direct from his home to Eton, and from there to St. John's College, Cambridge, where he graduated in 1813 as senior wrangler and Smith prizeman. In the same year he read a mathematical paper before the Royal Society, and was elected a fellow at the age of twenty-one. In 1831 William IV. bestowed upon him the Hanoverian Guelphic order, and five years later, at the coronation of Victoria, he was created baronet. Several gold medals were awarded to him by the Royal Society and the Astronomical Society of London, and he was made D. C. L. by the University of Oxford. He was successively elected rector of Marischal College, Aberdeen, president of the Astronomical Society, and finally permanent master of the mint, a position which his enfeebled health forced him to resign in 1855. He was honorary or corresponding member of the academies of Brussels, St. Petersburg, Vienna, Göttingen, Turin, Bologna, Naples, Copenhagen, Stockholm, and others, besides being chevalier of the Prussian order of Merit. In 1829 he married Margaret Brodie, daughter of Rev. Dr. Alexander Stewart, by whom he had nine daughters and three sons. From 1813 to 1822 he devoted himself to mathematics, chemistry, and optics, as his memoirs testify. He then began his astronomical work in earnest. In 1825 he began, in connection with Sir James South, a series of very important observations. Though his especial tastes lay in the direction of physics, his filial devotion determined his lifework. He passed in review the nebulæ discovered and catalogued by his father; while engaged in this work he catalogued between 2,000 and 3,000 double stars. In order to perfect the work begun by his father, he went, at his own expense, in 1833, to the Cape of Good Hope. That the results might be accurately comparable, he took telescopes of the same size as those used by his father. He spent four years at the Cape, observing, and five years more reducing and arranging his observations, which appeared in 1847 under the title *Results of Astronomical Observations made during the years 1834–38 at the Cape of Good Hope, being the completion of a Telescopic Survey of the Whole Visible Heavens, commenced in 1825.* This included seven treatises upon—1, nebulæ; 2, double stars; 3, apparent size of stars; 4, distribution of stars and constitution of Milky Way; 5, Halley's comet, etc.; 6, satellites of Saturn; 7, solar spots. While in South Africa he originated a valuable system of simultaneous meteorological observations, and instituted a fine public-school system. He prepared two elaborate and exhaustive treatises upon *Light* and *Sound*, for the *Encyclopædia Metropolitana* (1830–31), and wrote for Lardner a treatise upon the study of natural philosophy, which gave a strong and immediate impulse to the study of natural science in England; also a treatise upon astronomy, which was afterward expanded into his *Outlines of Astronomy*. In all Sir John added to the 2,500 nebulæ discovered by his father 2,208 of his own discovery, the whole number known being 5,200. He performed a great service to photography by the discovery of a process for making the impressions permanent. Not the smallest part of his work was that of popularizing without falsifying science. These discoveries, together with those recorded in 131 papers contributed to various scientific societies, compose the results of fifty-eight years of labor, included between the day of his graduation and the day of his death. The entire labor of this enormous work was performed by himself, except that which was purely mechanical in the use of his instruments. D. at Collingwood, Apr. 13, 1871.

**Herschel**, Sir FREDERICK WILLIAM, generally known as Sir William Herschel: astronomer; son of a bandmaster; b. in Hanover, Germany, Nov. 15, 1738. Besides music, to which he was educated professionally, he received instruction in French and metaphysics in his early years. At the age of fourteen, being forced to earn his own bread, he became a member of the band of the Hanoverian Guards; in this capacity he went to England in 1759, where the story of his life for some years is a record of bitter privation silently and heroically endured. Herschel became successively master of a military band, organist at Halifax, and organist at the Octagon chapel at Bath. In spite of innumerable professional duties, he pursued his abstract studies with ardor, sometimes going to them after fourteen hours of professional labor. He learned Latin, Italian, a little Greek, with no aid but that of a grammar and dictionary, and mastered alone an obscure mathematical treatise upon music. The harmony of sound soon led, by the way of optics, to a study of the "harmony of the spheres." A small Gregorian telescope fell into his hands, and waked into passionate life the longing which determined his future career. Finding the most ordinary telescope beyond his means, he determined to construct one. The fact that he made and polished 200 metal specula before he succeeded to his own satisfaction reveals the secret of his successful life. In 1781 he discovered, by the aid of one of his own teleseopes, a new planet, called by him Georgium Sidus, by his contemporaries Herschel, but now known under the name of Uranus. This brought him under the notice of George III., who bestowed upon him the position of special astronomer to the king, also a pension of 300 guineas a year, and a residence at Slough, near Windsor. He married, in 1788, Mrs. Mary Pitt, by whom he had one son, John F. W. Herschel. He was made member of the London Royal Society, of the Academy of Sciences, Paris, and president of the Royal Astronomical Society, London. The Hanoverian Guelphic order was bestowed upon him by the regent, and the title of LL. D. by the University of Oxford, besides other distinctions. He died at Slough, Aug. 23, 1822. His disposition was marked by sweetness and benevolence; his character by directness and simplicity, by untiring patience and indomitable energy; and his mind by breadth of view and extreme caution. His work is comprehended, in great part, in memoirs presented from 1780 to 1822 before the Royal Society of London, which "constitute," says Arago, "one of the principal riches of the celebrated collection known under the title of *Philosophical Transactions.*" The front-view teleseope suggested by Jacques Lamaire was perfected by Herschel; the mechanical contrivances, by means of which he mounted and adjusted his 40-foot telescope, with its speculum weighing a ton, showed him to be possessed of high mechanical genius. In optics he investigated the dark heat-rays of the solar spectrum, and made many experiments upon radiant heat, upon Newton's rings, and upon the illuminating power of the various prismatic rays. In his researches upon the solar system he made many remarkable observations upon the physical constitution of the sun; he discovered the planet Uranus and two of its satellites, as well as two satellites of Saturn. He added much to the subject of the form, time of rotation, and physical aspects of the planets. He discovered that the moon possessed no atmosphere, and made many valuable observations upon comets. But the real work of the Herschels, father and son, lay beyond the limits of our system in the sidereal depths. Sir William made many and accurate observations upon variable and binary stars; in his investigations upon sidereal parallax, though he failed to find it, he made the astounding discovery that the sun, with all its attendant planets, is rushing on through space toward a point situated in the constellation Hercules. By means of a 20-foot telescope he made a survey of the whole of the northern heavens, enumerating the stars as they came within the telescopic field. As a result of this survey he made the first attempt to assign the form of the universe of stars, which he conceived to be of the form of a flattened cylinder. To the known nebulæ, 500 in number, he added 2,500 of his own discovery, and under his trained eye and powerful telescopes numbers of what had been considered nebulæ resolved themselves into clusters and systems of self-luminous suns. See Holden, *Life and Works of Sir William Herschel* (New York, 1881).

Revised by S. NEWCOMB.

**Herschell**, Farrer, Lord: lawyer and politician; b. in England in 1837; educated at University College, London, and the University of Bonn; called to the bar 1860, and became Q. C. 1872; recorder of Carlisle 1873; in Parliament 1874–85, representing Durham city as a Liberal; knighted in 1880, and made Solicitor-General in Mr. Gladstone's ministry; raised to the peerage and became Lord High Chancellor 1886; again became Lord High Chancellor in 1892. D. in Washington, D. C., Mar. 1, 1899.

**Hersek**: See Hellenopolis.

**Hersent**, ãr'sañ', Louis: painter; b. in Paris, Mar. 10, 1777; one of the most characteristic representatives of French painting during the Restoration. He was one of David's most distinguished pupils, and obtained the Prix de Rome in 1797. In 1802 he exhibited for the first time in the Salon (*Metamorphosis of Narcissus*), and in 1831 for the last (portraits of Louis Philippe and Queen Amélie). His pictures were generally of historical subjects, and several of them are in the national picture gallery at Versailles. D. in Paris, Oct. 2, 1860.

**Hersent-Hildevert**, ãr'sañ'čĕl'de-vãr', Pierre: civil engineer and contractor; b. at La Vacherie, Eure, France, May 4, 1827; constructor of a very great number of important works in France, Belgium, Algeria, Austria, and elsewhere, many of them extraordinary by reason of their dimensions or the difficulties attending them. Among the most prominent are the dry docks of Toulon and of Saigon (Cochin-China), the harbor works of Antwerp, the port of Lisbon, the regulation of the Danube at Vienna, etc.; the foundation of the first named being the largest area ever sunk by compressed air in one caisson. Author of numerous papers descriptive of works constructed by himself, chiefly in the *Mémoires* of the Société des Ingénieurs Civils of France, and of an illustrated work in folio upon the same subjects. He was president of the Société des Ingénieurs Civils in 1886; received the Nozo prize in 1882; the grand prize of the Société d'encouragement in 1880; the medal of progress at Vienna 1873; the diploma of honor at Antwerp 1878; grand prizes at Paris 1878 and 1889; also the decorations of the Legion of Honor, the Iron Crown, of the Bust of Bolivar, of the order of Leopold, and of Cambodia.

Wm. R. Hutton.

**Herstal**, ãr'staal': town of Belgium; province of Liège; on the Meuse; forms now nearly a suburb of Liège, and is mostly inhabited by mechanics and workingmen (see map of Holland and Belgium, ref. 11–G). Is the seat of great manufacturing establishments, especially in iron and steel, and was the birthplace of Pepin, founder of the Carlovingian dynasty. Pop. 11,726.

**Hertford**: county-town of Hertfordshire, England; on the river Lea; 26 miles N. of London by rail (see map of England, ref. 11–K). It has a grammar school, several charity schools, including the Greencoat school, a preparatory school for Christ's Hospital London, an infirmary, a corn exchange, and free library. There are breweries, iron-foundries, and a trade in wheat, malt, and flour. Pop. (1891) 7,232.

**Hertfordshire**, or **Herts**: county of England; bounded by the counties of Essex, Middlesex, Buckingham, and Bedford. It contains 391,141 acres of fertile and well-cultivated land, consisting of chalk overlaid with gravel and loam, and presenting a pleasantly undulating surface. The products of its meadows and orchards are taken to the London market. Malt is a very important product. County-town, Hertford. Pop. (1901) 258,044.

**Hertz**, hãrts, Heinrich: electrician; b. at Hamburg in 1857; took his doctor's degree in physics at Berlin in 1880; became assistant to Prof. von Helmholtz in the physical laboratory of that university, and was a docent at Kiel (1883–85). After serving for four years as professor in the polytechnicum in Carlsruhe, he was elected to the chair of Physics in the University of Bonn, a position previously occupied for many years by Clausius, and left vacant by the death of that savant. Hertz's chief work consists in the experimental demonstration of the important fact, previously theoretically established by Maxwell, that electro-magnetic induction is propagated through space at the velocity of light by means of a wave-motion in all respects identical with that by means of which radiant energy is transmitted. His researches, first published in Wiedemann's *Annalen*, have since been collected into a volume entitled *Die Ausbreitung der elektrischen Kraft*. E. L. Nichols.

**Hertz**, Henrik: poet; b. at Copenhagen, Denmark, Aug. 25, 1798, of Jewish parents. With the exception of a tour through Germany, France, Switzerland, and Italy in 1833–34, he spent his life in his native city in a quiet way, devoting himself exclusively to literary work. In 1832 he was baptized, and his earliest comedy, *Hr. Burkhardt og hans Familie* (Mr. Burkhardt and his Family), was published under his own name, and the authorship of his other works was acknowledged. Several of his works caused a great commotion, especially his *Poetical Epistles from Paradise* (1830), a defense of Heiberg's system, whose satire and criticism made his opponents furious, though at the same time they could not help being charmed by the wit, elegance, and freshness of the style. He has written other poems, satirical, lyric, and epical, and also some novels; but his talent was eminently dramatic. He used to write a new drama every winter, and many of them have become very dear to his countrymen, such as his tragedy *Svend Dyrings Huus* (Svend Dyring's House, 1837); his character comedies *Sparekassen* (The Savings-bank, 1836) and *Et Offer* (A Sacrifice, 1853); his romantic comedies *Ninon* (1848) and *Den Yngste* (The Youngest, 1854). Some of them have been performed in the principal theaters of Germany, France, and England, such as *Kong Renés Datter* (King René's Daughter, 1845), twice translated into English. His general character as an author shows a perfect training—he never failed in what he undertook to do; and a perfect veracity—not one adjective in all his volumes was ever allowed to tell a lie. D. Feb. 26, 1870.

Revised by D. K. Dodge.

**Hertz**, Martin Julius: classical scholar; b. in Hamburg, Apr. 7, 1818; studied in Berlin and Bonn; privat docent in Berlin; professor ordinary in Greifswald 1855, and since 1862 in Breslau; editor of Priscian in Keil's *Grammat. Latini*; Vols. ii., iii. of Livy (4 vols., 1863); of Horace (1893); biographer of K. Lachmann (1851). Chiefly noted as the author of the standard edition of Aulus Gellius. A. Gudeman.

**Hertz**, Wilhelm: poet; b. in Stuttgart, Germany, Sept. 24, 1835; studied philology in Tübingen, and in 1858 went to Munich, where he published a volume of *Gedichte* (1859). In 1869 he was appointed professor in the Munich Polytechnicum. The deep spiritual insight and perfect mastery of diction displayed in his short poems are equally manifest in his more ambitious efforts. Among these are the epics *Lanzelot und Ginevra* (1860); *Hugdietrichs Brautfahrt* (1863); *Heinrich von Schwaben* (1869); the paraphrases *Rolandslied* (1861); *Tristan und Isolde* (1877); and the critical works *Deutsche Sage im Elsass* (1872); *Aristoteles in den Alexanderdichtungen des Mittelalters* (1890).

**Hertz Effect**: a name given to an important phenomenon in electro-magnetic induction, the existence of which was first experimentally verified by Prof. Heinrich Hertz. Whenever in any circuit electro-magnetic changes are brought about, as when an induction coil is in action, the disturbances are transmitted in all directions, bringing about similar changes in all conductors in the neighborhood. Hertz's work consisted in showing that these disturbances are transmitted by means of vibrations of the luminiferous ether and in determining the character and measuring the velocity of these waves (frequently called *Hertzian waves*). The result of his researches has been to place the electro-magnetic theory of light upon a well-established experimental basis. E. L. Nichols.

**Hertzen**, hãrt'sen, Alexander: journalist and political writer; b. at Moscow, Russia, Mar. 25, 1812. Shortly after completing his education he was imprisoned for his outspoken liberal ideas, and banished for a time to Viatka, then to Vladimir, although he was allowed to enter the service of the government. On his return he devoted himself to literature. In 1842 his *Dilettantism v Naukie* (Dilettanteism in Science) attracted much attention; but in the same year, for criticising the police too freely, he was ordered to live in Novgorod. In 1847, however, obtaining permission to travel, he sold his property, and left his country forever. In 1851 he settled in London, where he set up a "Free Russian Press" to attack the Russian Government, and to edit works of all kinds forbidden in his native land. His most famous enterprise was his weekly paper *Kólokol* (The Alarm-bell, started in 1857), whose influence was immense. Thousands of numbers were smuggled into Russia, where they were eagerly read by all classes, from the emperor down. In some mysterious manner Hertzen kept himself marvelously well informed, exposed countless abuses, and revealed state secrets. In 1859 he published the *Mémoires de l'Impératrice*

*Catherine, écrits par elle-même*, which had been kept private by her imperial descendants. After the great reforms of Alexander II. Hertzen lost much of his influence, and he forfeited the rest by his sympathy with the Poles in their insurrection of 1863. He transferred his *Kólokol* to Geneva, where it continued to exist as an obscure revolutionary sheet until about a year before his death in Paris, Jan. 21, 1870. As a writer Hertzen was both romantic and skeptical, eloquent and satirical. He had an impressionable nature and a keen intelligence. Perhaps the best of his purely literary efforts, most of which appeared under the pseudonym of *Iskandar*, are his novels *Doctor Krupov* and *Kto Vinovat?* (Whose Fault is it? both in 1847), and his *Prervannye Razskazy* (Interrupted Tales, 1854). Among his political productions, many written in English, French, or German, are *Du Développement des idées révolutionaires en Russie* (1851); *Baptized Property* (i. e. serfs, 1853); *Tiurma i Ssytka* (Imprisonment and Exile, part of which was translated by the author under the misleading title of *My Exile to Siberia*—he never was in Siberia). His works were published in 1875 (Basel, 11 vols.). Biography by J. Eekhardt (Leipzig, 1871). See also *European Republicans*, by J. W. Linton (1892).

A. C. Coolidge.

**Hertzian Waves**: See the Appendix.

**Her'uli**: a Germanic race who first appear in history in the third century A. D. on the shores of the Euxine. They were conquered by the Ostrogoths under Hermanric in the fourth century, and bands of Heruli appear after this in all parts of Century. They swelled the train of Attila, and are later found among the enemies of the Huns. In the valley of the Theiss, on the lower Danube, and in Illyria they founded governments, and were everywhere among the bravest and most barbarous and unruly of the Germanic peoples. Odoacer was called King of the Heruli, but was not of this race. After the fall of the Western empire (476 A. D.) the Heruli became one of the dominant races, but the subject Lombards rose and almost annihilated them about 512 A. D. From that time they were important only as soldiers in the service of the more powerful tribes.

**Hervás y Panduro**, ãr'vaas'ee-pañan-doo'rō, Lorenzo: Jesuit philologist; b. at Cuenca, Spain, May 20, 1735; studied at Alcalá de Henares; taught philosophy at Madrid, and spent some years in America. After 1767 he resided mainly in Italy, where he devoted himself to mathematical and linguistic studies. He published in Italian several important works on comparative philology, most of which were republished in Spanish. His *Idéa del' Universo*, a cosmographical work in 21 vols., appeared between 1778 and 1787, and he wrote various books on astronomy, physics, etc. In 1804 he was made director of the Quirinal Library at Rome. D. at Rome, Aug. 24, 1809. H. H. Smith.

**Hervé**, ãr'vā', Aimé Marie Édouard: journalist; b. in 1835 at St.-Denis (Réunion island); after brilliant studies in colleges entered the famous Paris Normal School, where he had as fellow mates Prévost-Paradol, About, Sarcey, Weiss, and Taine. Hervé contributed to many Paris journals, and with Weiss founded in 1869 the *Journal de Paris*, which was replaced in 1873 by the *Soteit*, both in support of the cause of a liberal constitutional monarchy modeled after the British constitution. In 1881 he was elected a member of the municipal council of Paris, but his subsequent attempts to secure a seat in the national legislature were unsuccessful. He was chosen a member of the French Academy in 1886. Hervé is the author of *Une page d'histoire contemporaine* (1869), a history of the liberal ideas in England, and a work on the history of Ireland, entitled *La crise irlandaise depuis la fin du XVIII^e siècle jusqu'à nos jours.*

**Hervey**, hêr'vĕĕ, James: author; b. at Hardingstone, Northamptonshire, England, Feb. 26, 1713; studied (1731–37) at Lincoln College, Oxford, where, from his acquaintance with John Wesley and from Zimmerman's writings, he received strong religious impressions. He took orders in the Anglican Church and held various rectorships, notably that of Weston-Favell (from 1752), where he died Dec. 25, 1758. Author of *Meditations and Contemplations among the Tombs* (1746 and 1747, latest edition 1875), which became exceedingly popular, and, notwithstanding its turgid and extravagant style, found many admirers, attracted partly by the devout spirit of the author (vol. i. contains the *Meditations among the Tombs*, by which title it is almost exclusively known); of *Theron and Aspasia* (3 vols., 1755), consisting of dialogues upon religious topics—a work which called forth replies from Robert Sandeman and John Wesley; and other works, among them posthumous *Letters to John Wesley* (1766), which, it is believed, suffered much from the reckless interpolations of Hervey's editors. He was a man of learning, but not of intellectual power. See the complete edition of his *Works* (Edinburgh, 1769; latest ed. 1834).

**Hervey Islands**: See Cook's Islands.

**Herwarth von Bittenfeld**, her'vaart-fōn-bit'en-felt, Karl Eberhard: field-marshal; b. at Grosswerther, Prussian Saxony, Sept. 4, 1796; entered the army in 1811. He took part in the campaign against France in 1814, and captured two hostile pieces at the storming of Montmartre. In 1847 he received the command of the First Regiment of the Guard, in 1850 of the Sixteenth Brigade of Infantry, in 1854 of the confederate fortress of Mentz, in 1860 of the Seventh Army-corps. In 1863 he became a general of infantry, and commanded in 1864 the Prussian troops against Denmark under Prince Frederick Charles, who was commander-in-chief of the allied Austrian-Prussian force. June 20 he took the island of Alsen. After the peace of Vienna he was appointed chief commander in the duchies of the Elbe, and in 1865 he received the command of the Eighth Army-corps. In 1866 he was commander-in-chief of the Army of the Elbe, gained victories in the encounter at Hünerwasser and Münchengrätz (June 26 and 28), and played a very conspicuous part in the battle of Königsgrätz by crossing the Biestritz and attacking the villages of Problus and Prune. The Austrian left wing rested on these two points, and by storming and taking them he completely destroyed this wing of the enemy. In 1870, in the war against France, he was appointed governor-general on the Rhine and of all the western provinces, which difficult and responsible position lost a great deal of its importance, as the war was carried on in the enemy's country. On Apr. 8, 1871, Herwarth retired from active service as field-marshal-general. D. in Bonn, Jan. 14, 1884.

**Herwegh**, hãr'vāch, Georg: poet; b. at Stuttgart, Germany, May 31, 1817; studied at Tübingen, was drafted into the army, quarreled with his lieutenant, and fled to Switzerland, where (at Zurich), in 1841, he published his *Gedichte eines Lebendingen* (11th ed. 1891), a collection of political poems or songs full of enthusiasm for liberty and equality, fresh, vigorous, and beautiful. The book met with immense success, and the poet returned to Germany in 1842; but a virulent letter he wrote to the King of Prussia caused him to retire a second time to Switzerland, where he married the daughter of a Jewish banker. He took an active part in the revolution in Baden in 1848, and published several minor collections of poems, but passed the latter part of his life in Southern France, almost in obscurity. D. at Baden-Baden, Apr. 7, 1875.

**Herzberg**, hãrts'bãrch, Ewald Friedrich: statesman and author; b. at Lottin, in Pomerania, Sept. 2, 1725; studied law at the University of Halle, and entered in 1747 the service of the Prussian Ministry of Foreign Affairs. He wrote in 1756 the famous *Mémoire raisonné*, founded on papers stolen from the archives of Dresden, and intended to defend the invasion of Saxony by Frederick II.; he also wrote a memoir in defense of the first partition of Poland in 1772; and the peace of Hubertsburg in 1763, as well as the formation of the so-called Fürstenbund in 1785 against Austria, was his work. Frederick II. appreciated him very much, and made him first Minister of State, but after the king's death Herzberg's influence soon decreased, though Frederick William II. made him a count and president of the Academy of Science of Berlin. The convention of Reichenbach in 1790 proved a failure, and Herzberg retired. In 1793, when the second division of Poland and the unfortunate war against France had brought Prussia into a critical position, he offered his services once more, but the offer was not accepted, and the old man felt this disappointment so keenly that he fell sick and died shortly after, May 25, 1795.

**Herzegovina**, hãrt-se-gō'vee-naă: province occupied by Austria-Hungary; bounded N. by Bosnia, S. W. by Dalmatia, and E. by Montenegro. Peopled largely by Slavic races; occupied by the ridges and valleys of the Dinaric Alps; produces much grain, tobacco, and honey. Capital, Mostar. For statistics, etc., see Bosnia. See also Herzegovina in the Appendix.

**Herzen**, Alexander, M. D.: Professor of Physiology at Lausanne, Switzerland; b. at Vladimir, Russia, June 25,

1839; edneated in England; studied medieine at Berne; assistant for several years to the physiologist Shiff in Florenee; called to Lausanne in 1881. The works of Herzen are principally on topies in physiology and physiological psyehology—i. e. *Expériences sur les centres modérateurs de l'action reflexe* (Turin, 1864); *Analisi fisiologica del libero arbitrio umano* (Florence, 1870, with two later editions; French translation, 1874); *The Brain and its Functions* (in French, *Le cerveau et l'activité cérébrale*, Paris, 1886; German translation, *Grundlinien einer allgemeinen Psychophysiologie*, Leipzig, 1887); also several studies on edneational topies, mainly of Swiss interest. J. Mark Baldwin.

**Herzog**, hăr'tsokh, Johann Jakob: b. at Basel, Sept. 12, 1805; studied theology in his native city and in Berlin 1823–29; and was Professor of Theology at Lausanne 1835–45; in Halle 1847–54; in Erlangen in 1854–77, when he retired upon a pension. He wrote *J. Calvin* (Basel, 1843); *Das Leben Œkolampadius* (1843, 2 vols.); *Die romanischen Waldenser* (Halle, 1853); *Abriss der gesammten Kirchengeschichte* (3 vols., Erlangen, 1876–82; supplement, 3 vols., on the nineteenth eentury, by G. Koffmane, 1887; 2d ed. of vols. i.–iii., by G. Koffmane, 1890–92), ete.; but his chief work was his *Real-Encyklopädie* (Hamburg and Gotha, 1853–68, 22 vols.; 2d rewritten, Leipzig, 1877–88, 18 vols.): a condensed translation with mueh new matter was prepared by Philip Sehaff, Samuel Maeauley Jaekson, and David Sehley Schaff (3 vols., New York, 1882–84)—a vast storehouse of Gerinan learning and speculation. D. at Erlangen, Sept. 30, 1882.
Revised by S. M. Jackson.

**He'siod** (in Gr. Ἡσίοδος): next to Homer the oldest of the Greeian poets whose works are known to us. From his poem, *Works and Days*, we learn that his father eame from Cyme, a town of Æolis in Asia Minor, and settled at the foot of Helieon in the wretehed village of Asera. At Asera Hesiod was born, and by Helieon he tended his floek. After his father's death Hesiod was defrauded of a part of his inheritanee by his brother Perses, who had bribed the judges; but Perses's foul play brought him no luek, and the lazy cheat undertook to sue his wronged brother again. Hereupon Hesiod left Ascra in disgust, and seems to have become a strolling minstrel with homes at Naupaetus and Orehomenus. A passage of doubtful genuineness in *Works and Days* tells us how he went to Chaleis in Eubœa in order to take part in a poetieal eontest at the funeral celebration in honor of King Amphidamas, and how he won a tripod as the prize, whieh he dedicated to the Muses. Hence the story of the *Contest between Homer and Hesiod* (Ἀγὼν Ὁμήρου καὶ Ἡσιόδου), still extant, and often printed with the works of Hesiod. According to a tradition, the poet was murdered at Oeneon in Ozolian Locris by two brothers, who suspected him unjustly of having seduced their sister. He was buried in Locris, where his poetic school flourished, but the bones of the poet were afterward removed by command of an oraele to Orchomenus, where a tomb was ereeted to his memory, and where he was honored as a hero. As to the age of Hesiod there is a eonflict of authorities. Herodotus makes him a eontemporary of Homer, and puts them both 400 years before his time—i. e. about 840 B. C. Ephorus makes Hesiod older than Homer, Eratosthenes and Aristarehus make him younger. (See Clinton, *Fasti Hellenici*, vol. i., pp. 359–361.) The internal evidence seems to point to the early Olympiads as the time of Hesiod. The chief works attributed to him are, 1, the *Works and Days* (Ἔργα καὶ Ἡμέραι), according to loeal tradition the only genuine work of Hesiod. It is called *Works* beeause of the directions given for various kinds of labor, *Days* because of an appendix whieh eontains a calendar of the days of the month on whieh éertain tasks are to be undertaken. 2. The *Theogony* (Θεογονία), an attempt to systematize the world of Hellenie deities, and to make the old gods of the soil receive into their ranks the new importations from foreign parts. In this strange performanee ritual and hymn are blended with theosophic and cosmogonie speeulation. The poem closes with a long list of the daughters of Zeus, who eondeseended to bear ehildren to mortal men. This prepares the way for 3, a *Catalogue of Women* (κατάλογος γυναικῶν), whieh has been lost. A subtitle, or a title of part of the work, was Ἠοῖαι μεγάλαι, a versified history of heroes in short paragraphs mechanically strung together, each beginning with ἢ οἵη, "or such a dame," whieh gave the title to the poem. From this work is borrowed the proëm to 4, the *Shield of Hercules* (Ἀσπὶς Ἡρακλέους), an imitation of the shield of Achilles in the *Iliad*. Hesiod is the representative of the Bœotian and Locrian school, as Homer is the representative of the Ionian school of epie poetry. A sober, homely nature, observant and reflective, he shared the peculiarities of his Bœotian eountrymen, their heavier mental build, their slower intellectual motion. What Hesiod has to say rather than to sing consists largely of wise saws and useful precepts. He gives us a housekeeper's companion, a farmer's calendar, a nautical almanac, a handbook of mythology. He is a plain man addressing plain men, and henee it is not surprising that Cleomenes called Hesiod the poet of the Helots, whereas Homer was the poet of the Spartan warriors. Nor is it surprising that when purple patehes in the way of episodes are let into the homespun fabric of Hesiod's poems modern eritics should suspeet diversity of authorship. In its external form the poetry of Hesiod resembles that of Homer. The meter is the hexameter. The dialect is substantially the same, though it shows here and there a local strain, which has led Fiek to rewrite Hesiod in Æolie. (See Fick, *Hesiods Gedichte*, 1887.) There is a vast deeline in art from the airy heights and the fairy splendor of Homerie poetry. True, Homer is melancholy at times, but the melancholy of Hesiod has a mediæval grimness and a modern cynicism that are almost startling. Still the Greek valued Hesiod as he valued Homer for his moral lessons, and the homely preacher of the Gospel of Labor was a power in Greek education, and in certain forms of reflective poetry a power in Greek literature. The best editions are by Th. Gaisford in *Poetæ Minores Græci*, vol. i.; by Göttling (Gotha, 1878, 3d ed.); by Van Lennep (Amsterdam, 1843–47, 3 vols.); by F. A. Paley (London, 1861): eritical editions by Schömann (1869), Köchly-Kinkel (1870), Rzaeh (1884), Sittl (1889). Chapman has translated the *Works and Days* into English under the title *Hesiod's Georgics and Book of Days*, and Elton has given the entire poems. See Müller, *Hist. Greek Lit.*, vol. i., p. 77: Mure's *History of Greek Literature*; Grote's *History of Greece*, vol. i.; Bähr, in *Pauly's Real-Encyklopädie*. B. L. Gildersleeve.

**Hesper'ides** [Lat. = Gr. Ἑσπερίδες, liter., daughters of Hesperus; Ἕσπερος, Hesperus + patronymie ending, *-ίδες*, plur. of *-ίς*, daughter of]: in Greek mythology, daughters of Atlas and Hesperis, the Night, or of Zeus and Themis, or of Phorcys and Ceto. On the occasion of the marriage of Zeus and Hera all the gods brought gifts. As her gift to Hera, Gaea brought golden apples, which Hera planted in the garden of the gods in the farthest west, on an island on the other side of Oceanus where Day and Night meet. The children of the Night, the Hesperides, were set to watch the garden and the golden apples. The Hesperides were fond of the apples and plucked them; so Gaea was forced to send Ladon, the hundred-headed dragon and son of Typhon and Echidna (or of Phorcys and Ceto), to watch the Hesperides and the golden apples. Heraeles was sent by Eurystheus to fetch three of the golden apples to him at Mycenæ. By the help of Atlas (*q. v.*) he secured the apples, but they were finally restored to the garden of the gods by Athene to whom Heracles had given them. The golden apples are emblematic of love and fruitfulness, over which the children of the Night keep watch. The Atlantides (so called from their father, Atlas) or Pleiades (so called from their mother, Pleione) were half-sisters of the Hesperides. J. R. S. Sterrett.

**Hesperor'nis** [Gr. ἕσπερος, west + ὄρνις, bird]: an extinct genus of birds belonging to the sub-class *Odontornithes*, and found in the Cretaceous of Kansas. These birds had the legs fitted for swimming, and closely resembling those of the modern divers, but the sternum was destitute of a keel, as in apteryx and the ostrich, and the diminutive wings were ineapable of supporting the body in flight. The most remarkable feature was, however, the presence of well-developed teeth both above and below. These teeth were not set in sockets, as in Ichthyornis, but in a groove, as in Ichthyosaurus. Other reptilian characters were shown in the skeleton, but the vertebræ are of the true bird type. *H. regalis* was nearly 6 feet in height. See also Odontornithes.
O. C. Marsh.

**Hesse**, hes (Germ. *Hessen*; cf. Lat. *Chatti*, *Catthi*): a mountainous territory in the western part of Central Germany; situated between 7° 51′ and 9° 39′ E. lon., and 49° 24′ and 50° 50′ N. lat., between the Neckar, Rhine, Main, Lahn, and Fulda. It was inhabited by the tribe of the Catti at the time of Germanieus, but the Catti became lost as an individual tribe among the Franks, and when these emigrated to Belgium and France the Hessian territory became nearly depopulated. Meanwhile the Saxons pushed into the coun-

try from Thuringia, and for a period Hessia was united with the Thuringian principality; but at the death of Henry Raspe in 1247 a war of succession broke out between his nephew, Henry of Misnia, and his niece, Sophia, married to Henry, Duke of Brabant, which ended in 1263 in a separation of the two countries. Sophia obtained Hessia, and her son, Ludwig the Child, was acknowledged as landgrave, took up his residence at Cassel, and founded the Hessian dynasty. One of his descendants, Philip the Magnanimous, divided his land at his death in 1567 between his four sons, William IV., Ludwig IV., Philip II., and George I. But Ludwig IV. died in 1604 and Philip II. in 1583, without children, and thus only two branches of the family were continued—that of Hesse-Cassel, descending from William IV., and that of Hesse-Darmstadt, descending from George I. In the time of the Revolution in North America (1775) the Grand Duke of Hesse-Cassel held his subjects as mercenaries, and sold to George III. of England the service of 22,000 Hessian troops with which the British army in North America was reenforced. In the time of the Napoleonic wars Hesse-Cassel, under William I., fought now on one side and now on another. Under William II. the discord between monarch and subjects became dangerous, and when in 1830 a revolution actually broke out, he followed his father's example: he promised everything on one day, and broke his promises the next. Still worse was Frederick William I., who succeeded his father Nov. 20, 1847. When the revolution of 1848 came the elector consented to some important reforms, but his attempt to return to the former policy of the government caused a popular commotion, and he was forced to retire to Wilhelmsbad. Austria and the Diet came to his aid, and in spite of the menacing attitude of Prussia enforced the obedience of his subjects. A period of reactionary government followed, but in 1866 Hesse-Cassel, having joined Austria against Prussia, was conquered by the latter power, and has since been a government district of the Prussian province of Nassau.

In Hesse-Darmstadt, or Hesse proper since the Prussian conquest of Hesse-Cassel in 1866, an excellent constitution was adopted in 1848, and this was modified in 1862 and 1872. Under the revised constitution the executive authority is vested in the grand duke, who is supported by a ministry that is divided into three departments—that of Foreign Affairs, that of the Interior and of Justice, and that of Finance. The legislative branch of the Government consists of an Upper Chamber, composed of nobles and twelve members elected for life, and a Chamber of Deputies, 48 in number. According to the census of 1890 Hesse had an area of 2,965 sq. miles and a population of 992,883, of whom 666,118 were Protestants and 293,651 Roman Catholics. Pop. (1900) 1,120,426. The country is mountainous or hilly, covered by the Vogelsberg range, the Odenwald, and spurs of the Taunus and Westerwald, but the soil is very productive and well cultivated. Wheat, barley, oats, potatoes, fruit, and tobacco are raised; iron, salt, and brown coal are mined; linen and woolen fabrics, leather and straw goods are manufactured; the carriages from Offenbach are celebrated. The largest town is Mainz, with a pop. (1895) of 76,300. The university at Giessen had in 1898 850 students. Revised by C. K. Adams.

**Hesse-Nassau**: province of Prussia (formed in 1866 of portions of the electorate of Hesse-Cassel, the duchy of Nassau, the landgraviate of Hesse-Homburg, and the free city of Frankfort); situated between Hesse, Bavaria, and the provinces of Saxony, Hanover, Rhenish Prussia, and Westphalia. Area, 6,055 sq. miles. The surface is occupied by the Spessart, Rhön, Westerwald, and Taunus Mountains, but the soil is very fertile and well cultivated. Agriculture, cattle-raising, and manufacture of cloth, iron, jewelry, and pottery are the chief occupations. Much excellent wine is produced. Mineral springs are numerous, and the watering-places of Ems, Wiesbaden, Schlangenbad, and others are celebrated. Pop. (1895) 1,756,802.

**Hessian-fly** [so called because believed to have been brought by the Hessian troops during the Revolution]: the *Cecidomyia destructor*, a dipterous insect which is very destructive to wheat in parts of the U.S. In spring and autumn the larvæ crawl in between the stalk and the sheath of a leaf, and remain near the ground, head downward, sucking the juice. In five or six weeks they enter a semi-pupa or flaxseed state, from which they go into the pupa, and then become perfect insects. They are destroyed in great numbers by insect parasites, and burning the stubble in the autumn will destroy a great proportion of their larvæ. See Cecidomyia.

**Hes'tia** (in Gr. Ἑστία): the first-born daughter of Cronus and Rhea. According to the etymology of the word now generally accepted (i. e. from the Indo-European root *vas*, which means to glow or burn, and not from another root *vas*, which means to dwell) she was the fire-goddess, though even in very early times the word ἑστία came to mean hearth, and then tropically house or dwelling. Hestia was averse to the works of Aphrodite, and when she was wooed by Apollo and Poseidon, she swore by the head of Zeus that she would always remain a virgin. The virginity of the goddess and the purity of the hearth were necessitated by the purity of fire. Instead of marriage Zeus granted her the right to sit in the center of the house, to receive the fat of victims, to be honored in the temples of all the gods, and to be esteemed by mortals as the eldest born and most venerable of all the gods (Hom., *Hymn. in Venerem*, 22 ff.). In spite of the fact that she has no myths and is not mentioned in *Iliad* or *Odyssey*, she was not a post-Homeric deity. She was a virgin because fire is pure and purifying. When defiled by contact with impurities fire had to be extinguished and then be relighted from pure fire. But Hestia received the fat of victims not only in family sacrifices but also in public sacrifices. A kind of grace was acted by pouring a libation upon the hearth before beginning a feast or even an ordinary meal. There was a proverbial phrase, ἀφ' Ἑστίας ἄρχεσθαι (to make the beginning with Hestia), that applied to sacrifices, libations, treaties, oaths, compacts, etc., though it is impossible to say whether sacrifice was offered first to Hestia in *all* public and private ceremonies. The thought underlying the custom was first to offer sacrifice to the sacred sacrificial Fire itself, the fire in which the offerings to the other gods were to be burned, and secondarily only to the goddess herself, for it must be remembered that it was through the instrumentality of the ascending flame and smoke that the gifts of man were carried up to the gods, and to Zeus in especial. Zeus was closely allied to Hestia, as such epithets as ἐφέστιος show. Hestia was the goddess not only of sacrificial fire, but she was the goddess of the hearth, which unites and binds together the family, and is really the center of the family life. Hestia appears rarely in art as she does in myth. She is represented occasionally in archaic vase-paintings, but nothing typical can be gathered from them. It is not certain that any statues of Hestia have come down to us, though the archaic statue in the Torlonia Museum may represent the goddess.

Literature.—Preuner in Roscher's *Lexicon*, under *Hestia*; Frazer, *The Prytaneum, The Temple of Vesta, The Vestal Perpetual Fires* in *The Journal of Philology*, vol. xiv., p. 169 ff.; Planck, *Die Feuerwerkzeuge der Griechen und Römer, und ihre Verwendung zu profanen und sakralen Zwecken* (Stuttgart, 1884); Petersen, *Der Hausgottesdienst der alten Griechen* in the *Zeitschrift für Alterthumswissenschaft* (1851, p. 196); Hagermann, *De Græcorum prytaneis* (Breslau, 1881); Preller-Robert, *Griechische Mythologie* (Berlin, 1888).

J. R. S. Sterrett.

**Hes'ychasts** [from Gr. ἡσυχασταί, plur. of ἡσυχαστής, hermit, quietist, hesychast, liter., one who remains still or quiet; deriv. of ἡσυχάζειν, be still or quiet, deriv. of ἥσυχος, still, quiet]: a body of mystics in the Greek Church, who professed that by retirement and contemplation they could come to behold the divine glory (called the "Taboritic light," because it was regarded as the same as that which shone at Christ's transfiguration on Mt. Tabor). They believed that the best position they could assume for beholding this light was to sit and gaze upon their navels. They flourished in the fourteenth century among the monks of Mt. Athos, but the leaven of their doctrine is not yet extinct in the East. Barlaam was their great opponent, but he was condemned in a synod in Constantinople (1341), and ten years later (1351) the doctrines of the Hesychasts were declared orthodox by another synod in Constantinople. See von Stein, *Studien über die Hesychasten des 14. Jahrhunderts* (Vienna, 1873).

Revised by S. M. Jackson.

**Hesych'ius** (in Gr. Ἡσύχιος): a grammarian of Alexandria, under whose name a valuable Greek lexicon has come down to us. Nothing is known of his life, and his date is so uncertain that critics vary in regard to it from 390 A. D. to the tenth century. The former is more generally accepted, and the forms and references which imply a later date are believed to be interpolations. The work is based on the earlier lexicon of Diogenianus, and is valuable as containing explanations of words and forms and literary and archæological information derived in part from writers now lost. The ex-

planations of words from the Scriptures and from Christian writers are the additions of later hands. The best editions are by Alberti and Ruhnken (Leyden, 1746–76, 2 vols. fol.), and by M. Schmidt (4 vols. 4to, Jena, 1858–61); smaller ed. 1867, in which an attempt is made to sift out the articles by Diogenianus: the *Glossæ Sacræ* separately by Ernesti (Leipzig, 1785). See Ranke, *De Lex. Hesych. vera origine*, etc. (Quedlinburg, 1831). Revised by B. L. Gildersleeve.

**Hesychius**: of Miletus; a philosopher and historian, surnamed Ἰλλούστριος (*illustris*); lived in the sixth century A. D. under the Emperor Justinian. He wrote a synoptical history of the world, in six parts, from Belus, King of Assyria, to the death of Anastasius I. Of the sixth part a portion, relating to the origin of Constantinople, is extant. He was also the author of a dictionary of authors (Ὀνοματολόγος ἢ πίναξ τῶν ἐν παιδείᾳ ὀνομαστῶν), extracts from which have been preserved by Suidas. Best edition of both treatises by Orelli (Leipzig, 1820); of the latter by Flach (Leipzig, 1882).
Revised by B. L. Gildersleeve.

**Hetæ'ræ** (in Gr. Ἑταῖραι): a euphemistic name given in Greece to the better class of prostitutes. In Corinth prostitutes were connected with the worship of Aphrodite; they were introduced into Athens by Solon, who thought thereby to prevent the Athenian families from being ruined by the licentious young men of Athens. Originally these prostitutes were slaves owned by the state, which derived a revenue from them. They were intended by Solon for the use of unmarried men exclusively, for in his time married men were required to live up to their marriage vows. But about the time of Pericles men began to entertain lax views with reference to the sanctity of the marriage relation, and we begin to hear of the hetæra, or friend. The hetæra was not a common prostitute; she was usually a foreigner, and she sought to please men not only by her personal charms, but also by the brilliancy of her intellect and conversation. The greatest and best men of Greece were attracted by them, and Pericles was so fascinated by Aspasia, a gifted hetæra of Miletus, that for her sake he abandoned his legal wife and lived openly with Aspasia. Many of these hetæræ won immortal fame; some of them amassed huge fortunes; and some even reached the royal purple, and had temples erected in their honor. Some of the most distinguished were Thais, Myrrhina, Lamia, Leæna, Theodota, Thargelia, and Phryne. Phryne, the beautiful, who served as model for Praxiteles, offered to rebuild the walls of Thebes provided the Thebans would agree to place upon the walls the inscription, "Alexander destroyed them and Phryne, the hetæra, rebuilt them."
J. R. S. Sterrett.

**Hetæria** [Gr. Ἑταιρία φιλική, friendly association]: a society having for its original object the promotion of science and literature in Greece, but chiefly concerned during the early years of the nineteenth century with the project of Greek independence. Founded in the latter part of the eighteenth century, it was a flourishing organization at the time of the Congress of Vienna (1814–15), and soon numbered among its members the ablest Greeks of all classes, though at first it was recruited mainly from the Greeks of foreign countries, especially Russia and the Danubian principalities. Its purposes were akin to those of the Carbonari, the Burschenschaft, and the Spanish Freemasons, and it sought to realize them by the same means, i. e. revolution. Ypsilanti, the leader of the ill-starred revolt in Wallachia and Moldavia in 1821, was the head of the Hetæria which supported that movement, as well as the more successful attempt in Greece proper. When by the intervention of the great powers Greek independence had been achieved (1828), the society ceased to be an important factor in Greek politics.

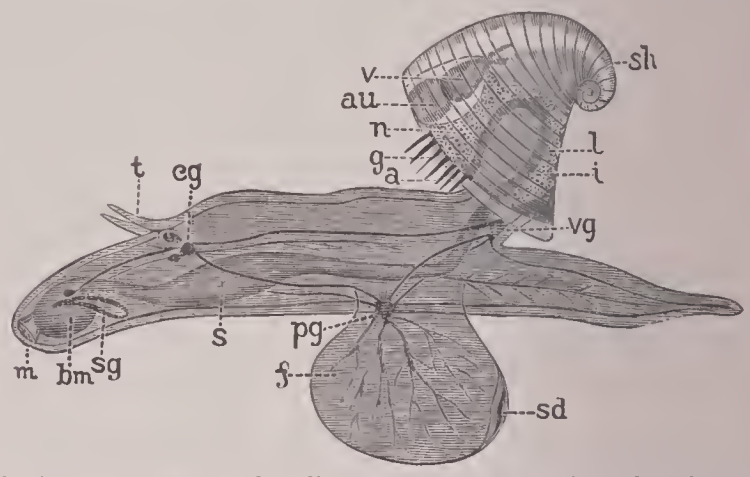
**Hetchel**: See Hackle.

**Heteroc'era**: See Lepidoptera.

**Heterocer'cal** [liter., having a second tail; Gr. ἕτερος, other, second + κέρκος, tail]: a name applied to the tails of those species of fish which have the vertebral column extended into the upper lobe, which is the larger of the two, a condition found in all sharks. In the large majority of osseous fishes the posterior end of the vertebral column is bent upward, but the bones on its under side (hypural bones) which support the rays of the tail are correspondingly lengthened, so that the lower and upper portions of the tail appear symmetrical. This pattern is termed *homocercal*. Finally, the vertebral column may be quite straight, and the rays of the tail equally disposed about its end, so that the upper and lower portions of the tail are alike. This condition, which is well shown by the burbot (*Lota lota*), is called *diphycercal*. F. A. Lucas.

**Heterodon'tidæ** [Mod. Lat., liter., belonging to the tribe with peculiar teeth; Gr. ἕτερος, other, different + ὀδούς, ὀδόντος, tooth + patronymic ending -ίδαι, descended from]: a family of sharks, including the Port Jackson shark (*Heterodontus philippi*) and several other living species interesting to naturalists as the surviving relics of a once extensive group. The head is squarish, with a declivous forehead; the mouth near the anterior extremity; the two dorsal fins are each armed in front with a spine. Important anatomical peculiarities also differentiate it as a peculiar group or sub-order. One species (*Gyropleurodus francisci*) occurs on the Californian coast.

**Heterop'oda** [Mod. Lat., from Gr. ἕτερος, other, different + πούς, ποδός, foot]: a group of gasteropod molluscs (see Gasteropoda), formerly regarded as a distinct order, but now




*Carinaria*, a heteropod mollusc: *a*, vent; *au*, auricle; *b m*, buccal mass; *c g*, cerebral ganglion; *f*, foot; *g*, gills; *i*, intestine; *l*, liver; *m*, mouth; *n*, nephridium; *p g*, pedal ganglion; *s*, stomach; *s g*, salivary gland; *sh*, shell; *t*, tentacles; *v*, ventricle; *v g*, visceral ganglion.

known to belong to the tænioglossate group, the body being modified for a pelagic life. They have the foot compressed to a vertical keel, a shell may be present or absent, the gills are in front of the heart, and the sexes are separate. Usually body and shell are transparent. The principal genera are *Atlanta*, with a spiral shell; *Carinaria*, with a hood-like shell; and *Pterotrachea*, without a shell. J. S. Kingsley.

**Heteroptera**: See Hemiptera and Entomology.

**Heteropyg'ia** [Mod. Lat., having a peculiar rump; Gr. ἕτερος, other, different + πυγή, rump, or anus]: a name formerly applied to the cave blindfishes and their relatives, the family of *Amblyopsidæ*, in allusion to the peculiar position of the vent, which is in front of the ventral fins. There are five species known, two of them confined to the caves, and three to the swamps or springs of the lowlands of the southern part of the U. S. One of these is especially abundant in the Dismal Swamp and the Okefinokee Swamp. There is not much doubt that the blind forms are descended from the eyed swamp types, and probably all are relics of an ancient fauna which preceded the ordinary river-fishes of the present day. The blind forms constitute the genera *Amblyopsis* and *Typhlichthys*, those with eyes the genus *Chologaster*. See Amblyopsis. See also Putnam, F. W., in *American Naturalist* (Jan., 1872). David S. Jordan.

**Heteroso'mata** [Mod. Lat., liter., (animals) with unsymmetrical bodies; Gr. ἕτερος, other, different + σῶμα, σώματος, body]: an order of true fishes, peculiar among the vertebrates in the asymmetry of the body, to which the name alludes. The animal is very much compressed, with dorsal and abdominal edges trenchant, and generally it rests on the sandy or muddy bottoms of the water, flat on one side, and hence the inferior is white, while the side which is kept uppermost is dark; the ventral fins are jugular or thoracic; the dorsal and anal fins very elongated; the scapular arch is destitute of a mesocoracoid bone. They are most nearly related to the codfishes and allied tribes. In the early embryonic stage these fishes are symmetrical, but they very soon assume that dissimilarity of the sides which is characteristic of the mature condition. Their development has been studied by Malm, Steenstrup, Thompson, Traquair, Schrödte, etc. Steenstrup (1864) contended that the combination of the eyes on one side was effected by a transfer of the upper one from the blind side through the tissues below the arch formed by the frontal bone of its own side to the opposite

one. But a more consecutive study of the development and anatomy of the various forms seems to establish the fact that this transfer is rather effected by a rotation of the eye and contiguous parts from the one side to the other. There is some reason to believe that both methods occur in different species. The rotation of the eye has been explained on the principle of its tendency, while the fish is yet young and symmetrical, but prone to lie on one side, to turn toward the light; this tendency, confirmed and established by slow degrees, finally culminated in the habit now universal. The least specialized type is *Atheresthes stomias*, a kind of halibut. The order embraces two families (*Pleuronectidæ* and *Soleidæ*) and numerous species. THEODORE GILL.

**Het-her**: See ATHOR.

**Hetman**: See ATTAMAN.

**Hetzel**, ā't'sel', PIERRE JULES: editor and man of letters; b. at Chartres, France, Jan. 15, 1814; began as the partner of Paulin, the publisher of the works of the greatest modern French writers. In 1848 Hetzel exercised a great influence in favor of the republican movement, and occupied several offices in the capacity of an under-secretary in two ministries, and finally as general secretary of the executive power. He was banished in 1857, but returned in 1859, and during the empire he busied himself exclusively with publishing the books of Victor Hugo, George Sand, etc., and he wrote also, under the pseudonym of *P. J. Stahl*, some highly moral books, like *The Famitiar Morat*, *A Student's Travels*, *New and Sote Adventures of Tom Thumb*, *The Esprit of Women and Women of Esprit*. D. Mar. 17, 1886.

**Heuglin**, hoi'glēn, THEODOR, Baron von: explorer; b. at Hirschlanden, Würtemberg, Mar. 20, 1824; traveled in the East 1850–52; became Austrian consul at Khartum, and explored Abyssinia and the White Nile valley in 1852–54; traveled along the Gulf of Aden and the shores of the Red Sea 1856–58; from 1860 to 1865 was again engaged in African explorations; made a journey in the region of Spitzbergen and Nova Zembla 1870–71. Author of *Reisen in Nordostafrika* (1857); *Ornithologie Nordostafrikas* (1860); *Systemat. Uebersicht der Säugethiere Nordafrikas* (1867); *Reise nach Abessinien*, etc. (1868); *Reise in das Gebiet des weissen Nil* (1869), etc. D. at Stuttgart, Nov. 5, 1876.

**Hewes**, JOSEPH: a signer of the Declaration of Independence; b. of Quaker stock at Kingston, N. J., in 1730; was educated at Princeton, and went into business, first in Philadelphia and then at Edenton, N. C.; was a member of the General Congress from North Carolina 1774–77, and again in 1779. In Congress he took a prominent part in the performance of public business. D. at Philadelphia, Nov. 10, 1779.

**Hewit**, AUGUSTINE FRANCIS, D. D.: a Roman Catholic (Paulist) priest; a son of Nathaniel Hewit, D. D.; b. at Fairfield, Conn., Nov. 27, 1820; baptized as Nathaniel Augustus; graduated at Amherst in 1839; studied theology at East Windsor, Conn., and became an Episcopalian minister. In 1846, while residing in North Carolina, he became a Roman Catholic; was ordained in 1847; joined the Redemptorists in 1850; was associated later with the founders of the Congregation of St. Paul (Paulists), in whose seminary at New York he taught philosophy, theology, and Holy Scripture from 1865 to 1889. Later superior of the Paulists in New York until his death, July 3, 1897. Author of *Problems of the Age* (New York, 1868); *Light and Darkness* (1871); *King's Highway* (1874; 2d ed. 1879); of several translations, and a frequent contributor to such Roman Catholic periodicals as *The Catholic World*, *American Quarterly Review*, and *The American Ecclesiastical Review*. Revised by J. J. KEANE.

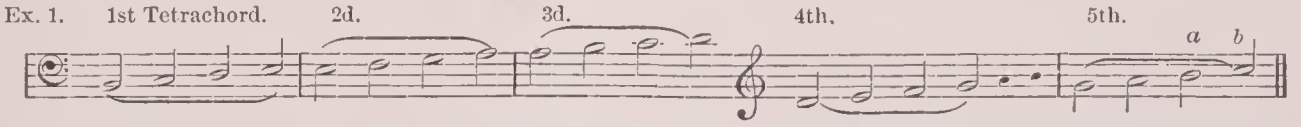
**Hewit**, NATHANIEL, D. D.: clergyman; b. at New London, Conn., Aug. 28, 1788; graduated at Yale in 1808; taught for some years, and in 1811 was licensed to preach; studied theology at Andover; was pastor of a Presbyterian church at Plattsburg, N. Y., 1815–17, and of the Congregational church at Fairfield, Conn., 1818–27; engaged in the temperance reform 1827–30 (he was called the "Luther of the early temperance reform"); was pastor of Congregational and Presbyterian churches at Bridgeport, Conn., 1830–62. He was one of the founders of the East Windsor (now Hartford) Theological Seminary. D. in Bridgeport, Conn., Feb. 3, 1867.

**Hewitt**, JOHN NAPOLEON BRINTON: linguist and ethnologist; son of David B. Hewitt, M. D.; b. on the Tuskarora reserve, Niagara co., N. Y., Dec. 16, 1859; of mixed blood, having Scotch-English on the paternal side, and Tuskarora-French-English blood on the maternal side. In early youth he acquired a fair knowledge of the Tuskarora language from some of his schoolmates. He was educated at the Wilson, N. Y., union school and the Lockport, N. Y., union school, and for several years thereafter devoted himself to farming and journalistic work. In 1879 he was engaged by Mrs. Erminnie Adele Smith to aid her in the linguistic and other work in which she was engaged on the Tuskarora reserve in field-work for the Bureau of Ethnology. Mr. Hewitt's work consisted in the collection of vocabularies and mythologic materials in the vernacular of the various Iroquoian tribes and in the translation of this matter, and this work was the means of familiarizing him with the grammatical elements of these different dialects. Since the death of Mrs. Smith he has continued this and other linguistic work. He is also compiling a dictionary and grammar of the Tuskarora language, and collecting material for a work on the ethnology of the Iroquoian people.

J. W. POWELL.

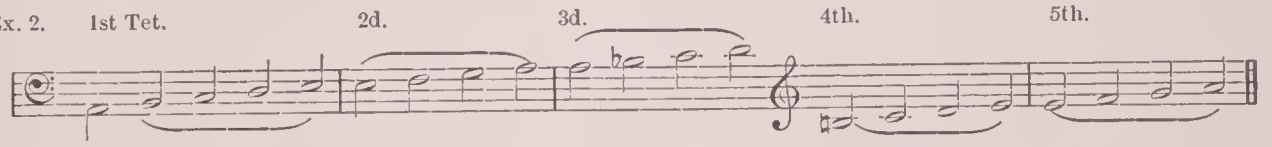
**Hex'achord** [from Gr. ἕξ, six + χορδή, gut, string, cord, chord]: in music, a series of six notes in direct succession, forming a portion of a scale. The extension of the musical scale and its division into hexachords are attributed to Guido, a monk of the eleventh century. Under the system of the ancient Greeks, which continued for ages to influence all music, both ecclesiastical and secular, the scale was divided into *tetrachords*, or portions of four notes each. As the Greek scale comprised only about fifteen notes, or two octaves, these tetrachords could not apparently exceed four and a fraction in number; but the Greeks, by an ingenious use of some extraneous elements, obtained no fewer than five. According to modern reckoning—taking B in the bass, as the Greeks did, and following their mode of division—the four tetrachords would not fill the double octave, and a fifth tetrachord added would reach beyond it, as at *a*, *b* in Ex. 1:

Ex. 1. 1st Tetrachord. 2d. 3d. 4th. 5th.

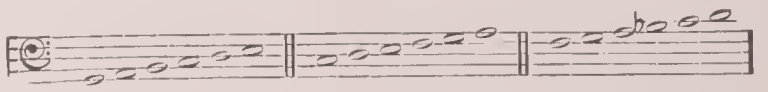



But under the Greek system the five tetrachords were obtained—1, by adding an initial note A, which note was called the *Prostambanomenos*; 2, by using B♭ in the third tetrachord, and then beginning the fourth tetrachord by a descent to B♯, thus:

Ex. 2. 1st Tet. 2d. 3d. 4th. 5th.



About the year 1024 Guido Aretinus proposed the following arrangement, an evident approach toward the modern scale. The hexachords will be seen to be groups of *six* sounds with a diatonic semitone between the third and



fourth notes of each series. The four remaining hexachords are simply repetitions of these three in higher octaves.

The system of hexachords is of no practical use in modern music, being superseded by the simple and natural division of the scale on the normal type of the series of notes forming the octave.

Revised by DUDLEY BUCK.

**Hexacoral'lia** [Mod. Lat., from Gr. ἕξ, six + κοράλλιον, coral]: an order of Cœlenterates belonging to the class Seyphozoa and the sub-class Anthozoa. In it are included the common sea-anemones and coral polyps in which the parts are arranged in six, or multiples of six. Thus the tentacles are in sixes, while the digestive cavity is divided in the same way in most forms. In their development they pass through a stage where eight is the prevailing number, a fact which leads to the placing of these forms above those forms

(Octocorallia, *q. v.*) in which the number eight is never exceeded. The order *Hexacorallia* is divided into three suborders: (1) Antipatharia, or horn corals, in which the colony forms a horny axis and the mouth is surrounded with either six or twenty-four tentacles, and the septa are similarly arranged, except in *Antipathes*, where but two septa are developed. (2) Madreporaria, the true coral polyps, which play the most important part in the formation of coral reefs. In these the tentacles and septa are very numerous, but always in multiples of six. The polyps are usually in connected groups or colonies (rarely single), and from the outer skin (ectoderm) of the base and sides of the body is secreted the deposit of lime which we know as Coral (*q. v.*). In this can be easily seen the sixfold arrangement of the calcareous septa, which alternate with the fleshy septa of the polyp itself. (3) Actinaria, which differ chiefly from the madreporaria in the absence of all calcareous skeleton. The polyps are usually solitary, and are commonly known as sea-anemones. (See Bunodes, Gemmacea, and Actiniidæ.) All the hexacorallia (which are also often called hexactinaria or zoantharia) are marine. J. S. Kingsley.

**Hexactinaria**: See Hexacorallia.

**Hexagonal System**: See Crystallography.

**Hexam'eter** [readapted to Lat. from M. Eng. *exametron*, from Lat. *hexa'metrum* = Gr. ἑξάμετρον, neut. of ἑξάμετρος, having six measures; ἑξ, six + μέτρον, measure]: properly *dactylic hexameter*, called also *heroic hexameter*, or *verse*; is the meter used by the Greeks from the earliest times and by the Romans, beginning with Ennius, in epic poetry, such as Homer's *Iliad* and *Odyssey*, and Vergil's *Æneid*. It consists of six feet, as its name suggests. Each of the first four is either a dactyl or a spondee; the fifth is regularly a dactyl, but sometimes a spondee (in which case the verse is called "spondaic"); the sixth always a spondee or trochee. As the last syllable of a verse is "*anceps*," i. e. may be either long or short, it makes no difference in practice whether the last foot of this verse be regarded with some as a spondee (— —), or with others as a trochee (— ⏑), i. e. a catalectic dactyl (— ⏑ ∧).

The verse consists of two *cola*, or members, and hence always has a verse-cæsura. This cæsura does not fall in the middle (*diæresis*), but falls regularly in the third foot, either (*a*) after the first long ("male" cæsura) or (*b*) between the two short ("female" cæsura), but not rarely (*c*) after the first long of the fourth foot. Sometimes, especially in pastoral poetry, a diæresis (*d*) between the fourth and fifth feet serves as main ("bucolic") cæsura. Accordingly, the general scheme, exhibiting all the main cæsuras simultaneously, is

— ⏑⏑ —⏑⏑ —,⏑⏑⏑ —,⏑⏑, — (⏑⏑) — ⏑.

Verses without a cæsura are very rare and inelegant, as are also verses composed entirely of spondees.

The following examples illustrate the special forms the verse may assume:

(*a*) O fōrmōsĕ pŭĕr, ‖ nĭmĭūm nē crēdĕ cŏlōrī.
(*b*) Nīl nōstrī mĭsĕrērĕ? ‖ mŏrī mē dēnĭquĕ cōgēs.
(*c*) Mīrāntūr dōn(a) Ænēæ, ‖ mīrāntŭr Iūlŭm.
(*d*) Insānīrĕ lĭbēt | quŏnĭām tĭbĭ, ‖ pōcŭlă pōnăm.
(*Spondaic.*) Pōst vēntō crēscēntĕ ‖ măgīs măgĭs ĭnerrēbēscūnt.

The hexameter, combined with the Pentameter (*q. v.*), formed the Elegiac Distich (*q. v.*).

The hexameter arose from the welding of two shorter series, and traces of the origin are discernible in the Homeric poems, e. g. in

ἀλλ' ἀκέουσα κάθησο, | ἐμῷ δ' ἐπιπείθεο μύθῳ (*Il.*, i., 565), and
νῦν δ' ἄγε νῆα μέλαιναν | Ϝερύσσομεν εἰς ἅλα δῖαν (*Il.*, i., 141).

It is also to be noted that in Homer the cæsura after the short syllable in the third foot, as in the first line of the *Odyssey*,

Ἄνδρα μοι ἔννεπε, Μοῦσα, | πολύτροπον ὃς μάλα πολλά.

is somewhat more common than the break after the long syllable in the same foot, which is the favorite cæsura in Latin, as in the first verse of the *Æneid*:

Arma virumque cano | Troiæ qui primus ab oris.

Not too long to make unity impossible nor so short as to fatigue by repetition, the hexameter is admirably adapted to continuous composition, and the variety of longs and shorts, of breaks and pauses, by allowing the most diverse effects under the same rhythmical movement, has made of the hexameter in classical literature a wonderful vehicle for the conveyance of poetical thought from the majestic roll of the epic to the familiar amble of didactic and satiric verse. The general movement is common to the Indo-Germanic race, and the attempt to naturalize the hexameter in modern language is perhaps due to something deeper than imitation and affectation, but it must be borne in mind that ordinary English hexameters—certainly such as we find in Longfellow's *Evangeline*—are simple stress-verses in which quantity is neglected, often to the utter effacement of the stress itself. See Meter and Rhythm.

**Hex'apla** [= Gr. (τὰ) ἑξαπλᾶ, neut. plur. of ἑξαπλοῦς, sixfold; ἑξ, six + -πλόος, -fold]: a celebrated edition of the Old Testament presenting the original Hebrew, the Hebrew in Greek letters, the Septuagint, and the Greek versions of Aquila, Symmachus, and Theodotion. Besides these, there were columns containing parts of three other Greek versions, whose authors are not known. Origen was the author of this great work, which he originally prepared as a tetrapla, giving four columns only. The *Hexapla* had also marginal notes, and marks indicating variations, retrenchments, and additions in the texts. The *Hexapla* is not extant except in fragments, of which the most complete edition of the Septuagint fragments is that of the Benedictine Montfaucon (2 vols. folio, Paris, 1714), and F. Field (2 vols., London, 1867–74). Revised by S. M. Jackson.

**Hexap'oda** [Mod. Lat., from Gr. ἕξ, six + πούς, ποδός, foot]: the name of the group commonly called insects from the fact that they have six appendages adapted for walking. See Entomology. J. S. K.

**Hex'ateuch** [from Gr. ἕξ, six + τεῦχος, tool, implement, book]: the first six books of the Bible, viz., Genesis, Exodus, Leviticus, Numbers, Deuteronomy, and Joshua—recently so called. The first five of these have long been called the Pentateuch. This name, introduced by early Christian writers, was appropriate, since these five formed a distinct division of the Jewish Scriptures called the Torah or Law, and were believed to have been written by a single author, Moses. Now, however, it is claimed as a well-established result of biblical study that these books were not written by Moses, but that they are a compilation from four principal documents by later writers, and that the book of Joshua belongs with them, the six books forming a literary unit properly entitled the Hexateuch.

*The Higher Criticism.*—This result has been reached by that form of historical and literary investigation commonly called the higher criticism, whose special object is to ascertain the age and authorship of writings. The principles of this criticism are such as these: A writing can not be earlier than its historical allusions. Marked differences in language, style, and thought, especially when they concur in the treatment of the same subject, imply different writers. Silence concerning a writing under circumstances where it would naturally be mentioned implies its non-existence.

*The Beginnings of the Criticism.*—Whenever, after the Babylonian captivity, the Jewish canon of Sacred Scriptures was formed, the Pentateuch was received as the work of Moses. This opinion passed into the Christian Church. Early, however, it was noticed that these books contained passages inconsistent with Mosaic authorship. This seems to have been gently expressed by Jerome (d. 420), who said, "Whether you choose to say that Moses was the author of the Pentateuch or that Ezra was the restorer, I have no objections." During the Middle Ages attention was also called to this fact by Jewish scholars, directly by Isaac ben Suleiman (d. 940 A. D.), and obscurely by Ibn Ezra (d. 1167 A. D.). But neither the early centuries nor the Middle Ages were at all favorable to investigations of this nature. Not until the seventeenth century were these passages systematically pressed to their conclusion (although in the previous century Carlstadt (d. 1541), a Protestant scholar, had openly denied the Mosaic authorship of the Pentateuch on the ground of its diction, and Andreas Masius (d. 1573), a Roman Catholic, regarded the apparently post-Mosaic passages insertions by Ezra). Then three writers—Hobbes (d. 1679), the English philosopher, Peyrere (d. 1676), a French Roman Catholic priest, and Spinoza (d. 1677), the distinguished scholar of Jewish race—all about the same time and independently of each other, made these passages a reason for the rejection of the Mosaic authorship.

*Passages Inconsistent with Mosaic Authorship.*—The leading ones which they presented were these—Gen. xii. 6: "The Canaanite was then in the land." This implies that

the writer wrote after Joshua's conquest, when the Canaanite was no longer in the land. Gen. xiv. 14: "And he pursued as far as Dan." Dan, however, did not receive its name until long after Moses's death. Gen. xxxvi. 31: "Before there reigned any king over the children of Israel." This implies an author after the establishment of the Jewish monarchy. Ex. xvi. 35: "Did eat the manna forty years . . . until they came unto the borders of the land of Canaan." This was after Moses's death (see Josh. v. 12). Deut. i. 1: "Beyond Jordan" must have been written by one west of the Jordan. Deut. ii. 12: "As Israel did unto the land of his possession," i. e. Canaan W. of the Jordan. The references to Og's bedstead (Deut. iii. 11), and to the name Havvoth-jair," with the expression "unto this day" (Deut. iii. 14), and to "the book of the wars of Jehovah" (Num. xxi. 14), could scarcely have been made by Moses. Deut. xxxiv. 10, "And there hath not arisen a prophet since in Israel like unto Moses," and Num. xii. 3, "Now the man Moses was very meek," imply a later or another writer than Moses.

*The Pentateuch not Written by a Single Author.*—The next phase of the question of the authorship of the Pentateuch arose from the observation (provoked, especially at first, by Richard Simon (d. 1712), an eminent French scholar, sometimes named the father of biblical introduction) of the repetitions, diversity of style, and lack of order in the Pentateuch, which precluded its composition by a single author. The real beginning, however, of scientific investigations in this direction was made by Jean Astruc (d. 1776), a French physician, who, led by the fact that in certain sections of Genesis the name of God is Elohim and in other sections Jehovah, distinguished two principal documents in the book, called the Elohistic and Jehovistic, and their writers the Elohist and the Jehovist. This discovery was confirmed and brought particularly to the attention of German scholars, who have been the most fruitful investigators of this subject, by their countryman Eichhorn (d. 1827). The proof of these documents is seen in the repetitions of Genesis; the double accounts of the creation, Gen. i.–ii. $4^a$ and ii. $4^b$–25; of the cause and announcement of the flood, vi. 9–13 and vi. 5–8; of the summons to enter the ark, vi. 18–21 and vii. 1–3; of entering, vii. 13–16 and vii. 7–9; of the promise not to bring a second flood, ix. 8–17 and viii. 20–22; of the promise of seed to Abraham and the establishment of a covenant, xvii. 1–14 and xv. 1–20; of the promise and name of Isaac, xvii. 15–19 and xviii. 1–15; of the destruction of Sodom, xix. 29 and xix. 1–25; of the expulsion of Hagar, xxi. 8–21 and xvi. 4–13; of the name of Beersheba, xxi. 22–32 and xxvi. 25–33; of Jacob's going to his uncle Laban, xxviii. 1–5 and xxvii. 1–45; of the name Bethel, xxxv. 13–15 and xxviii. 16–19; of Issachar, xxx. 16–18; of Zebulun, xxx. 20; of Joseph, xxx. 23 f.; of Israel, xxxv. 9–10 and xxxii. 22–28. (In this list, where two distinct passages are given, that of the Elohist is placed first.) These double narratives differing in the use of the divine name have also concurrent differences in language, style, and thought, and thus plainly point to two or more writers. Astruc and Eichhorn found two, the Elohist and the Jehovist, with some minor insertions from other sources. They both believed these writers to have been pre-Mosaic, and that Moses had used their productions. Thus the real Mosaic authorship of the Pentateuch was not denied by them. Eichhorn also noticed a lack of orderly arrangement in the contents of the three following books of the Pentateuch.

*The Fragmentary Hypothesis of the Pentateuch and the Repetitions in the last Four Books.*—The lack of unity in the Pentateuch was next presented by Geddes (d. 1802), Vater (d. 1826), and others in the form of the "fragmentary hypothesis." Its advocates held the Pentateuch to be composed of pre-Mosaic, Mosaic, and post-Mosaic fragments by various authors, which were gradually brought together and finally received their present form near the time of Solomon or as late as the captivity. While this view of many fragments was an extreme one, to its authors belongs the merit of having called attention more particularly to the evidences of a diversity of authorship in the books subsequent to Genesis. Among these are the two accounts of the announcement of the name Jehovah, Ex. vi. 2–7 and iii. 1–15; of Moses and the signs given him, vi. 14–vii. 9 and ii., 1 f., iv. 1–9; of the unleavened bread at the Exodus, xii. 9 and xii. 39; of the name of Moses's father-in-law, of the naming of his son, and of his wife's position in respect to Egypt, xviii. 1–6, and ii. 18–22, iv. 20; of the position of the tabernacle, within the camp, Num. ii. 17, without the camp, Num. xi. 23–27, xii. 4; of the ark, in the midst of the host, Num. x. 11–28, before the host, vs. 33–36.

These books contain also three sets of laws—Ex. xx.–xxiii., Leviticus, with related parts of Exodus and Numbers, and Deut. xii.–xxvi., which not only repeat many enactments but some of them in a decidedly different form. For example: In Ex. xxi. 2–7 the maidservant is not to be released like the manservant, but in Deut. xv. $17^b$ she is to be treated like the manservant. In Ex. xxii. 31 a torn animal is forbidden to be eaten, but is to be given to the dogs; in Deut. xiv. 21 that dead of itself is forbidden to be eaten, but may be given to the stranger to eat or sold to the foreigner; in Lev. xvii. 15 there is no prohibition, but every one eating of either of these, whether homeborn or stranger, shall simply purify himself and be unclean until the evening. In Deut. xviii. 3 the portion of the priest is "the shoulder, the two cheeks, and the maw"; in Lev. vii. 34 it is "the right thigh or shoulder" and "the wave breast." In Deut. xii. 6, 17 ff., xiv. 22–29 the tithes are eaten by the offerer; in Lev. xxvii. 30–33, Num. xviii. 21–29 they are given to the Levites, who in turn give tithes to the priests. (Further differences are mentioned below.) It was also noticed (by Geddes) that the Book of Joshua is a continuation of the Pentateuch, and thus belonged with the other five books. Subsequent investigations have fully confirmed this view. The casual reader even can not but notice that in language and style the first chapter is thoroughly one with Deuteronomy.

*The Supplementary Hypothesis.*—The fragmentary hypothesis was soon shown by Ewald (d. 1875) and others to be untenable, contradicting the too plain unity of the Pentateuch, and there was a return to the two writers of Genesis, the Elohist and the Jehovist, or Jahvist, whose work was shown to extend also through the other books of the Hexateuch, except in the case of Deuteronomy, which was naturally assigned to another writer, whose hand was seen in the Book of Joshua. This view was called the "supplementary hypothesis," because the Hexateuch was supposed to have been formed by writers supplementing or adding to one fundamental original writing. This was presented in various forms by many scholars, among whom may be mentioned de Wette (d. 1849), Bleek (d. 1859), Stähelin (d. 1875), Knobel (d. 1863), but generally the agreement was that the oldest document was the Elohistic, usually believed to have been written by a priest of the eleventh or tenth century B. C., containing, however, genuine Mosaic legislation, and then that this work was supplemented by the Jehovistic writer one or two centuries later, whose work was also supplemented in turn by the Deuteronomist (the author of Deuteronomy) living in the seventh century, who also, with the use of earlier Elohistic and Jehovistic material, wrote the Book of Joshua, and possibly was the compiler of the Hexateuch.

*The Documentary Hypothesis.*—It was soon clearly pointed out, however, especially by Hupfeld (d. 1866), that the Elohistic document was not a unit (this had previously been asserted by Ilgen (d. 1834) and slightly indicated by others), but that in its narrative portions must be recognized the hand of another writer (the younger Elohist) much resembling the Jehovist, and that these two writers had written independently of each other, and that their writings had been combined before their union with the underlying Elohistic or priestly document. This conclusion has been generally accepted, and thus we have the "documentary hypothesis" of the Hexateuch, i. e. the Hexateuch is a compilation from four leading documents: the underlying Elohistic or priestly document, sometimes called the "Priests' Code," and indicated by P; the Jehovistic, J; the other (younger) Elohistic, E; their combination, J E; and the Deuteronomic, D; and the formula of the Hexateuch is (P J E D) R. The letter R represents the final compiler, or editor, *Redacteur* as German writers call him. These letters are used interchangeably for the writers or their writings.

*The Leading Characteristics of the Documents.—P*: The principal document P is the framework of the Hexateuch, the part exhibiting its unity, and was composed upon a distinct plan. "Not only is the narrative constructed with a careful and uniform regard for chronology, but the history advances along a well-defined line marked by a gradually diminishing length of human life, by the revelation of God under three distinct names—Elohim, El Shaddai, and Jehovah, by the blessing of Adam with its characteristic conditions, and by the subsequent covenants with Noah, Abraham, and Israel, each with its special 'sign'—the rainbow,

the rite of circumcision, and the Sabbath." Wherever possible a concrete picture is given with definite figures and proportions. To P belong the precise measurements of the ark, of the tabernacle, the precise arrangement of the tribes on their march, their census, their exact gifts for the tabernacle, and the definite spoil taken from the Midianites. Its literary style is strongly marked, being rigid, stereotyped, verbose, and repetitious, reminding one constantly of a legal document. The Levitical legislation of the Hexateuch belongs to it.

*J, E, and D.*—The two writings J and E have much in common. To them belong most of the stories of the Hexateuch. Their style is free, flowing, and picturesque. Both are also prophetic in character. So much are they alike that at times they are with difficulty distinguished. The fact of their separate existence is seen in the repetitions of Genesis mentioned above. The work of the Deuteronomist appears plainly in the books of Deuteronomy and Joshua, and requires no further description than to observe its hortatory style. Save possibly in the case of a few verses, it is confined to these two books.

*The Limits of the Documents.*—In respect to the limits of these documents those accepting them are in some minor details not agreed, although they are in respect to their general outlines. Some parts of the Hexateuch are with difficulty assigned to any of the four writers. There is a tendency among some scholars to refine this criticism excessively, and to point out beside P, J, E, D, and R, $P^1$ $P^2$, $J^1$ $J^2$, $E^1$ $E^2$, $D^1$ $D^2$, $R^1$ $R^2$, etc. Such results, however, must be received with caution, for while a compiled or frequently reedited literary product of great antiquity like the Hexateuch must neeessarily contain the work of many writers, it is a very difficult and delieate process to point them all out.*

* The following analysis of the Hexateuch is taken from Driver's *Old Testament Introduction*, and is fairly representative:

P = Genesis i., 1—ii.. $4^a$. v., 1-28. 30-32. vi., 9-22. vii., 6. 7-9 (in parts). 11. 13-$16^a$. 18-21. 24. viii., 1-$2^a$. $3^b$-5. $13^a$. 14-19. ix., 1-17. 28-29. x., 1-7. 20. 22-23. 31-32. xi., 10-27. 31-32. xii., $4^b$-5. xiii., 6. $11^b$-$12^a$. xvi., $1^a$. 3. 15-16. xvii., xix., 29. xxi., $1^b$. $2^b$-5. xxiii., xxv., 7-$11^a$. 12-17. 19-20. $26^b$. xxvi., 34-35. xxvii., 46—xxviii., 9. xxix., 24. 29. xxxi., $18^b$. xxxiii., $18^a$. xxxiv., 1-$2^a$. 4. 6. 8-10. 13-18. 20-24. 25 (partly). 27-29. xxxv., 9-13. 15. $22^b$-29. xxxvi.,* xxxvii., 1-$2^a$. xli., 46. xlvi., 6-27. xlvii., 5-$6^a$ (LXX). 7-11. $27^b$-28. xlviii., 3-6. 7 ? xlix., $1^a$. $28^b$-33. l., 12-13.

Exodus i., 1-7. 13-14. $23^b$-25. vi., 2—vii., 13. 19-$20^a$. $21^b$-22. viii., 5-7. $15^b$-19. ix., 8-12. xii., 1-20. 28. $37^a$. 40-51. xiii., 1-2. 20. xiv., 1-4. 8-9. 15-18. $21^a$. $21^c$-23. 26-$27^a$. $28^a$. 29 (xv., 19).† xvi., 1-3. 6-24. 31-36. xvii., $1^a$. xix., 1-$2^a$. xxiv., 15-$18^a$. xxv., 1—xxxi., $18^a$. xxxiv., 29-35. xxxv.—xl.

Leviticus i.—xxvii.

Numbers i., 1—x., 28. xiii., 1-$17^a$. 21. 25-$26^a$ (to *Paran*). $32^a$. xiv., 1-2.* 5-7. 10. 26-38.* xv., xvi., $1^a$. $2^b$-$7^a$. ($7^b$-11). (16-17). 18-24. $27^a$. $32^b$. 35. (36-40). 41-50). xvii.—xix., xx., $1^a$ (to *month*). 2. $3^b$. 6. 12-13. 22-29. xxi., $4^a$ (to *Hor*). 10-11. xxii., 1. xxv., 6-18. xxvi.—xxxi., xxxii., 18-19. 28-32.‡ xxxiii.—xxxvi.

Deuteronomy xxxii., 48-52. xxxiv. $1^a$. 8-9.

Joshua iv., 13. 19. v., 10-12. vii., 1. ix., $15^b$. 17-21. xiii., 15-32. xiv., 1-5. xv., 1-13. 28-44. 48-62. xvi., 4-8. xvii., $1^a$. ($1^b$-2). 3-4. 7. $9^a$. $9^c$-$10^a$. xviii., 1. 11-28. xix., 1-8. 10-46. 48. 51. xx., 1-3 (except "*and* unawares"). $6^a$ (to *judgment*). 7-9 [cf. LXX]. xxi., 1-42 (xxii., 9-34).

J = Genesis ii., $4^b$-iii., 24. iv., 1-26. v., 29. vi., 1-4. 5-8. vii., 1-5. 7-10 (in the main). 12. $16^b$-17. 22-23. viii., $2^b$-$3^a$. 6-12. $13^b$. 20-22. ix., 18-27. x., 8-19. 21. 24-30. xi., 1-9. 28-30. xii., 1-$4^a$. 6-20. xiii., 1-5. 7-$11^a$ (to East). $12^b$ (from *and moved*)—18. xvi., $1^b$-2. 4-14. xviii., 1-xix., 28. 30-38. xxi., $1^a$. $2^a$. 33. xxii., 15-18. 20-24. xxiv., xxv., 1-6. $11^b$. 18. 21-$26^a$. 27-34. xxvi., 1-14. (15). 16-17. (18). 19-33. xxvii., 1-45. xxviii., 10. 13-16. 19. xxix., 2-14. 31-35. xxx., $3^b$-5. 7. 9-16. $20^b$ (*now . . . sons*). 24-xxxi., 1. 3. 46. 48-50. xxxii., 3-$13^a$. 22. 24-32. xxxiii., 1-17. xxxiv., $2^b$-3. 5. 7. 11-12. 19. 25 (partly). 26. 30-31. xxxv., 14. 21-$22^a$. xxxvii., 12-21. 25-27. $28^b$ (to silver). 31-35. xxxviii., xxxix., xlii.. 38-44. 34. xlvi., 28-xlvii., 4. $6^b$. 12-26. $27^a$ (to Goshen). 29-31. xlix., $1^b$-$28^a$. l., 1-11. 14.

Exodus iii., 7-8. 16-20. iv., 1-16. 19-$20^a$. iv., 22-vi., 1. vii., 14-18. 23. 25. viii., 1—4. 8-$15^a$. viii., 20-ix., 7. 13-21. $23^b$-34. x., 1-7. $13^b$-19. 28-29. xi., 4-8. xii., 29 f. xiii., 21 f. xiv., 5-7. $10^a$ (to *afraid*). 11-14. $19^b$-20. $21^b$ (to *dry land*). 24-25. $27^b$. 30-31. xvi., 4-5. 25-30. xvii., $1^b$-2. xix., 20-25. xx., 22-xxiii., 33. xxiv., 3-8.

E = Genesis xx., 1—17. (18). xxi., 6-$32^a$. ($32^b$). (34). xxii., 1-14. 19. 28. 11-12. 17-18. 20-22. xxix., 1. 15-23. 25-28. 30. xxx., 1-$3^a$ (to *knees*). 6. 8. 17-$20^a$. $20^c$-23. xxxi., 2. 4-$18^a$. 19-45. 47. 51—xxxii., 2. $13^b$-21. 23. xxxiii., $18^b$-20. xxxv., 1-8. 16-20. xxxvii., $2^b$-11. 22-24. $28^a$ (to *pit*). $28^c$-30. 36. xl. xli., 1—45. 47-57. xlii., 1-37. xlv., 1-xlvi., 5. l., 15-26.

Exodus i., 8-12. 15-22. ii., 1-$23^a$ (to *died*). iii., 1-6. 9-15. 21-22. iv., 17-18. $20^b$-21. vii., 17 (partly). $20^b$-$21^a$ (to *river*). 24. ix., 22-$23^a$. $24^a$. 35. x., 8-$13^a$. $14^a$. 20-27. xi., 1-3. 9-10. xii., 31-36. $37^b$-39. xiii., 17-19. xiv., $10^b$. $19^a$. xv., 1-18. 20-21. xvii., 3-6. 8-16. xviii. xix., $2^b$. 3-19. xx., 1-21. xxiv.*, (1-2). (9-11). 12-14. $18^b$. xxxi., $18^b$. xxxii., 1-8. 15-29. 30-xxxiii., 6 (in the main). 7-11. Joshua xxiv., 1-$11^a$. $11^c$. 12. 14-30. 32-33.

J E (passages which are from this source and yet can not be with confidence separated into component parts or assigned to either J or E) = Genesis (xiv.). xv. xlviii., 1-2. 8-22. Exodus xii., 21-27. xiii., 3-16. xv., 22-27. xxxii., 9-14. xxxiii., 12-xxxiv., 28. Numbers x., 29-36. xi. xii. xiii., $17^b$-20. 22-24. $26^b$-31. $32^b$-33. xiv., 3-4. 8-9. 11-25. 39-45. xvi., $1^b$-$2^a$. 12-15. 25-26. $27^b$-34. xx., $1^b$. $3^a$. 4-5. 7-11. 14-21. xxi., 1-3. $4^b$-9. 12-35. xxii., 2-c. 24. xxv., 1-5. xxxii., 1-17 (in the main). 20-27 (in the main). 34-42. Deuteronomy xxvii , 5-$7^a$. xxxi., 14-22. xxxii., 1—43. 44. xxxiv., 10. Joshua ii., 1-9. 12-24. iii., 1. 5. 10-iv., $11^a$. 15-18. 20. v., 2-3. 8-9. v., 13-vi., 27. vii., 2-26. viii., 1-29. ix., 3-$9^a$. 11-$15^a$. 16. 22-23. 26-$27^a$ (to *day*). x.. 1-7. 9-11. $12^b$-$14^a$. 15-24. 26-27. xi., 1-9. xiii., 13. xv., 14-19. 45-47. 63. xvi., 1-3. 9-10. xvii., 5. (6). 8. $9^b$. $10^b$-18. xviii., 2-6. 8-10. xix., 9. 47. 49-50.

D = Deuteronomy i.-xxvi. xxvii., 1-4. $7^b$-8. 9-10. 11-13. (14-26). xxviii. xxix.-xxx. xxxi., 1-13. 23-30. 45-47. (xxxiii.). xxxiv., $1^b$-7 (in the main). 11-12. Joshua i. ii., 10-11. iii., 2-4. 6-9. iv., $11^b$-12. 14. 21-24. v., 1. 4-7. viii., 30-35. ix., 1-2. $9^b$-10. 24-25. $27^b$. x., 8. $12^a$. $14^b$. 25. 28-43. xi., 10-23. xii. xiii., 1-12. 14. 33. xiv., 6-15. xviii., 7. xx. (4-5). ($6^b$). xxi., 43-45. xxii., 1-6. (7-8). xxiii. xxiv., $11^b$ (to *Jebusite*). 13. 31.

* In the main.

† The verses and chapters placed in parentheses appear due to the compilers, or their assignment is doubtful, or they are from other independent sources.

‡ With traces in xxxii., 1-17. 20-27.

*The Dates of the Documents.*—The history of the criticism of the Hexateuch has been traced thus far with only slight allusion to the dates given its various parts, and to the bearing of the history of Israel on this problem. That the Hexateuch has been proved to belong to a much later age than that of Moses we have already indicated. Especially fruitful in this proof were the investigations of de Wette and Ewald. Until recently P, as we have seen, was regarded as the oldest portion. Now, however, the majority of critics regard it as the latest. The reason for this change of view is obvious. The criticism which discovered the documents was primarily literary. They were discovered by literary features—differences in language, style, and thought. Their date, however, so unchanging was the Hebrew language, must be primarily determined by their relation to the history and literature of Israel. In the examination made from this point of view a corresponding development in the three legal codes of the Hexateuch and in the history and literature of Israel has been observed. (The researches of Graf (d. 1869), Kuenen (d. 1892), and Wellhausen are noteworthy in connection with this.) The legislation of J E (Ex. xx.–xxiii.) is the simplest, that of D next, and that of P the most elaborate and complex. Graded differences exist in many laws, especially those concerning the sanctuary and priests. J E allows sacrifice at different places (Ex. xx. 24): D insists, as though it were an innovation, upon one place (Deut. xii. 5 ff., 13 f., 26, *et al.*); while P treats the matter as though there always had been only one, or that only one were possible (Lev. xvii. 1–9). J E makes no provision for a priesthood, but apparently assumes that an Israelite of any tribe might perform that office. D assigns the duties of the priesthood to the Levites. P draws a sharp line of distinetion between other Levites and the sons of Aaron, who alone could be priests. D represents the Levites as poor, the recipients of charity, P as well endowed with cities and pastures, and the recipients of a stated revenue, the tithes. Similar differences in respect to the regulations concerning tithes, offerings, and feasts also appear. An examination of the historical books—Judges, Samuel, and Kings—reveals a corresponding development in the history of Israel. In the early times sacrifices were not confined to one place. This was not attempted until the reigns of Hezekiah and Josiah. But during the exile and after nothing else was thought of. In the early times the functions of the priesthood were performed by others than Levites. (Samuel, aceording to the earliest aceount, was not a Levite, and David's sons were priests, 2 Sam. viii. 18.)

The literature of Israel gives a similar testimony. In the writings of the early prophets Amos, Hosea, and Isaiah, there is no clear acquaintance with any other history or legislation than that of J E, while Jeremiah and the books of Kings, probably both of the same date, show a manifest acquaintance with D, and Ezekiel and the post-exilic literature generally, especially Chronicles, show a marked acquaintance with P, being thoroughly of its spirit. Another line of evidenee for the late date of P is seen in the ideal character of its historical portions, in which partieular it strikingly resembles Chronicles. Instead of being the most trustworthy portion of the Hexateuch, P has on critical examination been proved to be the least reliable in its historical statements; inferentially, then, it is the latest of all the documents.

Hence the conclusion has been reached that the order of the documents is (J E) D, P. J and E are regarded not later than 750 B. C. Their tone is that of the prophets of this period. They may, however, be one or more centuries earlier, but their post-Mosaic passages show that they are later than the period of the conquest of Canaan. D is not later than 621, the eighteenth year of the reign of Josiah, for it was clearly the book of the law, or in the book diseovered at that time (Josiah's reform was carried out step by step according to the prescriptions of D, 2 Kings xxiii.). It may, however, be as early as the reigns of Manasseh or Hezekiah,

but it follows J E, for its narrative and laws are clearly based upon J E. P is, then, a product of the exilic or post-exilic period. Some (Dillmann, Schrader, Nöldeke, and others), however, place P earlier than D, holding that while the exilic or post-exilic period exhibits the influence of this legislation in a marked manner, the time for its composition is earlier, yet after the centralization of worship at Jerusalem through Solomon's temple, whose priests must be recognized as the authors of P. Within P is recognized, in Lev. xvii.–xxvi., a distinct code of laws older than the remaining portions, called from their subject-matter the "laws of holiness," and designated by H.

*The Contents of the Documents Earlier than their Dates.*—These dates do not, however, necessarily represent the periods of the origin of all the laws and beliefs contained in the documents. These in many particulars may be much older, some extending back to the time of Moses. These dates rather express the periods of the closing of codes which were gradually formed and were for a long time open.

*Opposition to Modern Views of the Hexateuch.*—The views of the Hexateuch, whose rise and progress have been sketched, have been controverted from the first by Carpzov (d. 1767), Michaelis (d. 1791), Hävernick (d. 1845), Hengstenberg (d. 1869), Keil (d. 1888), and others, and both in the U. S. and in Great Britain a goodly number of biblical scholars hold to the traditional opinion of the unity and Mosaic authorship of the Pentateuch. They present in its behalf (*a*) the unbroken Jewish and Christian tradition; (*b*) the fact of the Samaritans having the Pentateuch, received, it is said, from the ten tribes who must have obtained it before the division of the kingdom, about 975 B. C.; (*c*) the acquaintance of the author of Genesis and Exodus with Egypt; (*d*) the local coloring of the desert in P and the historical coloring of the conquest in D (for example the command to exterminate the Canaanites); (*d*) the testimony of the historical and prophetical books to the history and laws of the Pentateuch; (*e*) the unity of the Pentateuch, pointing to one master mind as its composer; and (*f*) the accuracy of the Pentateuch as confirmed by modern researches in archæology and geography. And in reply to the evidence presented for the post-Mosaic authorship and documentary character of the Hexateuch it is argued: (*g*) the alleged post-Mosaic statements arise either from glosses or have been misunderstood; (*h*) the appearance of different documents is due either to documents used by Moses, different occasions and purposes of writing, or the use of amanuenses or scribes on his part; and (*i*) also in many cases their appearance is forced upon the narratives by the arbitrary process of selecting their criteria beforehand; (*j*) the differences in the codes are due to their different purposes, and to the experience of the forty years in the wilderness: the code of J E was the first rough draft of legislation given at Sinai for immediate use; P was a technical code designed especially for the priests; D was a people's code embodying changes suggested by the forty years' experience, and designed for use only after the permanent conquest and settlement of Canaan; (*k*) the neglect of D and P during Israel's early history arose not from their non-existence, but from the unsettled condition of affairs, which forbade their enforcement, and from the backsliding and failure of the people to live up to their requirements; (*l*) the correspondence between the literature of periods and certain parts of the Hexateuch arises merely from the attractiveness of those parts for the writers of those periods; (*m*) the apparent unhistorical character of portions of the Pentateuch is due to our ignorance, our ignoring the supernatural element in Israel's history, or to copyist's errors; (*n*) and finally the introduction of laws in the name of Moses and in the setting of the wilderness at a later age implies a fraud and deliberate deception inconsistent with the moral and spiritual tone of those laws and the character of the religious leaders in Israel.

*Observations on the Argument for the Mosaic Authorship and Unity of the Pentateuch.*—In regard to the points mentioned above it may be said: (*a*) Jewish and Christian traditions have often proved erroneous; (*b*) the Samaritans probably received their Pentateuch through the priest Manasseh (Josephus, *Ant.*, xi., 8) about 430 B. C.; (*c*) there was close intercourse with Egypt during many periods of Israel's history; (*d*) the local coloring of the desert in P and the historical of the conquest in D arise either from traditions and formulas coming down from those periods, or have been reproduced in good faith by later writers; (*d*) the testimony of the historical and prophetical books, as shown above, is not to the Pentateuch as a whole, and, properly considered, confirms the documentary theory; (*e*) the unity of the Pentateuch arises from the extent of P, and with this unity is a diversity proving two or more authors; (*f*) this accuracy has no bearing on *Mosaic* authorship or unity; (*g*) (*h*) (*i*) (*j*) (*k*) (*l*) (*m*), while apparently plausible, are inadequate explanations of the facts of the Hexateuch, of Israel's history and literature, and their relations to each other; (*n*) arises from a misunderstanding of the nature of ancient law: the promulgation of later laws, carrying forward or developing more ancient ones, in the name of an ancient law-giver, implies no fraud or deception, but is a necessary device, in early periods of civilization, to preserve the continuity of law; and likewise the beginnings of later institutions are in good faith assigned to early periods.

The problem of the authorship, composition, and date of the Hexateuch (Pentateuch) is thus seen to be very complex. These books present a great variety of phenomena, and that hypothesis is to be accepted which, taking all the facts into consideration, sets forth their most probable explanation. The conclusion is reached by different lines of evidence and by their cumulative force.

LITERATURE.—The literature on this subject is very voluminous. For a list of over 2,000 titles, see Bissell's *The Pentateuch, its Origin and Structure* (New York, 1885). The following are a few of the more important works, which will serve to introduce the reader to this subject: (*a*) Works favoring modern critical views: Introductions to the Old Testament by de Wette (trans. 1843); Davidson (1862–63); Bleek (trans. 1875); and Driver (1891). This last is especially to be commended. Colenso's *The Pentateuch and Book of Joshua Critically Examined* (1862, part i.; 6th ed. 1873), for treatment of historical questions. Ewald's *History of Israel* (trans. 1869), vol. i.; Wellhausen's *History of Israel* (trans. 1885), an epoch-making book in presenting the relation of the codes to the history and literature of Israel; Kuenen's *The Origin and Composition of the Hexateuch* (trans. 1886); Bacon's *Genesis of Genesis* (1892); and *The Triple Tradition of the Exodus* (1894). In these last two works Genesis and the story of the exodus are printed in different kinds of type to represent the documents. Briggs's *The Higher Criticism of the Hexateuch* (1893); a good explanation of the subject and history of the criticism. (*b*) Works defending the traditional view of the Pentateuch: Hengstenberg's *Genuineness of the Pentateuch* (trans. 1848); Hävernick's *Introduction to the Pentateuch* (trans. 1850); Green's *The Pentateuch Vindicated from the Aspersions of Bishop Colenso* (1863); Keil's *Introduction to the Old Testament* (trans. 1869); Green's *Moses and the Prophets* (1883), containing a reply to W. R. Smith's *The Old Testament in the Jewish Church*; Bissell's *The Pentateuch, its Origin and Structure* (1885), an examination of the codes to vindicate their Mosaic origin; Cave's *Inspiration of the Old Testament* (1888) contains a constructive theory of a Mosaic Pentateuch; Green's *Hebrew Feasts* (1883), directed especially against the argument of Wellhausen. (*c*) Works marking epochs in the historical criticism and the analysis of the Hexateuch: Spinoza's *Tractatus Theologico-Politicus* (Hamburg, 1670; republished in England, 1863); Astruc's *Conjectures sur les Mémoires Originaux, dont il paroit que Moyse s'est servi pour composer le Livre de la Genèse* (Brussels, 1753); Eichhorn's *Einleitung in d. Alte Testament* (1st ed. Leipzig, 1780); Vater's *Commentar über den Pentateuch* (Halle, 1802); de Wette's *Dissertatio critico-exegetica qua Deuteronomium a Prioribus Pentateuchi Libris Diversum alius cujusdam Recentioris Auctoris Opus est Demonstratur* (Jena, 1805); Ewald's *Die Composition d. Genesis kritisch untersucht* (Brunswick, 1823); Hupfeld's *Die Quellen der Genesis* (Berlin, 1853); Knobel, *Die Genesis erklärt* (Leipzig, 1852); *Exodus und Leviticus* (1857); *Numbers, Deuteronomy, und Joshua* (1861); Graf's *Die geschichtliche Bücher des Alten Testaments* (Leipzig, 1866); Colenso's *The Pentateuch and Book of Joshua Critically Examined* (part i., London, 1862); Nöldeke's *Untersuchungen zur Kritik d. Alten Testaments* (Kiel, 1869); Kuenen's *Die Godsdienst van Israel* (2 vols., Haarlem, 1869–70; English trans. 1874); Wellhausen's *Protegomena zur Geschichte Israels* (Berlin, 1883; English trans. 1885). EDWARD L. CURTIS.

**Heyne**, hīne, CHRISTIAN GOTTLOB: classical scholar; b. in Chemnitz, Germany, Sept. 25, 1729. On the recommendation of Ruhnken, he was called in 1763 to succeed Gesner at Göttingen, where he remained for fifty years till his death in 1812, during which time he succeeded in raising the reputation of the university throughout Europe. Though

once occupying the position of a philological pope, owing to his activity as a reviewer (he wrote more than 1,000 reviews) and an author, his fame declined with the appearance of the *Prolegomena* of F. A. Wolf. Heyne possessed neither the critical acumen nor the constructive genius of his great pupil, but he was the first scholar to attempt a serious and scientific explanation of Greek mythology, and, while his writings are now quite forgotten, the stimulus which he gave to philological studies generally entitles him to an honorable place in the pantheon of classical scholars. His most notable works of the many that proceeded from his untiring pen were the chiefly exegetical editions of Vergil (1775; 4th ed., by Ph. Wagner, 1833), and Homer's *Iliad*, in 8 vols. (1802), with indexes by Gräfenhan, vol. ix. (1822), to which may be added his edition of Pindar (1798, in 5 vols.), and *Opusc. Academ.* (6 vols.). See Heeren, *Christian Gottlob Heyne* (Göttingen, 1813); Hand, *Allgem. Encycl. der Wissensch. u. Künste*, sect. ii., vol. vii., p. 369 ff.; Bursian, *Allgem. deutsch. Biographie*, vol. xii., 375 ff.; and Carlyle, *On the Life of Heyne*. ALFRED GUDEMAN.

**Heyse**, PAUL: poet and novelist; b. in Berlin, Germany, Mar. 15, 1830. The son of Karl Wilhelm Heyse, a university professor and distinguished philologist, he was familiar from early youth with the best scholars and writers of Berlin. He studied under Lachmann and Boeckh, then went to Bonn, working there on the Romance languages under Diez. In 1849 and again in 1852 he journeyed to Italy, on the latter occasion ostensibly to study manuscripts in the libraries. In truth, however, he got more imaginative than philological profit therefrom. In 1854 he went to Munich, being given a place with a salary at the court of art-loving King Max. There he has since lived, though he gave up his public place and salary in 1868. Heyse's scholarly training has chiefly shown itself in translation, of which he is one of the greatest living masters in Germany. (Cf. particularly his versions of Giuseppe Giusti, 1875, and Giacomo Leopardi, 1878.) Far more important, however, is his original work. As early as 1847 his anonymously published *Jungbrunnen, neue Märchen von einem fahrenden Schüler* showed the hand of the born writer. After his return from Italy he began tentatively, and at first not altogether successfully, to produce plays, of which the list is now long: *Francesca da Rimini* (1850); *Meleager* (1854); *Die Sabinerinnen* (1859); *Ludwig der Bayer* (1862); *Elisabeth Charlotte* (1864); *Maria Moroni* (1865); *Hadrian* (1865); *Hans Lange* (1866); *Kolberg* (1868); *Ehre um Ehre* (1875); *Graf Königsmark* (1876); *Elfriede* (1877); *Die Weiber von Schorndorf* (1881); *Alcibiades* (1883); *Don Juans Ende* (1883); *Das Recht des Stärkern* (1883); *Die Hochzeit auf dem Aventin* (1886); *Getrennte Welten* (1886). At the same time that he was writing these plays Heyse was producing much else both in verse and prose. And here his success has been, on the whole, far greater. As a playwright he is too delicate, too fanciful, too poetic. He has not the gift of bringing upon the stage flesh-and-blood men and women; and his dramas suit better the library than the theater. As a romancer, however, he succeeds admirably, finding abundant opportunity for his imagination, and yet giving the reader the feeling of life and of truth to nature. His earlier tales were in verse: *Die Brüder* and *Urica* (1852); *Die Braut von Cypern* (1856); and he has always affected this *genre*, of which perhaps the best representative among his works is the romantic narrative *Thekla* (1858). In 1863 he published his *Gesammelte Novellen in Versen*; in 1867, *Syritha*; in 1879, *Die Madonna im Oelwald*. He speedily tried his hand, however, at *Novellen* in prose; and from 1855, when the first collection of these appeared, down to 1886, no less than eighteen volumes of them were published. In all his tales Heyse shows great literary power. His style is often very beautiful, and he has the rare art of giving to every piece its own atmosphere, its own inner *raison d'être*. Often, to be sure, his themes are remote from the moral purposes of the actual world, but when this is not the case—for example, in *Marion* or *La Rabbiata*—his success is complete. The *Tendenz* element in Heyse, however, has been too strong to be kept out of sight. Essentially a modern pessimist, an intellectual follower of Strauss in religion, and of Schopenhauer in philosophy, he has striven to find a faith for himself in the service of beauty, and has not hesitated to show his scorn of the conventional beliefs of others. All this appears in his two longer romances, *Die Kinder der Welt* (1873) and *Im Paradiese* (3 vols., 1875). Both are written with rare ability, and have found multitudes of readers; but few imaginative productions of modern Germany have caused more bitter discussion. Besides all these works, we must mention three collections of poems: *Das Skizzenbuch* (1877); *Der Salamander, ein Tagebuch in Terzinen* (1879); and *Verse aus Italien* (1880). Heyse's *Gesammelte Werke* have been appearing in Berlin since 1871 (twenty-one volumes up to 1886). A. R. MARSH.

**Heyward**, hā'ward, THOMAS, Jr.: a signer of the Declaration of Independence; b. in St. Luke's parish, S. C., in 1746; the son of a wealthy planter, Col. Daniel Heyward. The son studied law in London, and was early and prominently connected with the Revolutionary movement in North Carolina. He was (1775–78) a delegate to Congress, and was afterward a judge in his native State, holding also a military command. He was (1780–81) a prisoner in the hands of the British at St. Augustine. He was a member of the constitutional convention of 1790. D. in St. Luke's parish, Mar. 6, 1809.

**Heywood**: town of England; in Lancashire, on the Roach; 9 miles N. of Manchester (see map of England, ref. 7–G); has large iron-foundries and extensive manufactures of cotton fabrics, woolens, machinery, and chemicals. Pop. (1891) 23,286.

**Heywood**, THOMAS: English dramatist and miscellaneous writer from the latter part of the sixteenth and the first part of the seventeenth century; the exact dates of his birth and death are not known. He was born in Lincolnshire and educated at Cambridge. At one time he was a member of the lord admiral's company of players. The first of his dramas, so far as known, dates from 1596; the last from 1655. Twenty-three dramas by him have come down to us (*A Woman Killed with Kindness* (1607); *Fortune by Land and Sea* (1655); *The English Traveler*, *The Fair Maid of the West* (1631), etc.); they were printed by the Shakspeare Society in 1874 (6 vols.) with notes and illustrations. Besides dramas, he wrote *Troia Britannica*, containing a universal chronicle from the creation of the world to the date of publication (1609); *An Apology for Actors* (1612); *England's Elizabeth: Her Life and Troubles from the Cradle to the Crown* (1631); *The Hierarchy of the Blessed Angels* (1635); *The Life of Merlin, surnamed Ambrosius* (1641), etc.

**Hezeki'ah** [Heb., strength of the Lord]: the thirteenth monarch of Judah; son and successor of Ahaz, a devout man, a severe enemy of idolatry, and the restorer of the ancient worship. He warred successfully against the Philistines, and refused to pay the tribute established by Tiglath-Pileser, King of Assyria. According to the biblical data, his twenty-nine years were B. C. 723 to 695 inclusive, the numerals given in the marginal Bibles being, for his reign, too large by three. The Assyrian records treat of this period very fully (see Schrader's *Cuneiform Inscriptions*, and other like works), and opinions differ as to the order of the history; but the following cast harmonizes all the known facts. In Isaiah xxxvi.–xxxvii., 2 Kings xviii.–xix., we have an account of Hezekiah's relations to Sennacherib from before Hezekiah's fourteenth year, 710 B. C., to the death of Sennacherib, 681 B. C., six years after that of Hezekiah. In Isaiah xxxviii.–xxxix., 2 Kings xx., is an account of the illness of Hezekiah, 710 B. C. The chronological place for this account would be just before Isaiah xxxvi. 2, 2 Kings xviii. 17, with which verses begin an account of events which the Assyrian records date in 701 B. C. and later.

Sargon captured Samaria and reimposed tribute 722 B. C. He captured and destroyed Samaria, after three years' siege, 718 B. C. He conquered Hezekiah's Philistine allies 711 B. C. The following year he marched to Babylon, but his son Sennacherib captured the cities of Judah, and imposed a fine of 300 talents of silver and 30 of gold, 2 Kings xviii., 13–16. Later, in 701 B. C., Sennacherib again invaded Judah, proposing to deport the inhabitants, 2 Kings xviii. 32. He was diverted from laying siege to Jerusalem by the approach of Tirhakah, 2 Kings xix. 9. He defeated Tirhakah, but was compelled by circumstances to return to Nineveh, and therefore compromised with Hezekiah, receiving from him a tribute which included 800 talents of silver and 30 of gold. At some subsequent time and place not mentioned, Jehovah's angel destroyed the 185,000. (The deliverance was not to be sudden, but was to occupy more than a year, 2 Kings xix. 29–30. "That night," therefore, verse 35, does not mean the night after the prophecy was uttered, but means that night, whenever it was, when Jehovah fulfilled his threat.) Except during these two periods of invasion, the reign of Hezekiah appears to have been, in the main, peaceful and prosperous. WILLIS J. BEECHER.

**Hiawatha**, hī-a-waa'tha: city; capital of Brown co., Kan. (for location, see map of Kansas, ref. 4-J); on the Mo. Pac. and the St. J. and Gr. Is. railways; 42 miles W. of St. Joseph. It is in an agricultural and stock-raising region, and has several grain elevators, steam flour-mill, four periodicals, an academy, and a public library. Pop. (1880) 1,375; (1890) 2,486; (1900) 2,829. EDITOR OF "WORLD."

**Hibernation**, or **Hybernation** [from Lat., deriv. of *hiberna're*, hibernate, pass the winter, deriv. of *hiber'nus*, belonging to winter, deriv. of *hi'ems*, winter]: a condition into which certain mammals (such, for example, as some of the bats, rodents, insectivores, bears, etc.) and many inferior animals, both vertebrate and invertebrate, pass in cold weather, the temperature of the blood being lowered nearly to that of the air, and many of the vital functions entering a state of abeyance. The power of the will over the muscles is quite suspended, and respiration is nearly abolished, while the muscular irritability in the case of the higher hibernating animals is remarkably increased. Meanwhile a very great loss of weight occurs from the slow destruction of the store of fat which the animal has laid up in the autumn. It is evident that animals feeding on insects and succulent vegetables could never survive a northern winter but for the state of hibernation which suspends the need of food. Accordingly, while northern bats and some bears hibernate, those of tropical regions do not.

Somewhat analogous to hibernation is the long slumber which many reptiles, mollusks, and other inferior organisms undergo during the dry season in very hot countries. The animal becomes more or less completely desiccated, and from the loss of moisture the functions of life are suspended. This suspension also serves to preserve animal life in very untoward conditions. Revised by F. A. LUCAS.

**Hiber'nia**, **Iber'nia**, **Iver'nia**, and **Ier'ne**: the names under which Ireland is mentioned by the ancient writers—by Aristotle, Diodorus Siculus, Strabo, Pomponius Mela, Pliny, and Ptolemy. See IRELAND.

**Hibis'cus** [Mod. Lat., from Lat. *hibis'cus* = Gr. *ἰβίσκος*, mallow]: a large genus of malvaceous trees, shrubs, and herbs, often with large and showy flowers. The herbaceous species are numerous in the U. S., and are known as rose-mallows. Among the cultivated species are the GUMBO (*q. v.*), the *H. cannabinus*, or Deccanee hemp of India, a useful fiber-plant, and *H. syriacus*, the ornamental, shrubby althæa of gardeners. Other species, mostly tropical, are cultivated for their fruit or seeds or the beauty of their flowers. One of the most interesting species is *Hibiscus tiliaceus*, a very large but not tall tree, growing in Florida, the East and West Indies, and the South Sea islands. Its wood is light, tough, and very useful; its bark yields material for matting and cordage, and the same bark is used as food in the Pacific islands. Revised by CHARLES E. BESSEY.

**Hiccough**, hik'kŭp, or **Hiccup** (in Lat. *singultus*): a clonic spasm of the diaphragm and of the glottis, accompanied by a sharp sound, produced by the rush of air into the larynx from without. It may attend an over-distension of the stomach with food, and sometimes accompanies intoxication. In young children it often is the forerunner of intestinal disturbances. When persistent, it is, in some diseases, such as low fevers, peritonitis, and gangrene, a rather grave symptom. Lumps of ice frequently swallowed or small doses of antispasmodic medicines will usually relieve obstinate hiccough. Revised by WILLIAM PEPPER.

**Hickman**: town; capital of Fulton co., Ky. (for location of county, see map of Kentucky, ref. 5-B); on the Mississippi river, and the Nash., Chat. and St. L. Railway; 36 miles S. of Cairo, 56 miles S. W. of Paducah. It contains a college, town library, steam flour-mills and sawmills, two stove-factories, carriage and wagon factory, box-factory, and weekly newspapers. Pop. (1880) 1,264; (1890) 1,652; (1900) 1,589. EDITOR OF "COURIER."

**Hick'ok**, LAURENS PERSEUS, D. D., LL. D.: theologian and philosopher; b. at Bethel, Conn., Dec. 29, 1798; graduated at Union College 1820; ordained and settled as pastor of the Congregational church at Kent, Conn., 1824; installed pastor at Litchfield, Conn., 1829; became Professor of Theology in the Western Reserve College 1836, and in the Auburn Theological Seminary 1844; was again transferred to Union College as vice-president and Professor of Mental and Moral Philosophy 1852, where for eight years he was associated with Dr. Nott in the government and discipline of the college, and where for the eight years succeeding he had sole charge, being officially inducted into the presidency only at Dr. Nott's death, 1866. Besides occasional sermons and addresses, he was a frequent contributor to such periodical publications as *The Christian Spectator*, *Bibliotheca Sacra*, *Biblical Repository*, *Presbyterian Quarterly*, etc., on various theologieal and philosophical themes. His more extended published works are *Rational Psychology* (Auburn, N. Y., 1848); *System of Moral Science* (Schenectady, 1853); *Empirical Psychology* (1854); *Creator and Creation* (Boston, 1872); *Humanity Immortal* (1872); and *Logic of Reason* (1875). His collected works were published at Boston in 1875. D. at Amherst, Mass., May 6, 1888.

Revised by S. M. JACKSON.

**Hickory** [shortened from earlier *pohickery*, the Amer. Ind. word]: the common name of trees of the genus *Hicoria*, or *Carya* (of the family *Juglandaceæ*) often erroneously called walnut-trees in New England. The hickory-trees are North American. Besides the PECAN (*q. v.*), there are four species known as shellbark or shagbark hickories, having excellent timber and nuts generally edible, the bark of the trees being very rough. The pignut or bitter hickories, on the contrary, have more generally a smooth bark, inedible nuts, and rather inferior wood. Hickory timber is excellent for handspikes, axhelves, spokes, barrel-hoops, and the like. It is prized as fuel, but will not stand the weather. The oil of the nuts is recommended for oiling clocks and delicate machinery. Most species of the hickory become noble trees, reaching a height of from 60 to 90 feet, with straight trunks and with symmetrical branches. When confined in the forest, they shoot up 50 or 60 feet without any branches; but with sufficient room they expand into lofty pyramids of bold, pinnated foliage. They have, indeed, all the qualities which are neeessary to constitute a fine park-tree, and should find their way into every large plantation. Some of the species are worthy of cultivation on account of the delieious nuts they produee. The recent changes in the nomenclature of the hickories are as follows:

| | | |
|---|---|---|
| *Hicoria pecan* | formerly | *Carya olivæformis.* |
| *H. ovata* | " | *C. alba.* |
| *H. mexicana* | " | *C. mexicana.* |
| *H. alba* | " | *C. tomentosa.* |
| *H. sulcata* | " | *C. sulcata.* |
| *H. microcarpa* | " | *C. microcarpa.* |
| *H. glabra* | " | *C. porcina.* |
| *H. minima* | " | *C. amara.* |
| *H. aquatica* | " | *C. aquatica.* |
| *H. myristicæformis.* | " | *C. myristicæformis.* |

Revised by CHARLES E. BESSEY.

**Hickory**: town (founded in 1859); Catawba co., N. C. (for location of county, see map of North Carolina, ref. 3-D); 2½ miles from the Catawba river, on the Richmond and Danville Railroad; 50 miles N. W. of Charlotte, 80 miles N. E. of Asheville. It contains the Claremont Female College, Lenoir College, St. Paul's Seminary, Meade school for boys, Baptist, Methodist, Lutheran, German Reformed, Presbyterian, and Protestant Episcopal churches, a national bank, three periodicals, electrical lights, and numerous manufactures. Corn, wheat, tobacco, and cotton are the principal productions of the surrounding country. Pop. (1880) 1,400; (1890) 2,023; (1900) 2,535.

EDITOR OF "PRESS AND CAROLINIAN."

**Hicks**, ELIAS: minister of the Society of Friends; b. at Hempstead, L. I., Mar. 19, 1748; at the age of seventeen years was placed as an apprentice to a carpenter, and became master of that trade; subsequently followed the business of building houses. In the more advanced period of his life he engaged in agriculture. When about twenty-seven years of age he began, to use his own words, "to have openings leading to the ministry," and was "deeply engaged for the right administration of discipline and order in the Church, and that all might be kept sweet and clean, consistent with the nature and purity of the holy profession which Friends made before the world." In 1781 and subsequently he visited the meetings and families of Friends extensively through the country, working at his trade in the intervals passed at home, whereby he obtained means to pay his own expenses, declining to have them borne by the society, which made provision for its traveling ministers in necessity. Such was the high esteem in which he was held by all classes of people in his neighborhood that he was frequently chosen as an umpire to settle differences. Very early in life he denounced slavery as a crime, and preached persistently against it. As early as 1811 he published a

valuable essay on the subject, and exerted constant personal influence to induce persons who held slaves to set them free. But this fell short of the measure of justice in his view, and he obtained for many of the emancipated wages for their time in addition. He was a bold and fearless preacher, both in deed and word. His religious visitations were not confined to members of his own society, but extended to distant sections of country where few such resided. His meetings were crowded by people of every sect and opinion. He was an impressive speaker, with direct and clear enunciation, of commanding presence, and profoundly serious deportment in his public appearance. He was the subject of much misrepresentation in his religious opinions by bigots and by many dissenters from the original doctrines of Friends. The name Hicksite was given as a reproach to that part of the old Society of Friends with which he continued in fellowship, but was never recognized by it or him. A journal of his religious travels was published (Philadelphia, 1828; 3d ed. 1832); *Observations on Slavery* (1811); and *Doctrinal Epistle* (1824). There have been published since his death (in Jericho, N. Y., 1830) a volume of his sermons and one volume of his letters. See FRIENDS, SOCIETY OF. Revised by F. B. GUMMERE.

**Hicks**, JOHN BRAXTON, M. D.: gynecologist; b. at Rye, Sussex, England, Feb. 23, 1823; educated privately; lecturer on obstetrics at Guy's Hospital, London, 1865; consulting obstetric physician, Guy's, in 1883; obstetric physician and lecturer 1888–92, now also consulting obstetric physician at St. Mary's Hospital, London. Author of a large number of professional essays published mainly in *Transactions of the Obstetrical Society*, London.

**Hicks-Beach**, Sir MICHAEL EDWARD: statesman; b. in London in 1837; educated at Eton and Oxford; elected member of Parliament for East Gloucestershire in July, 1864, and served the Conservative interest; was parliamentary secretary to the poor-law board in 1868, and later a member of the royal commission on friendly societies. When the Conservatives returned to power in Feb., 1874, he was appointed Chief Secretary for Ireland, and had a seat in the cabinet in 1877. He was Secretary of State for the Colonies from 1878 to 1880, and in Lord Salisbury's government he was appointed Chancellor of the Exchequer June, 1885. He was again made Chief Secretary for Ireland 1886, but resigned on account of failing sight in 1887. He was president of the Board of Trade from Feb., 1888, till the change of administration in Aug., 1892. In the latter year he was re-elected to Parliament for West Bristol.

**Hicksites**: See FRIENDS, SOCIETY OF.

**Hicksville**: village (founded in 1837); Defiance co., O. (for location of county, see map of Ohio, ref. 2–C); on the Baltimore and Ohio Railroad; 24 miles N. E. of Fort Wayne, Ind. It is surrounded by one of the finest agricultural regions in Northwest Ohio, is a center of wooden manufactures, with extensive handle-factories; and has water-works supplied by a subterranean stream, a bank, and two weekly newspapers. Pop. (1880) 1,212; (1890) 2,141; (1900) 2,520. EDITOR OF "INDEPENDENT."

**Hidalgo**, ĕe-daal′gō (named in honor of Hidalgo y Costilla, a popular Mexican patriot): one of the central states of Mexico; between lats. 19° 37′ and 21° 17′ N. and lons. 97° 58′ and 99° 53′ W.; bounded N. by San Luis Potosí, N. E. by Vera Cruz, S. E. by Puebla, S. by Tlaxcala and Mexico, and W. by Querétaro. Area, 8,917 miles. The northern part is mountainous, culminating in the Cérro Canjando, 9,380 feet high. The drainage is by the Panuco river and by the San Juan, which with its branch, the Pate, forms the western boundary. There are several small independent drainage basins, the largest being by the Metztitlan, which empties into a lagoon of the same name. The principal product is maize; others are wheat, barley, rice, cotton, sugar-cane, peas and beans, and sarsaparilla. The maguey-plant is extensively grown and large quantities of the national beverage, *pulque*, are produced. The state is most celebrated for its very rich mines of silver, iron, copper, coal, lead, sulphur, etc., the annual product from which is about $5,000,000. There are a number of cotton-factories in the state. Several railways pass through the southern part. Pop. (1890) 506,028. Capital, Pachuca.

MARK W. HARRINGTON.

**Hidalgo de Cisneros y Latorre**, ĕe-daal′gō-dā-thĕe-nā′rōs-ee-laă-tōr′rā, BALTAZAR: naval officer; b. at Carthagena, Spain, about 1755. He entered the navy in 1770, commanded vessels from 1780, and in 1792 had charge of a squadron on the coast of France. During the wars with France and Great Britain he took part in many actions, including the battles of Cape St. Vincent, Feb. 14, 1797, and Trafalgar, Oct. 21, 1805, where he was severely wounded and his ship, the Trinidad, was sunk. In 1809 the *junta* of Seville appointed him Viceroy of the Platine colonies. He took possession of the office at Buenos Ayres July 14, but his severity and high-handed measures tended to precipitate the revolution which was impending. On the fall of the *junta* of Seville it was decided that Cisnero's commission was no longer valid; a governmental board was formed, with Cisneros as one of the members; but the people compelled it to resign May 24, 1810, putting an end to Spanish power in that part of South America. Next year Cisneros was forced to leave the country. The Spanish Government exonerated him and made him *vocal* of the *junta*, and in 1813 captain-general of Cadiz. In 1818 he was made Minister of Marine and director-general of the Armada. While preparing to send a fleet to America he was deposed and imprisoned by the revolution of 1820. After his release he became councilor of state, and from Nov., 1823, was captain-general of Carthagena, where he died June 9, 1829.

HERBERT H. SMITH.

**Hidalgo y Costilla**, -kōs-teel′yaă, MIGUEL: Mexican priest and patriot; b. in the state of Guanajuato, May 8, 1753. He took orders in 1779, and after holding various other charges became curate of Dolores in his native province. In conjunction with Allende, Abasalo, and others, he planned a revolt against the Spaniards; this was finally proclaimed by Hidalgo in his church, on Sunday, Sept. 16, 1810. Thousands of country people flocked to his standard, and on the 28th he entered Guanajuato city with an undisciplined and almost unarmed mob of 50,000 men. Hidalgo had been named general, and he distributed many commissions. Marching toward Mexico he met and defeated Trujillo, who had been sent by the viceroy to stop him (Oct. 30, 1810). Instead of taking advantage of the victory he fell back toward Querétaro, and was defeated by Calleja at Aculco. He then retreated to Guadalajara, where he soon had a force of, it is said, 100,000 men, but all badly armed. With these he met Calleja's army of 5,000 regular soldiers at the bridge of Calderon Jan. 17, 1811. After a bloody struggle Hidalgo was disastrously defeated. Eight days after he resigned his command, and with other chiefs endeavored to make his way to the U. S., but he was captured Mar. 21, taken to Chihuahua, tried, condemned, and shot Aug. 1, 1811. Hidalgo is called the father of Mexican independence. He was actuated by noble motives, but lacked abilities for the difficult position in which he was placed. His record is stained by many cruelties which he permitted his followers to inflict on Spanish prisoners. H. H. S.

**Hide**: See the Appendix.

**Hides** [O. Eng. *hȳd*: O. H. Germ. *hūt* > Mod. Germ. *haut* < Teuton. *hūdi-* < Indo-Eur. *kuti-* > Lat. *cutis*, skin, hide]: in commerce, the skins of large animals, such as domestic cattle, horses, and the buffaloes of the Old World. They appear in commerce either dried, salted, or in the undried and natural state. Hides are used chiefly in the manufacture of leather, and the fragments and waste go to the glue-maker. The hair is also saved for plasterers' use, and is used to some extent in upholstery. (See also LEATHER.) *Domestic* hides are those sold in the green state, and manufactured into leather in the country where produced. The hides of general commerce are the product of South America, South Africa, Australia, India, California, Russia, etc. The hides of sheep, goats, deer, etc., are known in commerce as "skins."

**Hideyoshi**, hĕe-dā-yō′shĕe, TOYOTOMI: general and statesman; b. in Owari, Japan, in 1536. Of low birth, he gradually worked his way up to power in the troublous times of the sixteenth century civil wars, and succeeded to the power of his patron NOBUNAGA (*q. v.*). In 1586, having become virtual ruler of Japan, he caused the expulsion of Christian missionaries. He resigned his functions in favor of his son in 1591, receiving then the title of *Taiko*, which appears in the name *Taiko-Sama*, by which he is still popularly known. D. in 1598. A *Life*, by W. Dening, appeared at Tokio in 1889. J. M. DIXON.

**Hiel**, EMANUEL: Flemish poet; b. at Dendermonde, May 31, 1834. His early life was difficult and straitened. At one time he was superintendent in a cotton-factory; later, bookseller and custom-house official. Finally he obtained a

post in the Ministry of the Interior, and was made soon after Professor of Declamation in the Conservatory of Music at Brussels, as well as librarian of the Industrial Museum there. In spite of the obstacles of his career, however, he has succeeded in obtaining a pre-eminent place among modern Belgian poets, and that by work in several fields. His collections of verse, which contain much of interest, are *Gedichten* (Ghent, 1863; new series, Arnheim, 1868); *Nieuwe liedekens* (Ghent, 1861); *Bloemeken, een liederkrans* (Utrecht, 1877). His dramatic poems *Jacoba van Beieren* (1879) and *Bloemardinne* (1877) have many beauties. He has obtained much repute from his little poems for the use of children (*Liederen voor groote en kleine kinderen*), many of which were set to music by van Gheluwe (*Liedersolfege*, 1875). In a second edition others were adapted to German and Flemish popular melodies. Most important of all Hiel's works, however, are his great poems written for musical accompaniment. Such are *Lucifer* and *De Schelde* (music by Benoist), *Vrijheidshymne* (music by Hol), the oratorio *Prometheus*, and the northern legend *Helga*. In 1880 Hiel wrote for the celebration of the fiftieth anniversary of Belgian independence two fine poems, *Belgenland* and *Eer Belgenland*, which are among the best achievements of Belgian poetry in the nineteenth century. An edition of Hiel's poetical works is *Volledige dichtwerken* (3 vols., Rousselaer, 1885). A. R. Marsh.

**Hierap'olis**, or **Bamby'ce** [= Gr. Ἱεράπολις, liter., holy-town; ἱερός, strong, holy, sacred + πόλις, city]: a once splendid but now utterly ruined city of Cyrrhestica, in Syria; five days' journey from Antioch; about 25 miles S. of Carchemish, on the road to Seleucia and Babylon. It stood on a rocky, barren plain, and derived its prosperity from the caravan trade. Its palmy days were under the Seleucidæ. Extensive ruins mark its site.

Revised by J. R. S. Sterrett.

**Hierapolis**: the birthplace of Epictetus; in Phrygia, Asia Minor, between the rivers Lycus and Meander; celebrated for its warm mineral springs. Among its ruins, which are a mile and a half in circumference, is one of the most complete and best-preserved Greek theaters. The place is mentioned by St. Paul in his Epistle to the Colossians (iv. 13). Its present name is *Pambook Kalessi* (the cotton castle), which is probably derived from the singular appearance which the deposit of the springs has given to the place. It is totally deserted. Hierapolis (the sacred city) must be carefully distinguished from Hieropolis (the city of the Hieron) in the plain of Sandukli and once the home of St. Abercius. Revised by J. R. S. Sterrett.

**Hi'erarchy** [from Gr. ἱεραρχία, deriv. of ἱεράρχης, hierarch; ἱερός, sacred + ἀρχή, rule, government], or **Hierocracy** [from Gr. * ἱεροκρατία, from ἱερός + κράτος, might, authority, power]: the power, dignity, or office of a *hierarches*, a steward or president of sacred rites, one supreme in holy things, a high priest, a hierarch; especially in ecclesiastical Greek, the episcopate or patriarchate. The word is unknown to the classic Greek and to the Septuagint and New Testament (but ἱερεύς, priest, is used of Jewish priests, and metaphorically of Christians, Rev. i. 6, v. 10, etc.). In the work of the sixth century, of a Neo-Platonic cast, attributed to Dionysius the Areopagite (*q. v.*), the angelic orders are the prototypes of the ecclesiastical hierarchy. He enumerates three orders of angels, with three hierarchies in each—seraphim, cherubim, thrones; dominations, powers, principalities; virtues, archangels, angels. (See Moreri, *Dict. Historique*; Dean Colet, *On the Hierarchies of Dionysius* (1869); and Schaff, *Church History*, vol. iv., 590 *sqq.*). Milton adopts in *Paradise Lost* every one of these titles, though he does not use them all in any one place or in the order given. The word *hierarchy* came to be applied to the orders of clergy in the Christian Church—the ecclesiastical hierarchy, or to the body of priests in the various systems, in which they are regarded as divinely instituted administrators of holy things.

Among the Hebrews the hierarchy was hereditary, and its headship was in the high priest. In the Christian Church the hierarchy is the government of the Church by the clergy. It took its historical shape as the congregations increased in number and came into closer conjunction. The government of the Church is conceded to have originally been, at least relatively, popular in part (democratic hierarchy), and to have changed more and more into a spiritual aristocracy (aristocratic hierarchy). The line of historical advance is generally supposed by Protestant writers to have been from a government of perfect co-ordination among the presbyter-bishops of a congregation to the congregational and parochial episcopate, then to the diocesan episcopate. From this arose the metropolitan system, in which a governmental superiority was exercised by the bishops of the chief cities of the provinces. Then came the system of patriarchates, under which the bishops of the great sees of Rome, Constantinople, Antioch, Alexandria, and Jerusalem were recognized as patriarchs of the metropolitans. Civil events destroyed the prominence claimed for the last three. The tendency to unification remained fixed at the patriarchate in the Eastern Church, but advanced in the Western Church till it culminated in the papacy. Among the earlier representatives of this tendency was Leo. I. (440–461). In the ninth century this papal hierarchy was greatly strengthened by the false Isidorian decretals. (See Decretals, False). They systematized and professed to give historical vouchers for the tendency of the era, which made the pope a spiritual monarch, regent and lord of Western Christendom. This great hierarchy, preserving the unity of its purpose and plan amid the confusions of the Middle Ages, supplementing by moral power the feebleness of civil rule, preserved order when society without such a bond might have been reduced to chaos. From the eleventh century to the thirteenth the papacy had a political supremacy which was not successfully challenged. This it owed especially to several popes of distinguished ability and force of character. Gregory VII. (1073–85) is more readily recalled by his earlier name, Hildebrand, which made Hildebrandism the synonym of that hierarchical system of which he was so great a master. Clear in vision, iron in will, cautious and bold, he did much to subordinate the civil authority to the ecclesiastical. He made the papacy a universal theocracy of all Christian states, with the pope as Christ's vicar, by whom kings reigned; people and princes were simply, in different degrees, the virtual subjects of the pope. Innocent III. (1198–1216), in many respects the greatest of the popes, whose history is the history of his era, finished the work of Hildebrand and brought the hierarchy to the summit of its glory and power. Political independence and unlimited spiritual authority were the objects of his struggle. He brought to it the greatest qualities of Hildebrand, with others of the highest order, and the mightiest powers of Christendom bowed before him. Boniface VIII. (1294–1303), not inferior in intellectual force to his predecessors, but destitute of their nobler qualities, urged to the extremest point their principles of domination over the temporal power. As in him the loftiest assertion of the hierarchical claims to power over the state came to a crisis, so with his reign began that great reactionary movement of the fourteenth century by which that power was narrowed in various ways. His great opponent was Philip (IV.) the Fair of France (1268–1314). The pope interfered as umpire in the war between France and England, and in favor of the latter. The pope sent a legate; the king threw him into prison; the pope pronounced the king a heretic; the king called the pope a fool; the pope issued a bull; the king burned it; a council excommunicated the king, and the agents of the king seized the pope on his throne and held him captive. The Roman people said of him, "He crept in like a fox, he lorded it like a lion, and died like a dog." But harsh judgment did not cease with his death. He has been "damned to everlasting fame" by Dante, who assigns him a place in hell, as a Simonist, between Nicholas III. and Clement V. The French king came forth victorious in this conflict. Clement V. (1305–77) was the mere tool of the French policy, and formally transferred the curia to Avignon, where it remained during the "Babylonian exile." The French party elected John XXII. (1316–44). In the contest between Louis of Bavaria and Frederick of Austria for the imperial crown, John took sides against Louis. Louis was chosen by the electors; appealed to a general council against the pope; was excommunicated (1324); was crowned at Rome (1327); procured the temporary deposition of John, and the nomination, though not the permanent establishment, of Nicholas V. as a counter-pope. The residence of the popes in France, the great schism (1378–1429) with one pope at Rome, another at Avignon, for a time three popes (1409), the great reformatory councils of Pisa (1409), of Constance (1414–18), of Basel (1431–43), and the character and conduct of John XXIII. and other popes, greatly weakened the papacy. Though it seemed to come forth triumphant from the struggle, it had received deep wounds. The Church was yearning for reformation. Many symptoms of reaction from the Hildebrand

type were manifest, and at length the great struggle of the sixteenth century began.

The influence of the Reformation on the hierarchical claims was very marked. The part of European Christendom which sympathized with that movement rejected all these claims. All the Reformers, and none more radically than Luther, declared in the most uncompromising manner against the whole hierarchical system. But even in the states which adhered to the Roman Catholic Church tendencies the papal power was more and more restricted and limited by concordats. The progress of events has made the civil and hierarchical powers more completely independent of each other. Civil constitutions, the regulation of police and finance, show the influence of the modifications of the polity of the Church. See Polity, Ecclesiastical. For the latest history of the hierarchy, see Pius IX. and Leo XIII.

The *divisions* of hierarchical power made in the theology of the Roman Catholic Church may be stated thus: The authority which belongs to the Church is connected either with her agency as the distributer of divine grace and blessings, or with the preservation and control of the Church's life. In accordance with this, the power correspondent with the authority is divided either into three parts, *potestas ordinis*, *magisterii*, and *jurisdictionis* (so Walter, Hinschius, Schulte), or into two, the *potestas ordinis* (the power derived from ordination, and embracing the *potestas magisterii*, or teaching function) and the *potestas jurisdictionis*, or ruling authority. The second classification is that of St. Thomas Aquinas (Bouvier, iv., 97), and of the majority of theologians, and accords with the Catechism of the Council of Trent (ii., 7, 7). See Richter, *Lehrbuch d. K. u. L. Kirchenrecht bearb. v. Dove* (7th ed., 1874, § 91).

I. The *potestas ordinis* respects the spiritual goods, especially the sacraments, which those in holy orders are to distribute to believers. It rests in its fullness on the bishops, from whom, by ordination, it passes over to the priests in *quantitative restriction*. The sacrifice of the mass, which is the supreme point of this power, appertains to both bishops and priests, and in virtue specially of this fact the bishops and priests constitute one priestly order—*ordo*. In ancient times the deacons were aids to the bishops and priests, and at a later period for the same end there were appointed subdeacons, acolyths, exorcists, lectors, and vestiarii, all of whom receive the necessary gifts for their offices by ordination. Hence the organs of the Church in the sphere of *ordo*, the sphere of the power conferred by holy orders on bishops, priests, and ministers. Under this last name are grouped all the clergy but those of the first order, which embraces the bishops and priests. This is called the hierarchy of (holy) orders—*hierarchia ordinis*.

II. The *potestas jurisdictionis*, or governmental power, is divinely committed to the bishops and the pope. Between the diocesan bishop and the pope exist by human right the gradations of archbishops, primates, exarchs, or patriarchs. The priest, with no *potestas jurisdictionis*, exercises the *potestas ordinis* in his parish; the bishop with the *potestas jurisdictionis* rules the clergy of his diocese; the metropolitan has as his suffragans the bishops of his province; the primate ordinarily has under him several metropolitans or archbishops; the patriarch is the superior of the metropolitans; and the pope, patriarch of patriarchs, primate of primates, metropolitan of metropolitans, bishop of bishops, priest of priests, and servant of the servants of God, is earthly head of the whole Church on earth. This is the *hierarchia jurisdictionis*. See Decorde, *Diction. d. Culte Catholique* (1859), and Wetzer und Welte (2d ed. by Kaulen, 1888, vol. v., 2011).

The hierarchy of orders is of divine institution; the hierarchy of jurisdiction is of ecclesiastical institution. The former may exist without the latter, but the latter exists by virtue of the former. In the hierarchy of order respect is had to the sacramental "character" impressed in ordination; in the hierarchy of jurisdiction respect is had to degree. As regards the hierarchy of orders, the diocesan bishop and the primate are on the same level; the parish priest is the same as the vicar-general, and is the superior of the cardinals when they are deacons. It is in the hierarchy of jurisdiction the gradations exist which have been enumerated. There is also in some cases a simple honorary hierarchy. See Pascal, *Origine et Raison de la Liturgie Catholique*, article *Hiérarchie*.

The theory on which the papal hierarchy rests is that the one Catholic Church of Christ on earth is a divine monarchy, under one catholic head, the pope, who is the œcumenical pastor of all the churches. The prelates under him govern particular churches, participating in the solicitude, but not possessing the plenary power, which belongs to the pope alone. To the spiritual rule, supreme in the pope and subordinate in the prelates, the whole laity, from the humblest to the most exalted, owe obedience. In the great body of the older Roman Catholic divines who have been distinguished as defenders of the hierarchy, the names of those now most frequently quoted are Bellarmin and Petavius. (See Infallibility.) In the Roman Catholic *system* the hierarchy is usually treated of under *Ordo*, the sacrament of holy orders. Ordo is defined as (1) the ecclesiastical hierarchy, or estate of the ministers of the Church; and (2) the act by which they are constituted a part of that estate—ordination. (See Bailly, *Theol. dogm. et moral.* (Lyons, 1822), v., 340; Perrone, *Prælect. Theolog.* (Paris, 1852), ii., 439.) "It is an article of faith that there exists in the Church a plurality of orders, constituting the sacred hierarchy—to wit, the episcopate, the presbyterate, and the diaconate." (Bouvier, *Instit. Theolog.*) "If any man shall say that there is not in the Catholic Church a hierarchy instituted by divine ordination, which consists of bishops, presbyters, and ministers, let him be anathema." (Can. 6, Sess. 23, Council of Trent.) Under the "ministry" is embraced certainly the deacons. How many more, or whether any more, are included is left an open question. (Bouvier, iv., 96.) The theology of the fifth and sixth centuries, in which the priestly office was greatly exalted, is sometimes styled the hierarchical theology. Offenses against the hierarchical government are called sacrilege of the hierarchy. The *celestial* hierarchy of Cellot is the rule of the Trinity, of Christ, the Virgin, and the angels in heaven. Trevoux, *Dictionn. Universel*, 1740.

In Protestant theology the term hierarchy is sometimes used in a generic sense to designate the sacred and divine rule of the Church established by Christ. The body of Protestant divines hold that Christ instituted no hierarchy in the ecclesiastical sense, but condemned it; that he endowed his Church with no civil power; and that the functions of its teachers and officers are purely moral and spiritual. From these views many of the writers of the Church of England dissent, rejecting the papal supremacy and what is involved in it, but holding in substantials the rest of the hierarchical views of the Church of Rome. (See Blunt, *Dict. of Doctrin. and Histor. Theology*, articles *Hierarchy*, *Jurisdiction*.) The Lutheran Reformers (at Augsburg, 1530) rejected the whole theory of the hierarchy. Retaining the twofold divisions of the *potestas ordinis* and *potestas jurisdictionis*, they defined the former as covering only the ministry of the word and sacraments—the latter as involving no more than the cognizance of doctrine, the office of the keys, absolution, and excommunication; and that both powers are by divine right conferred on one and the same body of ministers, all of whom are equal. (*Augsb. Confess.*, Abus. vii.) In the official reply of the Roman Catholic divines (the *Confutatio Pontifica*) they assert over against this that "the bishops not only have the power of the ministry of the word of God, but also the power of regimen and coercitive correction." (Given in full in Franke, *Lib. Symbol.*, App. 68; Hase, do. *Prolegom.*, 84, and better in the original of the *Confutatio*, which has recently been discovered and published by Fricker, 1891, pp. 124, *sqq.*) On this the *Apology* of the Augsburg Confession (xiv., 13) says, "We are satisfied with the old division of power into the *potestas ordinis* and the *potestas jurisdictionis*." It defines both in substance as defined in the Confession. The Reformers at the same time expressed their desire to retain the canonical polity and the grades existing in the Church, even though they rested on human authority, provided the bishops would cease their cruelty to the evangelical churches.

The literature of the subject, direct and indirect, is very large. The dogmatic and polemic works of a general kind take it up. Those on the Church and the sacraments more particularly discuss it. The great names connected with special discussions of the monarchy, priesthood, power of order and jurisdiction, the papal power, and infallibility, are Sander (1571), Palatin (1794), Rocaberti, (11 vols. folio, 1695–99), Pineda (1588), Maimburg (1685), Ballerini (1776), Veith (1781), Fischer (1819), Pinel (1829), Rothensee (1836–38), Ellendorf (1841), Vestermayer (1867–70), Phillips (1888), on the Roman Catholic side. On the Protestant side may be mentioned the names of Chamier (1601), Broehmand (1628), Salmasius (1608), Calixtus (1650), Hase (1871), J. Köstlin (1880, art. *Kirche* in Herzog's *Encyc.*, vii., 695 *sqq.*).

To these are to be added the special historical works on the constitution of the Church, the hierarchy and the papacy, and works on church polity. See the articles on the different forms of church government, CONGREGATIONALISM, EPISCOPAL CHURCH, METHODISM, LUTHERANISM, ROMAN CATHOLIC CHURCH, etc.; articles on the ecclesiastical orders, BISHOP, ELDER, etc.; on ecclesiastical dignities, ARCHBISHOP, EXARCH, POPE, etc.; and on rites connected with the clerical office, INSTALLATION, INVESTITURE, etc.

Revised by PHILIP SCHAFF.

**Hi'ero** (in Gr. Ἱέρων): tyrannus of Syracuse, in Sicily; was victor at Olympia 488 B. C. (*Müller*); succeeded Gelon, his brother, in 478; conquered Naxos and Catana in Sicily; defeated the great fleet of the Etruscans 474, and in the same year won a victory at the Pythian games. He was a generous patron of art and letters. In 472 and 468 he won his second and third victories in the Olympic games. Pindar celebrated these victories in his odes. D. in 467 B. C.

Revised by J. R. S. STERRETT.

**Hiero**: King of Syracuse; was a natural son of one Hierocles; b. before 306 B. C.; served with distinction under Pyrrhus; became general of the Syracusans; sent a supply of corn to Rome 272; routed the Mamertines at the river Longanus, and was declared king in 270 B. C.; waged a disadvantageous war with Rome 264–263 B. C., after which he was a most faithful ally of that power. He was a popular ruler, and his reign as a whole was one of splendor and prosperity. There are many coins, inscriptions, and other existing remains of Hiero's time. D. 216 B. C.

Revised by J. R. S. STERRETT.

**Hier'ocles**: a grammarian who wrote a guide-book (Συνέκδημος, or *Traveling Companion*), containing an account of the 64 provinces of the Eastern Roman empire, and of the 935 towns situated in them. Its date is probably about the beginning of the sixth century A. D. Ed. by Wesseling in his *Vet. Rom. Itineraria* (Amsterdam, 1735), by Bekker at the end of his *Constantinus Porphyr.*, in the *Byzantine Historians* (Bonn, 1840), and by Burckhardt in the Teubner collection (1893). More familiar is the name of another HIEROCLES, the reputed author of a very late collection of poor jokes (ἀστεῖα), which used to be dished up in Greek readers. This Greek Joe Miller (Φιλόγελως) has been edited by Eberhard (Berlin, 1869).

B. L. GILDERSLEEVE.

**Hieroglyph'ics** [from Gr. (τὰ) ἱερογλυφικά, neut. plur. of ἱερογλυφικός, hieroglyphic, pertaining to sacred writing or engraving: ἱερός, sacred + γλύφειν, grave, carve]: a word used by the Greeks to describe the Egyptian writing, and by moderns in reference to those graphic systems which employ more or less conventionalized representations of material objects as symbols of ideas or sounds. All writing was originally pictorial, and modern systems may be traced back to such a parentage. Pictures drawn by prehistoric man give the earliest traces, and those of uncivilized races in recent times are illustrations. But the records which have been preserved are not sufficient to allow us to formulate a doctrine of development without the aid of conjecture at some points. A pure picture-writing is necessarily independent of language, and it is only when a symbol begins to represent a sound that the fundamental distinction between an ideogram and a phonogram appears. It has been conjectured (Taylor, *The Alphabet*, i., 22) that the step from the one to the other grew out of the necessity of expressing proper names. In the earliest specimens of the Egyptian writing (possibly 5000 B. C.) are found determinatives (pure ideograms) and phonograms, verbal (phonetic ideograms), syllabic, and alphabetic signs. Specific and symbolic determinative signs were employed to denote the idea which was to be connected with a group of phonographic signs, composed of one or more of the three classes. They are evidently survivals from the original picture-writing. Closely connected with them and derived from them historically are the word-signs or phonetic ideograms whose values corresponded with the names of the objects originally depicted. A peculiar usage which marks one of the steps in the development from picture-writing to the phonetic delineation of a word is seen in the Assyrian and Egyptian practice of supplementary writing, by which the initial or final sound of the word intended was indicated by a character or letter prefixed or added to an ideogram. Such characters are called phonetic complements. Out of the ideograms there grew, by means of the application of acrophony, syllabic and alphabetic signs by the gradual restriction of their use to the representation of the phonetic value of the first syllable or of the initial sound of the word in question. The circumscribed possibilities of the hieroglyphic system caused some of the symbols to be used with more than one power, whence arose polyphones; and the similarity in the names of things and of abstract ideas, connected with the impossibility of finding adequate independent expression of all such, gave rise to homophones. The transition from the phonetic ideogram to the syllable, and thence to the alphabetic symbol, was one of the most momentous in the history of human intellectual development. With the Egyptian, however, this final step was one of convenience in the graphic system rather than one due to an insight into the primary elements of language. This last was a triumph of Semitic and Greek genius.

The peoples which have had a hieroglyphic system of writing known to us were the Aztecs and some tribes of Central America, the Chinese, the Assyrians and Babylonians, the Hittites, and the Egyptians. At the time of their discovery some of the peoples of Central America had passed beyond the hieroglyphic into the alphabetic stage, as the Maya remains indicate, but some of them were still in the ideogram stage of development. The Chinese system of picture-writing early became conventionalized, and lost its obviously hieroglyphic character, while subsequent use effected little advance in the system. The Chinese symbols were introduced in a modified form into Japan, where a purely syllabic writing was the final outcome. The Hittite writing is hieroglyphic, though it appears to contain phonetic elements along with ideograms. The original of the Babylonian wedge-writing or cuneiform was pictorial, the pictures being formed of right lines. The restrictions imposed by the limited possibilities of the only available writing material, clay tablets and the wooden stylus or stencil, caused a gradual abandonment of useless detail, and led to the adoption of forms which appear arbitrary. Like the Chinese, they expressed some abstract ideas by the union of two ordinary ideograms. Their system was ideographic and phonetic, containing word-signs and syllables to the number of about 500. The Proto-Medic cuneiform writing was almost wholly syllabic, with ninety-six signs, and the Persian form was almost solely alphabetic, with thirty-six letters. The Behistun inscription shows the three styles side by side. The Egyptian system of writing has retained most completely its picture forms, and in them is contained an extensive literature. Its range in time is immense, covering possibly more than 5,000 years, and reaching to the third century A. D. Through all this period the outward appearance of the hieroglyphic writing remained practically unchanged except for slight variations in the manner of execution. But at the earliest period it was no longer a pictorial writing pure and simple in anything except its symbols. That stage lay buried in a period then long past. Only traces of what the development had been were still visible.

Fig. 1 shows a section of an Egyptian text, reproduced in modern type. It contains about a line and a half of the celebrated decree of Canopus, dated from the ninth year of Ptolemy III., Euergetes I., B. C. 238.

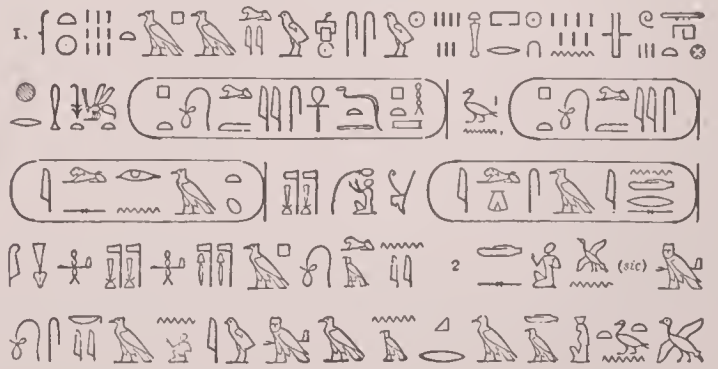



FIG. 1.

Egypt possessed three styles of writing—the hieroglyphic, the hieratic, and the demotic, the two latter being products of abbreviation. The idea of a sacred character attaching to the two former is exploded. The hieroglyphic was a lapidary script, in bas-relief or incised, traced in ink or painted, used for public monuments; but the very mistakes which occur in it show that the original copy from which the sculptors worked was in the shorter hieratic form. The demotic was a conventionalized form of the abbreviated hieratic.

Fig. 2 shows specimens of the three styles of Egyptian writing, in the order (reading downward) of hieroglyphic,

hieratic, and demotic. The words represented are (the god) Amon, "man" or mankind, "Pharaoh," and "day."

The total number of signs in the hieroglyphic writing can not be given exactly, but the movable types cast under

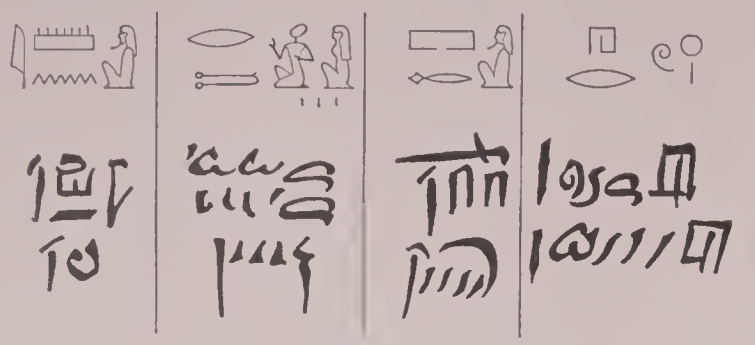


Fig. 2.

the auspices of the Royal Society of Berlin for the ready reproduction of Egyptian inscriptions are over 1,300 in number. The sign-lists in use in the handbooks, giving only the more common characters, contain about 600 alphabetic, syllabic, and word-signs, and about 150 determinatives. There are also twenty-four consonantal alphabetic values which had a separate representation. These consonantal symbols underwent slight change in the whole period, but for some of them there were alternative forms. The so-called "vowels" had consonantal power as in Semitic, and vowel power was a later acquisition. The following table, taken for the most part from *Das altägyptische Alphabet und seine Umschreibung* (*Zeitsch. der Deutschen Morgenländischen Gesellschaft*, xlvi., p. 727), by Prof. Georg Steindorff, of Leipzig, shows the Semitic consonants corresponding to the Egyptian letters, and the methods of transcriptions proposed by Lepsius and Erman, the former being the system in common use during the past decade or more, and the latter a more exact system adopted for use in scientific German works.

| | | Semitic. | Lepsius. | Erman. |
|---|---|---|---|---|
| 1. | | א | a | i |
| 2. | | א | a | ȝ |
| 3. | | ע ε | ā | ȝ |
| 4. | | ו ו | u | w |
| 5. | | ב | b | b |
| 6. | | פ ف | p | p |
| 7. | | none | f | f |
| 8. | | מ | m | m |
| 9. | | נ | n | n |
| 10. | | ל ר | r | r |
| 11. | | ה ח | h | h |
| 12. | | ح | ḥ | ḥ |
| 13. | | خ | χ | ḫ |
| 14. | | none certain | | ḫ |
| 15. | | ס س† | s | s |
| 16. | | ש س† | s | ś |
| 17. | | ש ش† | š | š |
| 18. | | ג† | ḳ | g |
| 19. | | כ | k | k |
| 20. | | ק | q | ḳ |
| 21. | | ת | t | t |
| 22. | | ث* | ϑ | ṯ |
| 23. | | ט | ṭ | d |
| 24. | | ظ צ | ṭ | ḏ |

* Somewhat uncertain. † Not satisfactorily proved.

Fig. 3.

Fig. 3 shows the Semitic equivalents of the hieroglyphic characters, with transcriptions into ordinary letters.

Some of the syllabic characters in the Egyptian are polyphones, as in the Assyrian syllabary. Determinatives were of two sorts—those which indicate concrete things or classes of things, and those used in connection with abstract ideas, specific or general. Occasionally the same sign was used for both purposes. A circle with a dot in the center represented the sun, and was also used to denote sections of time, year, day, hour, etc. A picture of the skin of an animal denoted a four-footed beast, a skin, leather, or an object made of leather. The "house"-sign was used also phonetically in spelling the name of Pharaoh.

The direction of the Egyptian writing was largely dependent upon convenience or artistic effect. It might run in either direction, horizontally, or vertically downward; all three directions are found in the same funereal stela. The successive groups of characters are found arranged in squares, each of which must be completely read before any in the following square. In papyrus rolls the ordinary direction was from right to left, but occasionally the scribe varied his practice and wrote vertically. In all cases the writing was read from the side toward which the hieroglyphs faced.

For an account of the discovery of the key to the hieroglyphic writing of Egypt, see the article in this work on Egyptology. See also the articles Egyptian Language and Literature and Coptic Language and Literature.

Charles R. Gillett.

**Hieron'ymites** [from St. Jerome, or, in Latin form, *Hieronymus*]: properly the hermits of St. Jerome. The name of four hermit-bodies of Spaniards and Italians: (1) The body founded by Ferdinand Pecha out of those who were originally Franciscan Tertiaries of the Strict Observance. In 1373 the new order was accredited by Pope Gregory XI., and received an Augustinian rule. The monastery of Yuste, where Charles V. passed his last days after his abdication, and that in the Escorial erected by Philip II., belonged to this order, which was once very rich and extensive, but is now small and feeble. (2) A branch founded by the Spaniard Lupus in 1424, but the monasteries in Spain in 1595 were by Philip II. assimilated with those of (1); those in Italy maintained their independence. (3) Another small congregation, called Hieronymites, was founded at Pisa by one of the Gambacorti about 1390. It still exists. (4) The Hieronymites of Fiesole, founded 1360, dissolved by the pope in 1668.

Revised by S. M. Jackson.

**Hieron'ymus**: Father of the Church. See Jerome.

**Hieronymus of Cardia** (in Thrace): Greek historian and general. He served with distinction under Eumenes, Antigonus, Demetrius, and Antigonus Gonatas, and wrote a history of the successors of Alexander extending to Pyrrhus, the invader of Italy. Fragments in Müller's *Fragmenta Historicorum Græcorum*, vol. ii., pp. 450–61. B. L. G.

**Hier'ophant** (in Gr. ἱεροφάντης): the mystagogue, prophet or priest of Demeter who had charge of the Eleusinian Mysteries, and initiated new members into those mysteries. He must be a descendant of the hero Eumolpus, unmarried, and unblemished in character and in body. He preserved and expounded the unwritten law, and exhibited the sacred symbols to the initiates. Revised by J. R. S. Sterrett.

**Hieropolis** (in Gr. Ἱερόπολις): a city of Phrygia Parva, whose extensive ruins may still be seen at Kotch Hissar in the plain of Sandüklü, a three days' journey directly N. E. of Hierapolis in Phrygia Magna. See Ramsay, *Trois Villes Phrygiennes* in the *Bulletin de Correspondance Hellénique* (1882, p. 503 ff.), and his *Tale of St. Abercius* in the *Journal of Hellenic Studies* (1882, p. 339 ff.); Duchesne in *Revue des Questions Historiques* (July, 1883, p. 1 ff.); Lightfoot, *Ignatius and Polycarp* (vol. i., p. 477 ff.).

J. R. S. Sterrett.

**Higbee**: town; Randolph co., Mo. (for location of county, see map of Missouri, ref. 3–G); on the Chi. and Alton and the Mo., Kan. and Tex. railways; 10 miles S. W. of Moberly. It is in an agricultural, stock-raising, and coal-mining re-

gion, and has a weekly newspaper. Pop. (1880) 347; (1890) 1,093; (1900) 1,151.

**Higgins**, Anthony, LL. D.: U. S. Senator; b. in Red Lion hundred, New Castle co., Del., Oct. 1, 1840; educated at Yale (A. B. 1861), Delaware College, and Harvard Law School; admitted to the bar in Delaware 1864; U. S. attorney for Delaware 1869–76; elected to the U. S. Senate as Republican, and took his seat Mar. 4, 1889. C. H. T.

**Higginson**, Francis: clergyman; b. in England in 1588; graduated at St. John's College, Cambridge, and became a parish clergyman of Leicester, but was deprived for Nonconformity, and in 1629 became teacher of the congregation at Salem, Mass., where he died Aug. 6, 1630. He wrote *New England's Plantations* (1630). See his *Life* by T. W. Higginson (1891); also Palfrey's *History of New England*.

**Higginson**, Thomas Wentworth, A. M.: philanthropist and author; b. in Cambridge, Mass., Dec. 22, 1823; graduated at Harvard College 1841; received the degree of A. M. 1869; studied divinity at Cambridge; was ordained at Newburyport, Mass. (First Religious Society), in 1847; was Free-soil candidate for Congress in 1859; went to Worcester, Mass., in 1852 as minister of the Free church; resigned in 1858 and left the ministry. Mr. Higginson had taken a leading part in the anti-slavery conflict that preceded the civil war; had visited Kansas in 1856; was acquainted with John Brown, and was active in sustaining the free-State men in the West. On Sept. 25, 1862, he was made captain in the Fifty-first Massachusetts Volunteers; on Nov. 10 accepted the colonelcy of the First South Carolina Volunteers, colored; was wounded Aug., 1863, and mustered out Oct., 1864. He has since lived in Newport, R. I., and Cambridge, Mass., devoting himself to literature and the work of social reform; is a vice-president of the Free Religious Association, a leader in the cause of woman suffrage, and an earnest friend of higher education. His efforts to introduce modern ideas and men into the management of Harvard College, and to have its facilities extended to women, have been assiduous. In 1880 and 1881 he was a member of the Massachusetts House of Representatives and also of the Governor's military staff, and from 1881 to 1883 he served on the State board of education. In 1889 he was appointed for five years as State military and naval historian. Mr. Higginson is the author of several volumes of collected essays: *Out-door Papers* (1863; illustrated ed. under title *In a Fair Country*, 1889); *Army Life in a Black Regiment* (1870; French transl. by Madame de Gasparin, 1884); and *Atlantic Essays* (1871); wrote a novel, *Malbone, an Oldport Romance* (1869); *Oldport Days* (1874); a history, *Young Folks' History of the United States* (1875; French transl. 1875; Germ. transl. 1876; Ital. transl. 1882); besides various pamphlets and magazine articles, memoirs of Lydia Maria Child and Margaret Fuller Ossoli in *Eminent Women of the Age* (1868), and a memoir of T. W. Harris, prefixed to his *Entomological Correspondence* (1869). He also edited (in connection with S. Longfellow) a book of poems, *Thalatta* (1853); a translation of Epictetus (1865; revised ed. 1891); *Harvard Memorial Biographies* (2 vols., 1866); and published *Child-pictures from Dickens* (1868); *Brief Biographies of European Statesmen* (1875); *A Larger History of the United States* (1885); *The Monarch of Dreams* (1886); *Hints on Writing and Speech-making* (1887); *Women and Men* (1888); *Travelers and Outlaws* (1889); *The Afternoon Landscape* (1890); *The New World and the New Book* (1891); *Concerning all of Us* (1892).

**Higginsville**: village; La Fayette co., Mo. (for location of county, see map of Missouri, ref. 3–E); on the Chi. and Alton and the Mo. Pac. railways; 12½ miles S. E. of Lexington. It is an important shipping-point for wheat and corn, has valuable coal mines, is the seat of a Confederate home, and has a monthly and three weekly periodicals. Pop. (1880) 797; (1890) 2,342; (1900) 2,791.

**Higher Criticism**: the scientific investigation of literary documents, to discover their origin, history, authenticity, and literary form. It is distinguished from *Lower Criticism*, which deals mainly with the text of the document, while the former judges it in its entirety. These terms are applied to the study of all ancient literature. The question whether this Greek word or that ought to stand in some line of the *Iliad* is a question of the lower criticism. The question whether the *Iliad* was written by Homer is a question of the higher criticism. Bentley's work on the *Epistles of Phalaris* is a fine illustration of the higher criticism. The term is most familiarly employed, however, in recent biblical studies. When thus applied it is an attempt to discover when the various books of the Bible originated; whether they were written by the authors to whom they are popularly assigned; of what materials they are composed; whether they are self-consistent, and to what extent they agree or disagree with one another; whether additions have been made to them from time to time; whether they are confirmed or discredited by the monuments and the history of the period in which they are supposed to have originated. For the most part, so far as the Bible is concerned, the higher criticism is engaged in the study of the Bible itself. Tradition says that the books of Samuel were written by Samuel. Higher criticism takes these books in hand and studies them to see whether they have anything to say about their author, and whether the facts recorded in them can be reconciled with this tradition. When two discrepant narratives of the same event occur, as frequently in the Kings and the Chronicles, higher criticism compares the two and seeks for a rational explanation of the discrepancy. It is sometimes supposed that the higher criticism is essentially destructive, but this is an error; it is simply the application of scientific methods to the study of ancient documents; and these methods are employed by those whose purpose it is to establish the authority of the Scriptures not less than by those who wish to undermine their authority. See Hexateuch. Washington Gladden.

**High German**: See Teutonic Languages.

**Highland**: city (founded in 1836); Madison co., Ill. (for location of county, see map of Illinois, ref. 8–D); on the Vandalia Line; 32 miles E. of St. Louis. It is in an agricultural region; contains 4 churches, Roman Catholic seminary and hospital, and 3 periodicals; and manufactures condensed milk, embroidery, machinery, flour, and beer. Pop. (1880) 1,969; (1890) 1,857; (1900) 1,970.
Editor of "Union."

**Highland**: town; Ulster co., N. Y. (for location of county, see map of New York, ref. 7–J); on the Hudson river and the W. Shore and the Phila., Read. and N. Eng. Railways; opposite Poughkeepsie, with which it is connected by railway and ferry; 72 miles N. of New York city. It contains Methodist Episcopal, Protestant Episcopal, and Presbyterian churches, union free school, 4 flour-mills, 2 felloe-factories, several fruit-package factories, and 2 weekly newspapers. It has daily steamboat connection with Newburg, Albany, and New York city. The principal business is fruit, especially grape-culture. Pop. (1890) 1,033; not returned separately in 1900. Editor of "Post."

**Highlanders**: properly the Gaels or Celtic inhabitants of the Highlands of Scotland. In the British army previous to 1881 the term designated the eight regiments of foot-soldiers who wore the old Highland costume, each with its own distinctive tartan. These were the 42d, 71st, 72d, 74th, 78th, 79th, 92d, and 93d regiments. The 91st (Argyleshire regiment) was sometimes reckoned with the Highlanders. In 1881 a territorial reorganization of regiments took place, the numerical designation of the foot-regiments was dropped, and the battalions were linked. The 42d and 73d regiments constitute the new Black Watch (Royal Highlanders); the 71st and 74th, the Highland Light Infantry; the 72d and 78th, the Seaforth Highlanders; the 75th and 92d, the Gordon Highlanders; the 91st and 93d, the Princess Louise's (Argyle and Sutherland Highlanders). The 79th remains a single battalion regiment, and is known as the Queen's Own Cameron Highlanders.

**Highland Falls**: village; Orange co., N. Y. (for location of county, see map of New York, ref. 7–J); on the Hudson river, and the West Shore Railroad, adjoining the grounds of the U. S. Military Academy at West Point; 11 miles S. of Newburg, its banking-place. It is the summer home of many New York business men, contains several hotels and many boarding-houses, commands a fine view of the river north and south, and is a delightful summer resort. Pop. (1880) 1,976; (1890) 2,237; township (1900) 4,519.
Editor of "Journal."

**Highland Park**: city; Lake co., Ill. (for location of county, see map of Illinois, ref. 1–G); on Lake Michigan, and the Chic. and N. W. Railway; 22 miles N. of Chicago. It is suburban in character and is the home of many Chicago business men; is the seat of Northwestern Military Academy, Deerfield Township High School, and Sylvan Dells

School for boys; and has two weekly newspapers. Pop. (1880) 1,154; (1890) 2,163; (1900) 2,806.

EDITOR OF "GAZETTE."

**Highlands**: city; Arapahoe co., Col. (for location of county, see map of Colorado, ref. 2–E); on the South Platte river, and the Union Pac. Railway; opposite Denver, of which it is a suburb. Pop. (1880) not separately returned; (1890) 5,161; now a part of Denver.

**Highlands of the Hudson**: the broken hills which stretch from S. W. to N. E. through Rockland, Orange, Putnam, and Dutchess counties, N. Y., being the northeast continuation of the Blue Ridge, extending farther northeast in the Taconic and Green Mountains of Western New England. The passage of the Hudson through the Highlands is marked by fine scenery, and it is remarkable as almost the only instance in the U. S. of a navigable river-passage through a great mountain range. The Highlands are mainly composed of azoic rocks, with rugged and steep sides and a somewhat scanty soil.

**High Places**: places frequently mentioned in the Old Testament as those where the people unlawfully went to worship strange gods. The custom of erecting shrines upon hill-tops is a very ancient and widespread one, and seems to have arisen from the belief that the tops of hills were nearer the abode of Deity. The high-place worship is forbidden in the Pentateuch, in the interest of worship at a single sanctuary for the whole nation; but it was prevalent at all periods, and, in certain circumstances, even such men as Samuel, David, and Elijah practiced it. In later times reforms occurred, and the more devout kings of Judah actively destroyed the high places. Revised by WILLIS J. BEECHER.

**High Priest**: in the hierarchy of the Hebrews, the principal religious dignitary of the nation. By the Mosaic law the office was held for life, and was hereditary in the line of Eleazar, son of Aaron, the first high priest. But in the New Testament times the office had ceased to be hereditary, and was held at the will of the civil ruler. One of the most brilliant periods of this pontificate was that of the Asmonæan princes (Maccabees), some of whom joined regal to priestly authority.

**Hightstown**: borough; Mercer co., N. J. (for location of county, see map of New Jersey, ref. 4–C); on the Penn. and the Penn. and Hights. railways; 14 miles E. by N. of Trenton. It is the seat of Peddie Institute (Baptist, chartered 1867), which in 1890 had 13 instructors, 192 students, grounds and buildings valued at $206,000, productive funds $70,000, and total receipts $48,500. It also has a noted seminary for young ladies. Pop. (1880) 1,355; (1890) 1,875; (1900) 1,749.

**Highway**: a road or way over which the public at large have a free right of passage. The term, in popular usage, is commonly restricted to ways upon land, as carriage or foot-roads or turnpikes, but it is employed in law as a generic designation, including not only ways of this kind, but also watercourses which are, in a similar manner, open to public convenience, as, for instance, natural streams. Ferries are also sometimes included.

*Mode of Creation.*—Highways upon land are created either by express dedication of the owner, by prescription, or in pursuance of legislative authority. Dedication occurs when the owner of the property appropriates it to the public use as a common passageway, and there is a sufficient acceptance of the privilege on the part of the public, evidenced either by positive acknowledgment and assent or by constantly enjoying the advantage offered. A right is obtained by prescription by a continuous, undisturbed use of the land as a common way for a particular period of time established by law, usually twenty years (see PRESCRIPTION); but highways are usually established by the exercise of the right of EMINENT DOMAIN (*q. v.*), the methods by which new roads may be laid out as occasion may require being regulated by statute. The authority in the U. S. is usually delegated to towns or bodies of commissioners, who, in conjunction with a jury, determine upon the necessity of a road, its direction, and extent. The commissioners may also have power to direct its construction and make all necessary repairs. Highways by water, in the case of natural streams, exist independently of the granting of any privilege by dedication or of any legislative interposition—by force of the natural right which every citizen possesses of free passage along all watercourses not of artificial construction.

*Rights of the Abutting Owner.*—The establishment of a highway gives to the public merely an easement, and though this is so far restrictive upon the owner's management and control of his property that he can do nothing to deprive the public of their privilege of free passage or to incommode them, yet it must be enjoyed simply as a right to travel over the land, and an obligation rests also upon the public not to interfere with the owner's interests further than the appropriate use of the way demands. As a general rule the title of the owners of land adjoining and on opposite sides of a highway or a stream extends to the middle of the stream or highway; but he may of course grant his entire interest to the public, or the statute may provide that it shall vest in the public, in which case he loses all his rights in the land the title to which is conveyed. He has a right to the full benefit of the soil, provided he does not deprive the public of the right of way or impair their exercise of it. Thus he has the exclusive right to trees or grass growing along the line of a road, or to mines beneath the surface, and he may construct water-pipes or drains, excavate cellars, etc., below the surface, and he can maintain an action against any one who interferes with these rights. But the public right of easement, especially in villages and cities, sometimes includes particular privileges not directly incidental to the right of transit, but so important and essential for the common welfare of communities that they are deemed to be included within the interest which the public acquires by establishing the highway. For instance, the soil may be opened for the construction of sewers or gas or water pipes for the convenience of neighboring residents. But acts of this nature can only be done by virtue of public authority, and if any individual or combination of individuals attempt to lay gas or water pipes without obtaining special powers for that purpose, they commit an actionable offense for which the owner may seek redress. But nothing additional to such privileges as these is embraced within the easement which the public acquires in property taken for a highway; and if the legislature authorizes the use of the soil for other purposes, as for the construction of a steam railway, this is a new exercise of the right of eminent domain, for which further compensation must be made. Grants of property bounded upon a highway carry with them the same interest in the soil of the road as the grantor previously possessed, unless there be precise expressions in the deed of transfer, limiting the boundary to the edge of the way.

*Rights and Obligations of the Public.*—The public right of transit must be entirely unrestricted. If obstructions be placed in the way impeding free travel, they will constitute public nuisances, and will afford ground for an indictment or for a private action by any person especially discommoded. They may also be abated or removed by any one, so far as may be necessary to permit him to continue on his way. Moreover, in order that the privilege of passage may be enjoyed with as little inconvenience as possible, it is the duty of every traveler to observe proper care to avoid collisions and accident. To promote this desirable end, it has been made the rule in most European countries that vehicles in passing each other must keep to the left. In the U. S. the regulation is exactly the reverse—that they must keep to the right. The obligation of this requirement ceases when one of the vehicles is confined to a specific line of travel, as a horse-car, and in such a case the other carriage may turn to either side.

In Great Britain the repair of highways is generally a duty obligatory upon the inhabitants of the parishes, and they may be indicted if they suffer defects to continue after knowledge of their existence. In some cases, however, the duty of repair is incumbent on a township or a division of a parish, or, less frequently, upon individuals. In the U. S. it is held, with few exceptions, that there is no common-law liability in the case of *quasi* corporations such as townships and counties. In the New England States it is generally held that neither cities nor towns are liable at common law, but the duty is imposed by statute, and a right of action is given if any injury be sustained by a traveler in consequence of their neglect. In other States the obligation devolves, as a rule, upon municipal corporations proper, such as cities and villages, while towns, which are usually considered *quasi* corporations, are sometimes made liable, or the roads within their limits are placed under the charge of specially appointed commissioners, who may be subjected to an action if they fail to make repairs after they are provided with the means to obtain the requisite funds. If a

person brings an action for an injury sustained through a defect in the highway against the body bound to make repairs, he must show that they had knowledge of the existence of the alleged defect, or a reasonable opportunity and means of obtaining such knowledge. If the defect or obstruction be caused by a resident adjacent to the highway, and the city or town be compelled to respond in damages to a person injured in consequence, a suit for indemnification may be instituted by the city, etc., in its turn against the party primarily responsible by reason of his unauthorized act or culpable negligence. Revised by F. STURGES ALLEN.

**Hil'ary**: the names of four persons prominent in Church history: I. HILARY OF ARLES, SAINT, b. in S. Gaul about 401; was persuaded by Honoratus, afterward (426–429) bishop of his native place, to enter the monastery of Lerins; in 429, on the death of Honoratus, was chosen his successor in the see of Arles, and died there May 5, 449. Zealous in discipline and strong of will, he had a bitter controversy with Pope Leo the Great, which, however, was amicably settled at last. He was learned, eloquent, and charitable to the poor. His sermons, it is said, were sometimes very long (four hours), so that his hearers were driven into the novelty of sitting. His *Life of Honoratus* is in the *Acta Sanctorum*, Jan. 16. His *Metrum in Genesin*, dedicated to Pope Leo, is an account of the Creation, including also the Deluge and the preservation of Noah, in 197 hexameters.—II. HILARY OF POITIERS, SAINT, "the Athanasius of the West"; of distinguished but heathen parentage; was born at Poitiers in Central Gaul, near the beginning of the fourth century; became a Christian about 350 after prolonged and careful investigation; was chosen Bishop of Poitiers about 353; in 356 was banished to Phrygia because he would not sanction the condemnation of Athanasius; in 359 the emperor sanctioned his return to Poitiers, but he did not reach there till 362; soon after went to Italy, but returned in 364 and died there Jan. 13, 368. He was one of the ablest men of his century—clear-headed, incisive, resolute, learned, and eloquent. The leading characteristic of his career was the sharp and steady war he waged against Arianism. The earliest edition of his works was by Erasmus (Basel, 1523); the best is the Benedictine, by Coustant (Paris, 1693; republished, with additions, by Maffei, Verona, 1730, and in Migne, *Pat. Lat.*, ix. and x.). English translation of his works on the Trinity and the Synods in vol. ix. of the *Nicene and Post-Nicene Fathers* (New York, 1894). (See J. H. Reinkens's *Hilarius von Poitiers*, Schaffhausen, 1864.)—III. HILARY THE POPE, was born (date unknown) in Sardinia; while deacon at Rome, under Pope Leo the Great, was sent as legate to the "Robber Council" at Ephesus (449 A. D.); succeeded Leo in the papal chair in 461, being consecrated Nov. 19, two days after the death of Leo; and died at Rome Feb. 28, 468. He was zealous for the faith and strict in discipline. A synod which met in Rome Nov. 19, 465, passed five canons, inspired by him, indorsing the canons of Nice, and forbidding, among other things, the ordination of men twice married or marrying widows, and forbidding bishops to nominate their successors. (See *Acta Sanctorum*, Feb. 21.)—IV. HILARY THE DEACON. A Roman deacon of this name was sent by Pope Liberius (352–366 A. D.) to a council (attended by 300 bishops) which met at Milan in 355. He appears afterward to have joined the schism of Lucifer (who died 371), Bishop of Cagliari (Lat. *Calaris*) in Sardinia. He has generally been identified with the unknown author (AMBROSIASTER) of the commentary on the Pauline Epistles, wrongly ascribed to Ambrose of Milan, who also wrote the *Quæstiones Veteris et Novi Testamenti*, wrongly ascribed to Augustine. But this identification is now questioned. The commentary on St. Paul's Epistles contains passages which have important bearings on questions of church polity. Revised by S. M. JACKSON.

**Hilda**, SAINT: abbess of the monastery of Whitby in England; b. about 614; was consecrated as a nun in 647 or 648, and two years later became the abbess of Heortea, or Hartlepool, where she was intrusted by King Oswy with the care of his daughter. Obtaining grants of money from the king, she founded in 658 the monastery at Whitby, to which her reputation for piety soon drew a large number of monks and nuns. Among the inmates were Hedda, Wilfrid, and the Anglo-Saxon poet Cædmon. She directed its affairs with ability, and succeeded in making it the strongest establishment of the kind in England. D. in 680. The church at Hartlepool preserves Saint Hilda's effigy on its ancient seal. See Bede, *Ecclesiastical History of our Island and Nation.*

**Hildebrand**: See GREGORY VII.

**Hildebrand**, HANS OLOF HILDEBRAND, Ph. D.: archæologist; b. in Stockholm, Sweden, Apr. 5, 1842; studied at Upsala, where he graduated in 1866. Since 1879 he has been Swedish state antiquarian and secretary of the Swedish Academy of Literature. He has been a fertile writer on topics of Swedish history and prehistoric archæology. Besides numerous articles in periodicals and journals, particularly in *Vitterhets-akademiens Månadsblad* (The Monthly News of the Literary Academy) and *Antiquarisk Tidsskrift för Sverige* (Antiquarian Journal for Sweden), both of which papers he has edited—the former since 1872, the latter since 1883—he has published a great many works of historical interest: *Svenska Folket under Hednatiden* (The Swedish People during Pagan Times, 1866; 2d ed. 1883); *Lifvet på Island under Sagotiden* (Life in Iceland during the Saga Time, 1867; 2d ed. 1883); *De förhistoriska folken i Europa* (The Prehistoric Nations of Europe, 1873–80); *Den kyrkliga konsten under Sveriges Medeltid* (Ecclesiastical Art in Mediæval Sweden, 1875); *Fynden i Troas och Homeros Troja* (1878); *Sveriges Medeltid* (Mediæval Sweden, i.–ii., 1879–84); a collection of essays treating subjects of ancient civilization under the common title *Från äldre tider* (From Ancient Times, 1882). In the English language he has published *The Industrial Arts of Scandinavians in the Pagan Time* (1882). Together with his father, the famous archæologist, Bror Emil Hildebrand, he published, in the years 1873–78, several volumes of plates containing designs from the historical museum of the Swedish state (*Teckningar ur Svenska statens historiska museum*). P. GROTH.

**Hildebrandsson**, HUGO HILDEBRAND, Ph. D.: meteorologist; b. at Stockholm, Sweden, Aug. 19, 1838. He was educated in the gymnasium at Stockholm and in the university at Upsala. From 1865 to 1869 he was assistant at the Physical Institute at Upsala; 1866–72 tutor in Physics; 1872–78, chief of the meteorological division of the astronomical observatory; since 1878 director of the new meteorological observatory of the university; since 1885 "censor" or member of the commission of examinations of the gymnasia of Sweden. He is a member of many scientific societies, and an honorary member of the meteorological societies of London and Vienna. He is a prolific writer both of official publications and of papers on private studies. Among his publications are *Atlas des mouvements supérieurs de l'Atmosphère* (published by the Swedish Government in 1877); *Sur la classification des nuages, avec photographies de M. Osti* (Upsala, 1879; 2d ed. 1881); *Observations météorologiques faites par l'Expédition de la Vega* (Stockholm, 1882); *Cloud Atlas* (Hamburg, 1890, with Drs. Köppen and Neumayer); *Les orages dans la péninsule scandinave* (Acta Upsal, 1888, with Dr. H. Mohn). MARK W. HARRINGTON.

**Hildesheim**, hil'des-hīm: town of Germany; in the province of Hanover; on the Innerste; 25 miles by rail S. E. of Hanover (see map of German Empire, ref. 4–E). It contains a fine old cathedral, built in 1015, with famous bronze gates and glass-paintings; the Church of St. Godehard, built in 1133; and the Church of St. Michael, built in 1022. It is a Roman Catholic bishop's see. The chief manufactures are those of sugar, machinery, stoves, castings, and tobacco. Hildesheim became a member of the Hanseatic League in 1241, and remained a free town until 1803, when it was acquired by Prussia. Pop. (1890) 33,481.

**Hildreth**, CHARLES LOTIN: See the Appendix.

**Hildreth**, RICHARD: historian; the son of Rev. Hosea Hildreth (1782–1835); b. at Deerfield, Mass., June 22, 1807. He graduated at Harvard in 1826; was admitted to the bar at Boston 1830; in 1832 became one of the editors of *The Boston Atlas*; resided 1834–35 in Florida, where he wrote *Archy Moore* (1837), an anti-slavery tale, republished in 1852 as *The White Slave*; published *History of Banks* (1837); a *Life of W. H. Harrison* (1839), whom he vigorously supported for the presidency; a translation of Dumont's version of Bentham's *Theory of Legislation* (1840, 2 vols.); and *Despotism in America* (1854), an anti-slavery work. He resided 1840–43 in Demerara, British Guiana, where he edited two free-labor journals. He published a *Theory of Morals* (1844) and a *Theory of Politics* (1853). His great work is a *History of the United States* (6 vols., 1849–56). The author's point of view is strongly Federalist. The first series of 3 vols. is devoted to the period from the colonization of the country to the adoption of the Constitution (1492–1789); the second series, also of 3 vols., extends from 1789 to the end of President Monroe's administration

(1821). The work is one of great vigor and general accuracy, but it is without attractiveness of style. He also produced *Japan as it Was and Is* (1855) and *Atrocious Judges* (1856), prepared from Lord Campbell's *Lives*. He was for several years on the editorial staff of *The New York Tribune*, and became U. S. consul at Trieste in 1861. D. at Florence, Italy, July 11, 1865. Revised by C. K. Adams.

**Hilgard**, Eugene Waldemar, Ph. D., LL. D.: chemist; b. in Zweibrücken, Germany, Jan. 5, 1833; emigrated with his father to Belleville, Ill., 1835–36; in 1849 returned to Europe, and studied at the Academy of Mines, Freiberg, Germany; also at the Universities of Zurich and Heidelberg, graduating at Heidelberg in 1853. In 1855 he returned to the U. S., and became assistant State geologist of Mississippi; in 1857 was in charge of the laboratory at the Smithsonian Institution, Washington, D. C.; in 1858 was appointed State geologist of Mississippi. Since 1871 he has held that office in connection with the chairs of Agriculture and of Chemistry in the State University at Oxford, Miss. In 1873 he took the chair of Geology and Natural History in the University of Michigan, and in 1874 was elected Professor of Agriculture in the University of California, a position he still occupies, in connection with that of director of the State agricultural experiment stations. He is the author of a report on the geology and agriculture of Mississippi, and of papers on chemical and geological subjects, particularly on the geology of the Cretaceous, Tertiary, and later formations of the Southwestern States, and on the chemistry and physics of soils; published in *The American Journal of Science* the *Smithsonian Contributions to Science*, and reports of the U. S. Department of Agriculture. Since 1877 he has published a series of reports of the agricultural department of the University of California, in which special stress is laid upon the investigation of soils; also the report on cotton culture for the U. S. census of 1880 (vols. v. and vi.), including descriptions of the physical features of the cotton-growing States. In 1892 he prepared for the U. S. Weather Bureau a discussion of the relations of soils and climate. This was published by the bureau, and was so favorably received abroad as to be translated into several European languages. The Liebig medal was awarded him by the Bavarian Government.

**Hilgard**, Julius Erasmus: scientist; b. in Zweibrücken, Germany, Jan. 7, 1825; he went in 1835 to Belleville, Ill., with his father, from whom he received a classical education; studied civil engineering in Philadelphia; in 1845 entered the Coast Survey service, which was the principal sphere of his labors, and to the success of which he largely contributed. His writings on geodetic methods, tides, and terrestrial magnetism are published in the Coast Survey reports and in various scientific journals. (See Coast and Geodetic Survey.) In 1862 he was appointed assistant in charge of the Coast Survey office, and of the construction of standard weights and measures, a position which he held until 1881; in 1863 he was named a member of the National Academy of Sciences; in 1872 took an active part in the international metric commission which met at Paris, and was chosen a member of its permanent committee. He at the same time conducted a determination by telegraph of the differences of longitude between the observatories of Washington, Greenwich, and Paris. In 1874 he was president of the American Association for the Advancement of Science. From 1881 to 1885 he was superintendent of the U. S. Coast and Geodetic Survey. D. in Washington, D. C., May 8, 1891.

**Hilgard**, Theodore Charles, M. D.: b. in Zweibrücken, Germany, Feb. 28, 1828; emigrated to the U. S. in 1835, and afterward completed his education at the German universities; settled as a physician in St. Louis, and devoted much time to the microscopic study of fungi and other lower forms of life. His papers on these and kindred subjects are published in the *Transactions* of the St. Louis Academy of Science and *Proceedings* of the American Association for the Advancement of Science. D. in New York city, Mar. 5, 1875. Revised by Charles E. Bessey.

**Hilgard**, Theodor Erasmus: lawyer; b. in Nassau, Germany, July 7, 1790; educated at Heidelberg and Paris; counselor at law at Trèves during the empire, and after the restoration of the Rhenish provinces to Germany judge of the court of appeals at Zweibrücken. While holding this position he published a series of reports on the working of the French system of jurisprudence and the Code Napoléon, which remained operative in those German provinces, contributing largely to the preservation and extension of that system. He was during five years member of the provisional assembly, maintaining the right of local self-government, but, dispirited by the reaction toward absolutism under the influence of Austria, he emigrated in 1835 to the U. S. with a family of nine children, whose education he personally directed at his new home in Illinois. He afterward returned to Germany, and settled in Heidelberg, where he died Feb. 14, 1873. He was author of publications on important social questions, such as panperism, the death-penalty, woman's rights, and the war-power. He also published metrical translations into the German language of Ovid, Homer, and Moore, an original poem entitled *The Hundred Days*, and many minor poems.

• **Hill**: village; Hamilton co., Tenn. (for location of county, see map of Tennessee, ref. 7–H); on the Tennessee river, and the Nash., Chat. and St. L. Railway; a suburb of Chattanooga. It is in an agricultural and stock-raising region, and has milling interests. Pop. (1880) not separately returned; (1890) 1,763; not separately returned in 1900.

**Hill**, Ambrose Powell: soldier; b. in Culpeper co., Va., 1825; graduated at the U. S. Military Academy July 1, 1847, and served in various positions in the U. S. army till Mar., 1861, when he resigned his commission to follow the fortunes of his native State. On the secession of Virginia he was appointed colonel Thirteenth Virginia Volunteers, and dispatched to Harper's Ferry, rejoining the army at and engaged in the first battle of Bull Run. Promoted to be brigadier-general, he was distinguished at the battle of Williamsburg, and advanced to be major-general. In the succeeding operations on the Peninsula he gained a brilliant reputation as a division commander. In Aug., 1862, his division rendered important aid in the defeat of Gen. Banks at Cedar Mountain (Aug., 1862), and in the succeeding battles of Bull Run and Chantilly. In the following month he received the surrender of Harper's Ferry, and hurrying forward arrived with his command at Antietam at the critical moment when he was most needed. At Fredericksburg his division formed the right of Jackson's command, which encountered the vigorous assault of Union troops under Meade, and which was finally repulsed; at Chancellorsville, still with Jackson, he participated in the famous flank movement which broke the Federal lines, and on the death of Jackson assumed command of the corps, being wounded soon thereafter. For gallantry on this occasion he was promoted to be lieutenant-general and placed in command of one of the three corps composing the Army of Northern Virginia. In the campaign of 1864–65 he commanded with great ability at all the conflicts from the Wilderness to the final assault of the Confederate lines before Petersburg, Apr. 2, 1865, where he displayed the greatest bravery, meeting his death by a rifle-shot while engaged in reconnoitering at the moment it was decided that Richmond could no longer be held.

**Hill**, Benjamin Harvey: politician; b. in Jasper co., Ga. Sept. 14, 1823; graduated at the State University with high honor in 1844; studied law, and entered the profession at La Grange, Ga., in Aug., 1845; in 1851 was elected a member of the Legislature from Troup county as a Union man; and for the next ten years was active both in State and national politics. He was a member of the secession convention of Jan., 1861, and was an earnest advocate of the Union until the convention passed a resolution declaring that the State ought to secede, after which he became one of the prominent supporters of secession. He was elected to the provisional Confederate Congress that met at Montgomery, Ala., on Feb. 4, 1861, and in the fall of the same year to the Confederate Senate, in which body he served until the end of the war. He was arrested at his home, La Grange, Ga., in May, 1865, and confined in Fort La Fayette, New York, until July following, when he was released on parole. After the war he opposed the reconstruction policy of Congress, against which he wrote his *Notes on the Situation* (1867–68). His *Address to the People of Georgia*, issued in 1870, brought upon him severe censure from many quarters previously friendly to him. He supported the "Greeley movement" with zeal and eloquence. He was defeated in the Senatorial contest of Jan., 1873, but pending the canvass made an able speech vindicating his course, and urging the Democracy of Georgia to stand by the policy adopted at Baltimore in 1872. He was elected U. S. Senator for Georgia for 1877–83. D. Aug. 16, 1882. A statue of him was unveiled at Atlanta, Ga., May 1, 1886.

**Hill**, Daniel Harvey: soldier; b. at Hill's Iron-works, York District, S. C., July 12, 1821; graduated at the U. S. Military Academy, and was appointed brevet second lieutenant of artillery July 1, 1842; transferred to the infantry in 1847, with rank of first lieutenant; served in the Mexican war with distinction, and was presented by his native State with a sword of honor. In Feb., 1849, he resigned his commission, and accepted the chair of Mathematics in Washington College, Va., which he filled until 1854; that of Mathematics and Engineering in Davidson College, North Carolina, 1854–59, when he assumed superintendency of the North Carolina Military Institute at Charlotte. On the outbreak of the war he entered the Confederate army as colonel. Speedily promoted to be major-general, he commanded a division during the Seven Days' fight on the Virginia Peninsula, remaining in command of the James on the departure of the main army of Gen. Lee for Northern Virginia, but rejoining it in season to participate in the battles of South Mountain and Antietam, where he led his division, as subsequently at Fredericksburg. He was in Sept., 1863, at the battle of Chickamauga, Ga., and in 1864 at Bermuda Hundred, Va.; his division was among the command of Gen. Johnston, who surrendered at Durham Station. At the close of the war he returned to Charlotte, N. C., and published *The Land We Love*, a monthly magazine. In 1877 he became president of the University of Arkansas, and in 1887 president of the Military and Agricultural College at Milledgeville, Ga. Among his works published prior to 1861 are *Elements of Algebra*; *Consideration of the Sermon on the Mount* (Philadelphia, 1858); and *The Crucifixion of Christ* (1860). D. at Charlotte, N. C., Sept. 25, 1889.

**Hill**, David Bennett: politician; b. at Havana, Schuyler (then Chemung) co., N. Y., Aug. 29, 1844; removed to Elmira, N. Y., in 1862, and in 1864 was admitted to the bar; member of New York Assembly in 1869 and 1871; presided at the meetings of the Democratic State conventions of 1877 and 1881; was elected alderman in 1881, and in 1882, mayor of Elmira; was elected in 1882 Lieutenant-Governor of New York on the ticket which had Grover Cleveland at the head, and acted as Governor from Jan. 6, 1885, through the balance of Mr. Cleveland's term of office, the latter having been elected President of the U. S. Mr. Hill was elected Governor of New York, Nov. 3, 1885, and was re-elected Nov. 6, 1888. In 1891 he succeeded William M. Evarts as U. S. Senator.

**Hill**, David Jayne, A. B., A. M., LL. D.: educator and author; b. at Plainfield, N. J., June 10, 1850; educated at Lewisburg (now Bucknell) University; Professor of Rhetoric Bucknell University 1877–79; president Bucknell University 1879–88; president University of Rochester 1888–96. He has published *The Science of Rhetoric* (New York, 1877); *Elements of Rhetoric and Composition* (New York, 1879); *Life of Washington Irving* (New York, 1879); *Life of William Cullen Bryant* (New York, 1880); *Principles and Fallacies of Socialism* (New York, 1885); *The Elements of Psychology* (New York, 1887); *The Social Influence of Christianity* (Boston, 1887); *Genetic Philosophy* (1893). He has edited Jevon's *Logic* (New York, 1884), and printed *Lecture Notes* for his students on political economy, anthropology, and ethics. He has written numerous articles for reviews. He was appointed First Assistant Secretary of State, at Washington, Oct. 1, 1898.

**Hill**, Frank Alpine: See the Appendix.

**Hill**, George William: mathematical astronomer; b. at Nyack, N. J., Mar. 3, 1838; graduated at Rutgers College in 1859. While in college he wrote for *The Mathematical Monthly* an essay which gained him the first prize in a general competition of mathematical students in the U. S. He was soon after appointed assistant in the office of *The Nautical Almanac*, with which he retained his connection until 1892. Mr. Hill's energies have been devoted almost entirely to the mathematical theories of the celestial motions. In 1887 the gold medal of the Royal Astronomical Society was awarded him for his mathematical labors, and in 1892 the University of Cambridge, England, conferred on him the honorary degree of LL. D. In 1890 his monumental work on the theory of Jupiter and Saturn was published. In 1892 he resigned his position, in order to pursue his researches free from the restrictions of official discipline.

S. Newcomb.

**Hill**, John Henry, D. D., LL. D.: educator; b. in New York city, Sept. 11, 1791; graduated at Columbia College; was ordained a deacon in the Protestant Episcopal Church in 1830, and in the same year went as a missionary to Greece. He and his wife opened at Athens a school for girls, and later a school for boys, which in 1833 were housed in a building erected by Dr. Hill, near the Agora. The departments of "the American School," as it was called, included a high school for the training of teachers. After severe discouragements and personal trials on the part of its founders, the school began to prosper, and received pupils from families connected with the Government at Athens and from wealthy Greek families in Turkey. In 1845 Dr. Hill was appointed chaplain of the British legation in Greece, and retained the position for thirty years, continuing, however, his work of instruction. He died at Athens, July 1, 1882, and, by special direction of the Government, was buried with the honors of a taxiarch, while the Demos of Athens erected a monument over his grave. The Hill Memorial, as the institution was called after his death, was carried on by Mrs. Hill for some years, and is still (1894) in operation. The education and elevation of woman in Greece are chiefly due to the labors of Dr. Hill and his wife.

**Hill**, Robert Thomas: See the Appendix.

**Hill**, Rowland: an eccentric divine, son of Sir Rowland Hill, first baronet; b. at Hawkestone Park, England, Aug. 13, 1744; was educated at Eton and at St. John's, Cambridge, B. A. 1769; became a Calvinistic Methodist; took orders in the Church of England, though six bishops refused his ordination on account of his Methodistic opinions; became an itinerant, and in 1773 curate of Kingston, Somerset; minister of the Surrey chapel, Blackfriars Road, London, 1783–1833; and was remarkable for wit, eloquence, and success as a preacher. D. in London, Apr. 11, 1833. His best-known publication was his *Village Dialogues* (London, 1810). See his *Life* by E. Sidney (1833) and by James Sherman (1857).

Revised by S. M. Jackson.

**Hill**, Rowland, Viscount: nephew of the great preacher; b. at Prees Hall, Shropshire, England, Aug. 11, 1772; entered the army in 1790; served with the greatest distinction in most of the battles against Napoleon in which the British participated from Toulon to Waterloo; was raised to the peerage in 1814; took the chief command in 1828, and became a viscount in 1842. D. near Shrewsbury, Dec. 10, 1842. Hill was called the "right arm of Wellington," and was the most popular general in the British army.

**Hill**, Sir Rowland, K. C. B.: reformer of the postal system; b. at Kidderminster, Dec. 3, 1795; early showed an unusual aptitude for mathematics and taught that branch at his father's school at Hilltop, Birmingham (subsequently removed to Hazelwood), where he practiced the system of education known as the Hazelwood method, which he afterward expounded in a pamphlet entitled *Plans for the Government and Education of Boys in Large Numbers* (1822). He was a successful educator, remarkable for the high moral standard which his personal influence maintained in the school. His health failing, he gave up his educational work in 1833, but soon after became secretary of an association for the carrying out of Gibbon Wakefield's scheme for colonizing South Australia. In 1835 he began to consider the reform of the postal service, and two years later published a pamphlet recommending that the postage should not exceed the rate of a penny for half an ounce on letters within the United Kingdom, and suggesting the use of postage stamps. By a diligent study of statistics, he had reached the conclusion that the distance of the point at which a letter was delivered was an unfair basis on which to reckon the charge, and that a small uniform rate would suffice for expenses on account of the great increase of correspondence. His proposals were widely and earnestly discussed, and the House of Commons appointed a committee to investigate the subject. The penny rate was established in 1840, and Hill received an appointment in the Treasury, but on the downfall of the Liberals in 1841 he was compelled to retire. To show the public appreciation of his services a subscription was started, and he was presented with over £13,000. On the return of the Liberals to office in 1846, he was appointed secretary to the Postmaster-General, and in 1854 became chief secretary. His reforms were successfully carried out, but in 1864 he was compelled by poor health to resign. He was gazetted K. C. B. in 1860. D. Aug. 27, 1879. F. M. Colby.

**Hill**, Thomas, D. D., LL. D.: Unitarian minister and mathematician; b. at New Brunswick, N. J., Jan. 7, 1818. He graduated at Harvard College 1843, and at the Cambridge Di-

vinity School 1845; was settled in Waltham, Mass., 1845: was made president of Antioch College 1859; of Harvard College 1862; resigned in 1868 on account of ill health; retired to Waltham; accompanied Agassiz on the expedition to South America; accepted on his return (1873) a call to the Unitarian church at Portland, Me. He invented an occultator and several other mathematical machines. He published *Christmas, and Poems on Slavery* (Cambridge, 1843): an elementary treatise on arithmetic (1845); *Geometry and Faith* (New York, 1849; Boston, 1874–82); a treatise on curves (1850); *First Lessons in Geometry* (Boston, 1855); *Liberal Education* (1855); *The True Order of Studies* (New York, 1876); *Jesus the Interpreter of Nature, and other Sermons* (1859); *The Natural Sources of Theology* (1875); *Practical Arithmetic* (1881); a volume of verse, *In the Woods and Elsewhere* (Boston, 1888), and other works. D. at Waltham, Mass., Nov. 21, 1891. Revised by J. W. Chadwick.

**Hill**, Thomas: See the Appendix.

**Hill**, Walter Henry: See the Appendix.

**Hil'la**, or **Hella**: town of Asiatic Turkey: in the province of Bagdad; about 60 miles S. of the city of Bagdad (see map of Turkey, ref. 8–J); on the Euphrates, which here is 450 feet broad and crossed by a floating bridge. It has manufactories of cottons and woolens, and large bazaars. It is built near the ruins of Babylon. Pop. about 10,000.

**Hillebrand**, Karl: critic; b. at Giessen, Germany, Sept. 17, 1829; studied law at Heidelberg; was imprisoned for participation in the insurrection of 1849; escaped to France, where he continued his studies; graduated at the University of France and at the Sorbonne; taught German for a few months in the military school at St.-Cyr; and in 1863 became Professor of Foreign Literatures at Douai. At the outbreak of the Franco-German war he resigned his professorship, went to Rome as correspondent for the London *Times*, and afterward settled in Florence. He was an accomplished linguist and published valuable works in English, German, French, and Italian. Among them are *Dino Compagni* (Paris, 1862); the prize essay *De la bonne comédie* (1863); *La Prusse contemporaine* (1867); *Études italiennes* (1868): *De la réforme de l'enseignement supérieur* (1868): *Zeiten, Völker, und Menschen* (7 vols., 1875–85); two volumes of *Geschichte Frankreichs von der thronbesteigung Ludwig Phillips bis zum Fall Napoleons III.* (1877, 1879); *Lectures on German Thought during the Last Two Hundred Years* (London, 1880). See Homberger, *Karl Hillebrand* (1884). D. in Florence, Oct. 19, 1884.

**Hillebrand**, William F.: See the Appendix.

**Hil'lel** [Heb.; singing, praising], the Great or the Elder (*Hazaken* or *Hassaken*): doctor of the Jewish law; b. at Babylon about 75 B.C., or, as others say, 110 B.C.; became one of the most illustrious of Jewish rabbis, eminent alike for wisdom, holiness, and learning; went about 50 B.C. to Jerusalem and worked with his hands for his living, at the same period attending the lectures of the principal officers of the Sanhedrin, of which, about 30 B.C., he became president, retaining that exalted position till his death, 10 A.D. He became the founder of the school of Hillel, which numbered thousands of adherents, while Shammai, vice-president of the Sanhedrin, was at the head of the rival school of Shammai. The two schools disputed mainly about questions of the law and discipline in sacred things, Hillel's, which was the more liberal, finally becoming the dominant one. (See Delitzsch's *Jesus und Hillel*, 3d ed., Erlangen, 1879.)—Hillel, the Prince, a descendant of the foregoing, became president of the Sanhedrin and head of the school of Tiberias, as some say in 258 A.D., dying in 320; or, as others say, was chosen president 330 A.D., and died before 400. He is distinguished as the great reformer of the Jewish calendar. Revised by S. M. Jackson.

**Hiller**, Ferdinand: composer; of Jewish parentage; b. at Frankfort-on-the-Main, Germany, Oct. 24, 1811; not only an eminent musician himself, but also the teacher of many eminent pupils. He studied under the best masters of his day, and in 1827 accompanied Hummel on a professional tour. He was in Paris from 1828 to 1835, then returned to Frankfort and subsequently to Cologne, which remained his home for the rest of his life, except when he was professionally engaged elsewhere. He conducted the Leipzig Gewandhaus concerts 1843–44; the lower Rhine music festivals at Cologne from 1850, and occupied various positions as conductor in different German cities. D. at Cologne, May 10, 1885. His first opera, *Romilda*, was produced at Milan in 1839. Five other operas were composed by him, two oratorios, *Saul* and *The Destruction of Jerusalem*, three symphonies, several cantatas, including, *Nala and Damayanti*, for the Birmingham festival of 1871; many motets, psalms, and smaller vocal and instrumental works; also several literary works, including *Aus dem Tonleben unserer Zeit* (2 vols., 1867), a third volume in 1871, and a fourth in 1876, besides many miscellaneous musical articles in German and English periodicals. D. E. Hervey.

**Hillern**, Wilhelmine, von: novelist; daughter of Christian Birch and Charlotte Birch-Pfeiffer; b. in Munich, Mar. 11, 1836; studied dramatic art and won success at the Hoftheater at Coburg in 1853; married Kammerherr von Hillern in 1857; and for many years has devoted herself to authorship. She has written the plays *Guten Abend* (1873): *Ein Autographensammler* (1874); *Die Augen der Liebe* (1878); and the novels and stories *Doppelleben* (1865; 2d ed. 1880); *Ein Arzt der Seele* (1869; 4th ed. 1885); *Die Geyer-Wally* (1873: 5th ed. 1884; dramatized 1880); *Höher als die Kirche* (1876); *Sie kommt doch* (1879); *Die Friedhofsblume* (1883).

**Hillhouse**, James Abraham: poet: son of James Hillhouse (1754–1832), chief justice of the U. S. Supreme Court: b. at New Haven, Conn., Sept. 26, 1789; graduated at Yale, in 1808; became a merchant in New York, and in 1822 married and retired from business. His principal poems were *The Judgment* (1812); *Percy's Masque* (1820); and *Hadad* (1825). His collected works in two volumes appeared in 1839. D. at New Haven, Jan. 4, 1841.

**Hilliard**, Henry Washington: lawyer; b. in Cumberland co., N. C., Aug. 4, 1808; graduated at South Carolina College, Columbia, in 1826. Soon afterward he went to Athens, Ga., where in 1829 he was admitted to the bar: in 1831 was elected to a professorship in the Alabama University at Tuscaloosa, and filled the position with distinction for three years; then, resigning, he resumed the practice of law at Montgomery in that State, and in the meanwhile was a lay preacher in the Methodist Church. He was a member of the State Legislature in 1838, and presidential elector on the Whig ticket in 1840. In 1842 he was appointed minister to Belgium by President Tyler, and afterward was a member of Congress from Alabama from 1845 to 1851, when he declined being again a candidate. In 1856 he was a candidate on the Fillmore electoral ticket of Alabama, and also on the Bell-Everett ticket in 1860. He strongly opposed secession in 1861, but after the convention of Alabama passed the ordinance of secession he espoused the cause of his State. He accepted from President Davis the appointment of commissioner to Tennessee, and held the rank of brigadier-general in the provisional army of the Confederate States. After the war he returned to Georgia, and resumed the practice of law. He was U. S. minister to Brazil 1877–78. A volume of his speeches was published in 1855, and in 1865 *De Vane, a Story of Plebeians and Patricians* (2d ed. Nashville, 1886). D. Dec. 17, 1892.

**Hills**, George, D. D.: first Bishop of British Columbia; b. at Eythorn, Kent, England, in 1816; a son of Rear-Admiral Hills: graduated B. A. at Durham University 1835; received several Church preferments, and in 1859 was consecrated Lord Bishop of British Columbia, having his see-house at New Westminster. In 1892 he resigned his see and returned to England. D. at Parham, Suffolk, Dec. 10, 1895.

**Hillsboro**: city; capital of Montgomery co., Ill. (for location of county, see map of Illinois, ref. 8–E); on the Cl., Chi., Cin. and St. L. Railway; 11 miles E. of Litchfield, 67 miles N. E. of St. Louis. It is in an agricultural region, and has manufactures of flour, furniture, and woolen goods, and a public high school and two weekly newspapers. Pop. of township, city not separately reported (1880), 2,858; (1890) 2,691; city (1900) 1,937.

**Hillsboro**: village: capital of Highland co., O. (for location of county, see map of Ohio, ref. 7–D): on the Balt. and O. S. W. and the Cin., Ports. and Va. railways: 60 miles E. of Cincinnati. It has a soldiers' monument, a college (M. E.), with 10 instructors and 102 students, high schools, planing, flour, and woolen mills, foundries, bent-wood and furniture factories, and three periodicals. Pop. (1880) 3,234: (1890) 3,620; (1900) 4,535. Editor of "Gazette."

**Hillsboro**: city; capital of Hill co., Tex. (for location of county, see map of Texas, ref. 3–H); on the Mo., Kan. and Tex. and the St. L. S. W. railways; 33 miles N. of Waco, 55 miles S. of Forth Worth. It is in a cotton, corn, small-

grain, and stock raising region, and contains a $100,000 court-house, several churches, a private academy, cottonseed-oil mill, ice-factory, gin-feeder factory, cotton compress, artesian wells, and three weekly newspapers. Pop. (1890) 2,541; (1900) 5,346. EDITOR OF "MIRROR."

**Hillsborough**: a village of New Brunswick; 100 miles E. N. E. of St. John; founded in 1763 by a Henry Steeves (see map of Quebec, etc., ref. 5–I); exports to the U. S. mineral oil from the Albert mines near by. Of the 3,000 inhabitants of the parish, 700 have the name of Steeves. M. W. H.

**Hillsborough River**: in Volusia co., Fla.; a salt-water lagoon continuous with Halifax river, and extending 30 miles S. of Mosquito inlet. It abounds in fish and oysters, and is separated from the sea by a strip of land from half a mile to 5 miles wide. It is shallow, though navigable for small boats, but its navigation is obstructed by mangroves, coral, sand, etc. Its west bank is a range of oyster-shells. From its head to Indian river a short and shallow canal has been dug. This channel was once called Mosquito South Lagoon, and (with Halifax river) it is still known as Mosquito river. It averages a mile in width.—Another Hillsborough river flows into Tampa Bay, and a third into the Atlantic, directly at Hillsborough inlet.

**Hillsdale**: city; capital of Hillsdale co., Mich. (for location of county, see map of Michigan, ref. 8–J); on the Lake S. and Mich. S. Railway; 66 miles W. of Toledo, 177 miles E. of Chicago. It is the seat of Hillsdale College, and has 3 steam flour-mills, screen, door, table, chair, and other factories, machine-shops, water-works, gas and electric light plants, and 5 periodicals. Pop. (1880) 3,441; (1890) 3,915; (1900) 4,151. EDITOR OF "STANDARD."

**Hillsdale College**: an institution founded as Michigan Central College at Spring Arbor, Mich., in consequence of a vote (1844) of the Michigan yearly meeting of the Free-will Baptist denomination. The college was chartered in 1845 by the Legislature, rechartered and removed to Hillsdale, Mich., in 1855. A portion of the principal college building was burned in 1874, but new buildings were ereeted. Both sexes are educated here. The college has musical, art, theological, academic, and commercial departments, 22 professors and instructors, 365 students, a library of 10,000 volumes, $150,000 invested in grounds and buildings, and $240,000 in productive funds.

**Hilo**, hee'lō: an important town of Hawaii, and the second town in size in the Sandwich islands. It has a spacious and commodious harbor, and is the center of a rich agricultural district. Pop. of district (1900) 19,785.

**Hiltl**, GEORG: actor and novelist; b. in Berlin, July 16, 1826; studied for the stage, and after a two years' engagement in Hanover went to the Hoftheater in Berlin in 1845, and nine years later became its manager. His literary productions consist of a great number of translations and adaptations, and a long list of rather shallow historical novels which have been widely read. Among them are *Gefahrvolle Wege* (1865); *Unter der roten Eminenz* (1869); *Der alte Derflinger und seine Dragoner* (1871); *Das Roggenhauskomplott* (1873); *Die Damen von Nanzig* (1874); *Auf immer verschwunden* (1878). He wrote also the popular histories *Der böhmische Krieg und der Mainfeldzug* (4th ed. 1875); *Der französische Krieg von 1870–71* (3d ed. 1876); *Preussische Königsgeschichten* (1875). D. in Berlin, Nov. 15, 1878.

**Hilton Head**: a township in Beaufort co., S. C.; on Hilton Head island; has on the N. the Port Royal entrance, which constitutes a noble harbor. On the outbreak of the civil war in the U. S. Hilton Head was fortified by the Confederates, but was taken by the U. S. naval forces Nov. 7, 1861.

**Himalaya**, hĭ-maa'la-ya [= Sanskr. Himālaya, abode of snow; *himá-*, snow, frost: Gr. *χιών*: Lat. *hiems* + *alaya*, abode; anc. *Emodus* or *Imaus*]: the great chain of mountains which form the southern rampart of the Tibetan table-land, separating it from the low-lying plains of Northern India. The name is usually limited to that part of the southern mountains of the Tibetan plateau which lies S. of the upper waters of the Indus and the Brahmaputra or Sánpu; but to the northward are two other ranges, which some geographers call Himalayas also, in which case the Himalayas proper are called the southern range. The latter are the highest and best known, and what follows relates to them. The eastern end is where the Brahmaputra breaks through to pass from the northern to the southern slope, but the same mountain axis is now known to extend into China, and that portion of it is in that country sometimes called the "Alps of Sze-chuen." The western end is usually taken at the place where the Indus breaks out of the mountains, but here also the axis can be traced several degrees farther. As thus defined, extending from the Indus to the Brahmaputra, it is a magnificent mountain-chain, striking a curve 1,400 miles long, containing the highest known mountains and the greatest number of high mountains in the world, and presenting the remarkable peculiarity of being drained on the N. by the same streams that drain more than half of the southern slope.

Beginning at the W., the range, from the Indus to where it is crossed by its tributary, the Sutlej, covering Kashmir and the Punjaub, is relatively low and diffused, apparently not reaching 20,000 feet in altitude. From here through the Northwestern Provinces and Nepaul to Sikkim mountains abound which are over 20,000 feet in height. About 70 are already known, and there is no reason to think that all have been found and measured. Of those known 16 are above 25,000 feet and 4 above 27,500. The latter are Gaorinsakar or Everest, on the northern boundary of Nepaul, 29,005 feet, the highest known mountain; Kinchinjinga, in the northwest angle of Sikkim, with two peaks respectively 28,156 and 27,815 feet; and Sihour, between Gaorisankar and Kinchinjinga, 27,799 feet. It may be interesting to add the next highest known mountains. These are Dapsang, in the Karakorum range, N. of Kashmir, 28,283 feet, and in South America, Aeoneagua, 22,423 feet. E. of Sikkim in Bhutan and to the N. of Assam the mountains are relatively low. The high peaks are thus confined to about half of the chain—seventy lofty peaks in about 700 miles—and it is a noteworthy fact that they are confined to that part of the chain whose southern slopes are drained by the Ganges.

The great mass of the Himalayan rocks are metamorphic, sometimes granitoid, sometimes schistose or slaty. Sandstone is found only in the small chain which separates the mountains proper from the southern plains, and these sandstones are fossiliferous. Igneous rocks are not entirely lacking, but there are no volcanoes, whether active or extinct. Slight shocks of earthquake are not uncommon, but very severe ones are unknown. The mountains rise from the plains by a series of interesting formations, often well marked but not always present. First comes a depression below the level of the plains. It is wet, marshy, and productive of fever. Then comes a gradual slope of detritus, dry but malarial, covered with forests especially characterized by the presence of the sal-tree; next a low range called the "Outer Hills," an anterior chain of sandstone rich in fossils, varying in height from 300 to 3,000 feet. Between these hills and the base of the mountains is a series of small valleys, with a rich productive soil and luxuriant forest vegetation, full of malaria a and favorite haunt of the larger wild beasts. Behind these rise the mountains proper, somber and monotonous, peaks without plateaus at the top, and separated by narrow winding gorges instead of broad and fertile valleys.

The snows extend in winter on the southern slope to a height of about 6,000 feet, but the line of perpetual snow is 10,000 or 12,000 feet high. It has been found to be about 3,000 feet higher on the northern than on the southern slope—a fact due to the greater aridity on the northern side. Glaciers occur as on other mountains, and it has been found that they have latterly decreased like those in the Alps. The forest growth on the slopes is abundant, varying with the altitude. At elevations of 14,000 or 15,000 feet a sort of barley is the only grain which can be cultivated. Wheat succeeds only up to about 12,500 feet, as also common barley, a millet, and peas. From about 10,000 feet down two crops a year are obtained. Bisons, musk oxen, and mountain sheep and goats are found wild in the highest region, while the tame animals are yaks and domestic sheep and goats. All parts of the chain abound in minerals, especially iron and copper. Lead, zinc, sulphur, and plumbago exist in smaller quantities. Mineral springs are common; limestone formations are absent. Salt is rare, though common farther north, and only traces of coal are found, and these are at the base of the mountains. A little gold is found in some torrent beds in the western Himalayas. The natives have mined copper largely, and lead to a less degree, while the British have mined some iron.

REFERENCES.—J. D. Hooker, *Himalayan Journals* (2 vols., 1855); Schlagintweit Brothers, *Scientific Mission to India*

*and High Asia* (5 vols. and atlas, 1861–72): H. von Schlagintweit, *Reisen in Indien und Hochasien* (4 vols., 1869–80); Saunders, *A Sketch of the Mountains and River Basins of India* (1870), and *The Himalayan System* in *Geographical Magazine* (1877); Markham, *Mission of T. Bogle*, etc. (1876), and *The Himalayan System* in *Geographical Magazine* (1877); article, *Himalaya*, in Saint-Vincent's *Géographie Universelle* (1884) and the *Encyclopædia Britannica*. MARK W. HARRINGTON.

**Hi'mera**: an ancient city of Sicily; situated on the northern coast; was founded in the seventh century before Christ by a colony from Zancle, and was destroyed in 408 B. C. by the Carthaginians under Hannibal.
Revised by G. L. HENDRICKSON.

**Hime'rius**: a Greek sophist of the fourth century after Christ (probably from 315 to 386); b. at Prusa in Bithynia; studied at Athens; traveled, and settled finally at Athens as a teacher of rhetoric. For some time he lived in Antioch at the court of the Emperor Julian, who fully appreciated him. Among his disciples was Gregory Nazianzen. He was, like Libanius, a pagan, but he speaks with moderation, and sometimes even with kindness, of the Christians. Of his orations, twenty-four have come down to us complete, and have been edited by Wernsdorf (Göttingen, 1790). There are fragments of eleven others, and extracts by Photius of thirty-six. His style is florid, figurative, affected. Apart from the allusions to his times, the chief value of Himerius lies in his poetic reminiscences and his reproduction in prose of lost poems of the best period.
Revised by B. L. GILDERSLEEVE.

**Himil'co**: a name of common occurrence in the history of Carthage. Pliny mentions one Himilco, a Carthaginian, who made a voyage of discovery along the western coast of Europe at the same time that Hanno explored the western coast of Africa. Both in the first and third Punic wars there were noted Carthaginian generals of this name, but the most famous was that Himilco, the son of Hanno, who in 406 B. C. commanded the Carthaginian expedition against Sicily, together with Hannibal, the son of Gisco. The expedition was very successful, and the whole western part of the island was conquered. In 397, however, Dionysius, tyrant of Syracuse, renewed the war. Himilco again commanded the Carthaginian force, and was successful in the beginning, but while he besieged the city of Syracuse a pestilence broke out in his camp. In this emergency Dionysius attacked and defeated him, and Himilco now made an infamous capitulation, paying 300 talents in order to be permitted to depart unmolested with all his native Carthaginians, while he left his allies and the mercenary troops to the mercy of Dionysius. Having returned to Carthage, the popular odium which he incurred pressed so heavily on him that he committed suicide. Revised by G. L. HENDRICKSON.

**Himyarit'ic Language**: See ARABIAN LANGUAGE.

**Hīnayāna** [Sansk.; *hīna*, imperfect, inferior + *yāna*, a vehicle or conveyance]: "the little or inferior vehicle or conveyance"; a slighting or contemptuous term applied to primitive Buddhism by those Buddhists, chiefly of the Northern school, who favored the expanded form of doctrine known as the MAHĀYĀNA (*q. v.*). The term implies that the monastic system founded by Buddha was adapted only for the few, while the speculative mysticism and the ampler and more varied means of salvation of the "great vehicle" or development provide salvation for all. The distinction is illustrated by what Buddha is reported to have said on one occasion: "A notable man's house took fire. He brought goat-carts to rescue his sons. He afterward gave them lofty broad wagons drawn by white bullocks." The first represents the methods of Hīnayāna, the latter of Mahāyāna. See Edkins, *Chinese Buddhism*, p. 63 (London, 1880). R. L.

**Hincks**, EDWARD, D. D.: archæologist; b. at Cork, Ireland, Aug. 19, 1792; studied under his father, Hebrew professor at Belfast; graduated with honors in 1812 at Trinity College, Dublin, and received a fellowship; took Anglican orders, and became rector of Ardtrea, and in 1826 rector of Killyleagh, Ireland, where he died Dec. 3, 1866. Though living in a remote country parish, and possessed of but small means, he became one of the first and ablest restorers of the lost knowledge of the meaning of the Assyrian inscriptions. He discovered the key to the Assyrian vowel system, and his papers *On Assyrian Verbs* (1855–56) contain the first successful attempts at an Assyrian grammar. Among his writings are valued papers on Egyptian MSS., and some polemical works.

**Hincks**, Sir FRANCIS, K. C. M. G., C. B.: Canadian merchant and politician; b. at Cork, Ireland, in 1805, a son of the Rev. Dr. Hincks, a learned Presbyterian divine of Belfast, and brother of Rev. Edward Hincks (1792–1866), the Assyrian archæologist. Sir Francis became a merchant, and in 1832 settled at Toronto, Canada, where he became a prominent editor and politician; Finance Minister of Upper Canada 1842–43 and 1848–54; Prime Minister in 1851; governor of the Windward islands 1853–62; of British Guiana 1862–69; Finance Minister of Canada 1869–73. He was knighted in 1869. D. Aug. 18, 1885.

**Hincmar**: Archbishop of Reims; b. in the province of Reims, 806. He was educated in the Benedictine monastery of St.-Denis, near Paris; became a monk there 829, but the next year was banished to New Corbie, in Saxony, for his alleged participation in a conspiracy against Louis the Pious, but was restored in 831 and lived at Louis's court. On May 3, 845, he was consecrated Archbishop of Reims and Metropolitan. He made a very vigorous prelate, and carried on some memorable and successful controversies, the most famous of which was with the monk Gottschalk upon the subject of predestination, which the monk advocated in its baldest form. He also played a prominent part as a statesman. In fact he was the foremost man of his very troublous times. In 882 the dreaded Normans made their appearance in the neighborhood of Reims, and he fled to Épernay, and there died Dec. 21, 882. Of far-reaching consequences was his use of the false Isidorian decretals, those bold forgeries of documents pretending to date from early Christian times. He was the first to employ them, when contending for the Gallican liberties against the pope, and did so probably in good faith. See his works in Migne, *Pat. Lat.*, CXXV.–XXVI., and his biography by H. Schrörs (Freiberg im Breisgau, 1884).
SAMUEL MACAULEY JACKSON.

**Hind**, HENRY YOULE: See the Appendix.

**Hind**, JOHN RUSSELL: astronomer; b. in Nottingham, England, May 12, 1823; began his astronomical studies on his arrival in London in 1840 as assistant to a civil engineer; discovered a number of the asteroids between 1847 and 1854, and was superintendent of *The Nautical Almanac* from 1857 to 1891. D. at Twickenham, Dec. 23, 1895. S. N.

**Hin'dersin**, GUSTAV EDUARD, von: soldier; b. at Wernigerode, Prussian Saxony, July 18, 1804; entered the artillery as a volunteer in 1820; distinguished himself by his quick apprehension, indefatigable application, and eminent business capacity, and was attached to the staff as first lieutenant in 1841. In 1846 he became major, and was appointed director of the topographical department. In the campaign of 1849 against the insurgents of Baden he had the misfortune to be taken prisoner while reconnoitering from a belfry, but was liberated after the capitulation of Rastadt. In 1854 he received the command of the Second Brigade of Artillery, in 1858 that of the Third, and in 1864 the position of inspector-general. Shortly before the assault on the Düppel intrenchments in Schleswig, during the war against Denmark, he was called to the headquarters of Prince Frederick Charles and appointed leader of the artillery attack; after the victory he was ennobled and received the title of a general of infantry. In the war against France (1870–71) he followed the royal headquarters as commander of the artillery, and took an active part in the siege of Paris. D. June 25, 1872. He did much for the improvement of the Prussian artillery, and introduced the breech-loading gun.

**Hindley**, hīnd'li: town of Lancashire, England; 2 miles E. S. E. of Wigan (see map of England, ref. 7–F); has extensive cotton manufactures and large coal mines in its vicinity. Pop. (1891) 18,973.

**Hindoo-Koosh**: See HINDU-KUSH.

**Hindostan**: See INDIA.

**Hinds**, SAMUEL, D. D.: clergyman and author; b. in Barbados 1793; graduated in 1815 at Queen's College, Oxford; became principal of Codrington College, Barbados; vice-principal of St. Alban's Hall, Oxford, 1827–31; domestic chaplain to Archbishop Whately 1831–33; was vicar of Yardley, Hertfordshire, 1834–43; prebendary and rector of Castlenock, Dublin, 1843–48; chaplain to the Lord-Lieutenant of Ireland 1846–48; dean of Carlisle 1848; Bishop of Norwich 1849–57, when he resigned. D. at Notting Hill, London, Feb. 7, 1872. Author of a *History of Christianity* (London, 2 vols., 1828; 3d ed. 1850); a treatise on logic, *Sonnets and Sacred Poems* (1834); *The Three Temples of the*

*One True God Contrasted* (Oxford, 1830; 3d ed. 1857); *Inspiration and Authority of Scripture* (1831); *Scripture and the Authorized Version* (London, 1845; 2d ed. 1853), etc. His *History of Christianity*, originally published in the *Encyclopædia Metropolitana*, has gone through many editions.

**Hinduism**: the religious system prevalent among the Hindus, who form the bulk of the people of India. It is a comparatively modern development, through Brahmanism and Buddhism (*qq. v.*), influenced by non-Aryan notions, of the primitive nature-worship of the earliest Aryan settlers, as exhibited in the collection of hymns called the *Vedas* (the oldest literary monuments of the country), and hence called *Vedism*. (See Veda.) These hymns have a strong mythic character about them. They are addressed to the elements and powers of nature personified—to fire, to the wind, to the firmament, the moon, and other objects. Those addressed to the dawn are peculiarly interesting from their mythical significance. No one of the divinities has any recognized superiority over the others, but the differences in the numbers of the hymns addressed to the individual deities show that they were held in various degrees of dread and reverence. There are glimpses in some of the hymns of a high and spiritual conception of the Deity, or direct mystical allusions to one superior Being, from whom all the rest emanate; and texts are found which speak more or less explicitly of "One Supreme Spirit, the Lord of the universe, whose work is the universe." But the general character of the hymns does not rise above earthly objects. Protection from the elements, from sickness, and from enemies, aspirations for the favors of nature, for increase of children and of cattle, are their main topics. Various rites and ceremonies are provided for and enforced, and very frequent reference is made to the fermented juice of the *soma* plant (*Asclepias acida*), a beverage in high favor among mortals, and therefore presented as an acceptable offering to the superior powers.

The difference between the religion of the Vedas and modern Hinduism is very wide—so wide indeed that the two religions have little or nothing in common beyond the Vedic texts and formulas still in use. "The great feature of difference," says H. H. Wilson, "is the total absence of the divinities, both *nomina* and *numina*, who have for ages engaged, and, to a great degree, engrossed, the adoration of the Hindus. We have no indications of a Triad, the creative, preserving, and destroying power; Brahmá does not appear as a deity, and Vishnu, although named, has nothing in common with the Vishnu of the Puránas; no allusion occurs to his *avatárs* or incarnations. As a divinity Siva is not named; nor is his type, the *lingam*, ever adverted to. Durgá and her triumphs, and Kálí, 'whom the blood of man delights a thousand years,' have no place whatever in the hymns of the Vedas." The doctrine of transmigration seems to be entirely unnoticed in the Vedic hymns: and the rite of *sati*, the burning of widows with the corpses of their husbands, although known to Greek writers 300 years before Christ, and said to be a Vedic institution, proves upon examination to have no better authority than a misquoted verse. Some portion of the ceremonial of the Vedas still survives in the domestic observances of the Bráhmans and in their obsequial offerings. It is incumbent on every householder to make offerings of cakes and other viands to his own ancestors, and to the collective *Pitris* or Patres of the human race. Every Bráhman also, on approaching maturity and being invested with the sacred thread, is taught the celebrated verse called the *Gáyatri*: "Let us meditate on the adorable light of the Sun (or Divine Ruler): may it guide our intellects!" This may be the only verse of the Veda he may ever learn, but this he must repeat in all his devotions.

Second only to the Veda in importance is the Code of Manu, which is also a pre-Christian production. This shows a considerable advance in the development of the Hindu system. A future state of reward and punishment is clearly recognized, and the doctrine of transmigration is distinctly enunciated. No one of the three great gods of modern times was known to the Veda, but Manu recognizes Brahmá, the Creator. But Brahmá is not the One Supreme Being, the Soul of the universe, but merely the creative energy; and after the world which he has produced has endured for long ages, the Divine energy is withdrawn and Brahmá himself returns to the Supreme essence from which he emanated. (See Brahmanism.) The most remarkable feature in Manu, however, is the full development of the caste system. Not only are the four great castes recognized, but the "mixed castes" also have come into being through the intercourse of couples belonging to different castes. Most stringent rules are laid down for the separation and guidance of all the castes, the chief and leading object throughout being the elevation of the Bráhman and the degradation of the others. See Caste.

It is in the Puránas (*q. v.*), however, that Hinduism receives its full development. Brahmá the Creator, Vishnu the Preserver, and Siva the Destroyer (or rather Regenerator) are acknowledged as the three great divinities constituting the Triad. The first of the Puránas is the *Brahmá-purána*; the others are devoted, some to the exaltation of Vishnu in one or other of his many forms, and some to the honor of Siva and his emblem, the *lingam*. It is doubtful if Brahmá was ever an object of worship, for even the Brahmá-purána does no more than indicate a local worship of him at one place near Ajmír. Vishnu the Preserver was then, as now, the most popular deity, under one or other of his ten *avatárs* or descents, or, as the word is sometimes translated, "incarnations." See Avatar and Vishnu.

Siva, the Destroyer and Regenerator, has also a vast number of votaries, but fewer than Vishnu. His appearance and attributes are of a very gloomy character. He is represented as sitting absorbed in thought—naked, smeared with funereal ashes, with matted hair, and a necklace of human skulls and bones. He has three eyes, and the fire from them consumes those who interrupt his devotions. See Siva.

Saraswatí, the wife of Brahmá, is the goddess of learning and the arts, and the inventress of the Sanskrit language. She receives more honor than her lord. Lakshmí, the wife of Vishnu, is the goddess of prosperity and fortune. Both of these deities receive adoration on particular occasions, and the latter is very frequently invoked, but they are not the objects of any regular worship. It is far different with the consort of Siva, who is known under a great variety of names—Deví, Dúrgá, Kálí, Párvatí, Bhaváni, etc.—and is the recipient of a fierce fanatical adoration. This goddess is represented in a variety of ways, all more or less terrible and disgusting. In the mildest form she is a handsome woman riding on a tiger in a fierce and menacing attitude. In another and more common one she is Kálí, "the black," with a black skin, a hideous and terrible countenance, dripping with blood, wreathed with snakes, and adorned with human skulls. The worship of this deity is very widely spread, especially in Bengal, and it is from her that Calcutta obtained its name. The worship of Deví owes its diffusion, perhaps its rise, to a class of writings called *Tantras*. These are works of a comparatively late date, but their origin is very obscure and their authors are unknown. They are ascribed to Siva, and are generally in the form of dialogues between him and his consort. "They are very numerous, and some are of considerable volume. They have been but little examined by European scholars, but sufficient has been ascertained to warrant the accusation that they are authorities for all that is most abominable in the present state of the Hindu religion. The great feature of the religion taught by the *Tantras* is the worship of Saktí—divine power personified as a female, and individualized, not only in the goddesses of mythology, but in every woman; to whom, therefore, in her own person, religious worship may be, and is occasionally, addressed. The chief objects of adoration are, however, the manifold forms of the bride of Siva. Even in its least exceptional division the Saktí worship comprehends the performance of magical ceremonies, and rites intended to obtain superhuman powers and a command over the spirits of heaven, earth, and hell. The popular division is, however, called by the Hindus the *left-hand* faith. It is to this that the bloody sacrifices offered to Kálí must be imputed, and that all the barbarities and indecencies perpetrated at the annual worship of Dúrgá and the swinging festival are to be ascribed. There are other atrocities which do not meet the public eye." (*H. H. Wilson.*)

The religion of the Hindus is thus principally directed to the worship of three leading divinities, Vishnu, Siva, and Deví—each of whom has many names and forms. Each form or manifestation has some peculiar attribute, some special kind of worship, but the general features are maintained throughout. The worship of Vishnu is cheerful and sensuous; of Siva, somber and severe; of Deví, terrible and disgusting. But besides these great divinities there are many others of less dignity and power, who have their special attributes and spheres of action. They are not the ob-

jects of any regular worship, but they are invoked and adoration is offered to them when it is desired to propitiate them and secure a favorable exercise of their powers. There is Indra, the god of the firmament and heaven; Súrya, the sun; Soma, the moon; Varuna, the waters; Pavana, the wind; Agni, fire; Kuvera, wealth; Kártikeya, war; Káma, love; Yama, the god of the infernal regions and judge of the dead; Ganesa or Ganapati, the god of wisdom and the remover of obstacles. He is represented as a short fat man with an elephant's head. His image is frequently found at the entrance of temples, and he is invoked at the beginning of important works and ceremonies. The total number of gods is said to be 330,000,000.

Two very remarkable features in the Hindu religion are the great powers and virtues ascribed to sacrifice and faith. Sacrifice and austere penance, perseveringly and rigidly performed, make even the gods subservient to the wishes of the devotee, and that quite irrespective of the object in view. The merit is in the performance, not in the spirit, of the observance, and the most impious and worthless are represented as gaining their ends by sacrifice and severe bodily torture. The virtue of faith was a leading principle in the *Bhagavad Gîtâ* ascribed to Krishna. Trust in the chosen deity, constant repetition of his name, the bearing of his sectarial marks—in short, the outward show of religion upheld by a fanatical faith—is of more avail than sacrifice and piety. Morality and innocence may be inculcated, but the saving principle is belief.

The worshipers of Vishnu and Siva are broken up into an infinite variety of sects and divisions, and they have also a great number of monastic and mendicant orders intent upon the maintenance of their respective phases of belief. Many instances are recorded of rival devotees coming in conflict at some of the great places of pilgrimage, and of hundreds and thousands being killed. There are among the Hindus men of superior intelligence who philosophically see through all these varieties of divinity the One Supreme Being, to whom alone worship is due. There have been others who, influenced by that feeling of mysticism so prevalent in the East, have treated all the forms of religion as mere symbols. Such were the founders of some of what may be called the dissenting sects, who deny the merit of religious ceremonies, and strive to seek above and beyond them the One Great Being. Such was the sect established by the weaver Kabir at the beginning of the fifteenth century; such also was that of the Sikhs, founded by Nának at the end of that same century. Many a pure thought and lofty idea is to be found in the verses of these and other such independent thinkers—for it is to be noted that all of them express their thoughts in verse—but there is a strong disposition in all such sects, as time wears on, unduly to exalt their *guru* or founder, and to adore him as a saint. See the articles Siva and Vaishnavas. See also *India* in Johnson's *Oriental Religions* (Boston, 1873); vol. iii. of Talboys Wheeler's *History of India from the Earliest Ages* (London, 1874); Robson's *Hinduism in its Relation to Christianity* (Edinburgh, 1874); Barth's *Religions of India* (London, 1881; New York, 1883); Monier-Williams, *Religious Thought and Life in India* (London, 1883; a third edition of this work appeared in 1887, with the title *Brahmanism and Hinduism*). See also a little work by the same author entitled *Hinduism*, prepared for the Society for the Promotion of Christian Knowledge (London and New York).

Revised by R. Lilley.

**Hindu-Kush**, or **Hindoo-Koosh**: a mountain range in Central Asia, extending from lon. 68° to lon. 75° E., and forming the boundary between Afghanistan and Turkestan. At its eastern extremity it is connected with the Karakorum Mountains, which it resembles in many of its features, though it is lower. The dividing-line between the Hindu-Kush and the Himalaya forms the Baroghil Pass, which leads from the high valley of Little Pamir down into the valley of Kashgar. At its western extremity it is separated from Koh-i-Baba by the Hajjigak Pass, which leads from Cabul to Turkestan. Its entire length is 365 miles. Its highest point is probably Tirich-Mir, about 23,000 feet high.

Revised by M. W. Harrington.

**Hindu Philosophy**: six schools of philosophy recognized by the Hindus. These are all founded ostensibly on the Vedas, and attempt to interpret the religious doctrine of those sacred books as regards the first principle of the universe and its relation (or non-relation) to the world. They claim to have one final object, the attainment of *mukti*, or deliverance, the emancipation of the soul from future birth and existence, and its absorption into the Supreme Soul of the universe.

The names of the six schools, or *darsanas*, are *Nyáya*, *Vaiseshika*, *Sánkhya*, *Yoga*, *Púrva-Mímánsá*, and *Uttara-Mímánsá* or *Vedánta*. But with European ideas as to what constitutes a system of philosophy, this classification is misleading and the cause of much confusion in the mind of the uninitiated. The Sánkhya system includes all that there is of philosophy in the six systems, the Nyáya system being merely an organon of logic and the Vaiseshika an atomic theory, or rather a system of physical categories used to explain the world of nature; but, unlike the atomic school of Leucippus, it does not regard atoms as ultimates, but as possessing a spurious individuality like the waves of the sea. The Yoga systems are professedly practical applications of the doctrines of the Sánkhya; the two Mímánsás are an attempt to interpret, by a commentary, the doctrine of the Vedas, using the insight of Kapila as the explanatory principle. That insight regards all beings in time and space as emanations from a One being entirely without attributes or variety of any kind. The orthodox Brahmins name this One Brahm, or Vishnu, Krishna, or by some other name, and consider themselves to be theistic; while the followers of Kapila describe their first principle negatively, and are called atheists. But it is a difference in names only, inasmuch as a pure being devoid of all attributes, properties, qualities, and actions, is an empty absolute accurately described by the word *nothing*. For the Hindu Absolute is not in fact a causal being nor a creator, although sometimes the Hindu lets his imagination go so far as to admit descriptive words that imply such causality. The one consistent view to explain both atheistical and theistical schools of philosophy in India is that all limited, particular being, including consciousness itself, is an illusion, owing to ignorance or error, which produces sense-knowledge of outside objects. True knowledge, enlightened by the Sánkhya, is aware that all seeming objects are illusionary. In fact Buddhism itself borrows the Sánkhya doctrine, and explains the world by twelve Nidânas or successive stages of ignorance of the true nature of illusions: first, ignorance that things are not real leads us to act in order to change something that does not please us; the second Nidâna is action. Again, action upon our environment leads us to knowledge of the limits between the *me* and the *not-me*; this is the third Nidâna, or consciousness, etc. In the eleventh chapter of the *Bhagavad Gîtâ* Krishna reveals to Arjuna the illusion in ordinary knowledge, and shows that the "universal form" destroys within it all particular beings, all individuality; whether in gods or in men, all limitation, all distinction, is unreal, and all supposed knowledge of things is ignorance. The *Sánkhya Káriká* (distich 64, Colebrooke's translation) says, "Through the study of (the twenty-five) principles the conclusive, incontrovertible, one, only knowledge is attained, that neither I am, nor is aught mine, nor do I exist." The *Bhagavad Gîtâ* is the best exposition of this one philosophy which underlies all Hindu thought. It represents that branch of the Sánkhya system called the Karma Yoga, and enjoins action to some extent (provided that the one who acts keeps himself in a state of complete indifference as to the results of his action), while the Yoga of Patanjali tends to complete non-resistance and quietism. The Yoga systems are applications of the Sánkhya doctrine to the purpose of religious emancipation from ignorance and the evils of mundane existence. The first authority is Colebrooke, *Miscellaneous Essays*, reprinted from the *Transactions of the Royal Asiatic Society*, and his translation of the *Sánkhya Káriká* (1837). Among the numerous writings accessible are *Hindu Philosophy*, by John Davies (1881); *The Vedântasâra*, translated by Maj. S. A. Jacob (1881); *The Religions of India*, by A. Barth, translated by Rev. J. Wood; *The Bhagavad Gîtâ*, translated by J. Cockburn Thomson (1855). (See R. W. Emerson's *Brahma* for a masterly summary of the doctrines of the *Bhagavad Gîtâ*.) *The Bhagavad Gîtâ*, translated by Mohini M. Cheterji (Boston, 1887); other and better known translations of this work by John Davies (London), Charles Wilkins, and by Kâshinâth Trimbak Telang in Max Müller's *Sacred Books of the East*. See articles on Sánkhya, Yoga, Vaisheshika, Mímánsá, and Vedánta.

W. T. Harris.

**Hindus**: See Caste and India.

**Hingham**, hing'am: town (settled 1633 and incorporated 1635); Plymouth co., Mass. (for location of county, see map

of Massachusetts, ref. 4–J); on Massachusetts Bay and the Old Colony Railroad; 14 miles S. E. of Boston, with which it has railway and steamboat connection. It contains 8 churches, a meeting-house built in 1681, excellent schools, 3 public halls, public library, Derby Academy, Melville Garden, Downer Landing, and weekly newspaper, and manufactures wooden-ware, wooden toys, cordage, awnings, boot-heels, furniture, worsted upholstery, and leatherette. In the cemetery are a monument to the first settlers and a statue of Gov. John A. Andrew. The township contains the villages of Hingham Center and South Hingham. The town is a noted summer resort. Pop. (1890) 4,564; (1900) 5,059.

**Hingston**, Sir William H.: See the Appendix.

**Hin'ny**, or **Jen'net** [*hinny* is from Lat. *hinnus*, mule; *jennet* is from Fr. *genet*: Span. *jinete*, pony, horseman: Ital. *ginnetto*, pony, probably < Gr. γυμνήτης, light-armed soldier. Origin in Arab. *zenāta*, name of a Barbary tribe of horsemen, has also been suggested]: a hybrid between the horse and the she-ass, a very different animal from the mule, which is bred between the ass and the mare. The hinny neighs like a horse, the mule brays like the ass. The mule's ears, tail, and general aspect are asinine. The hinny more nearly resembles the horse; is of slighter build, and of strength inferior to that of the mule. It is bred to some extent in Spain and Barbary. It was once called *jumart*, and was absurdly believed to be the fruit of a cross between the bull and the mare.

**Hinrichs**, hĕĕn'richs, Gustave: composer and conductor; b. in Ludwigslust, Mecklenburg, Germany, in 1850; educated there and at Hamburg; when nineteen years old emigrated to the U. S. and settled in San Francisco; conducted operas and concerts there; in 1885 became assistant conductor of the American Opera Company; when that company was reorganized in 1887 he became its only conductor. He has composed several operas, one of which, *Ontiora*, was successfully produced in Philadelphia, July 28, 1890.

**Hinrichs**, Gustavus D.: See the Appendix.

**Hinsdale**: village; Du Page co., Ill. (for location of county, see map of Illinois, ref. 2-G); on the Chi., Burl. and Q. Railroad; 18 miles W. S. W. of Chicago. It has a high school and two weekly newspapers. Pop. (1880) 819; (1890) 1,584; (1900) 2,578.

**Hinsdale**: town; Cheshire co., N. H. (for location of county, see map of New Hampshire, ref. 10–D); on the Ashuelot river and the Connect. River Railroad; 19 miles S. W. of Keene. It is noted for its manufactures, which include woolen goods, paper, machinery, mowing-machines, soap, hardware, etc. It has a weekly and two monthly periodicals. Pop. (1880) 1,868; (1890) 2,258; (1900) 1,933.

**Hinsdale**, Burke Aaron, Ph. D.: educator; b. at Wadsworth, Medina co., O., Mar. 31, 1837; was educated at the Elective Institute, now Hiram College, where he was a pupil of James A. Garfield; entered the ministry of the Christian Church (called also Disciple, Campbellite, etc.) in 1861; was pastor in Solon, O., 1864–66; in Cleveland 1866–68; assistant editor of *The Christian Standard* 1866–69; Professor of History and English Literature in Hiram College 1869–70; became its president and Professor of Philosophy, History, and Biblical Literature 1870; Professor of the Science and Art of Teaching in the University of Michigan 1886; author of *Genuineness and Authenticity of the Gospel* (Cincinnati, 1870); *The Jewish Christian Church* (1878); *Republican Text-book* (New York, 1880); *Garfield and Education* (Boston, 1881); *Schools and Studies* (1884); *The Old Northwest* (1888); and edited *The Life and Works of James A. Garfield* (1882–85), and has contributed much to periodical literature. D. Nov. 29, 1900.

**Hinton**: town; capital of Summers co., W. Va. (for location of county, see map of West Virginia, ref. 10–G); at the confluence of the Greenbrier and New rivers; on the Ches. and Ohio Railway; 100 miles S. E. of Charleston, the State capital. It contains the machine-shops and round-house of the Ches. and Ohio Railway, large steam sawmills, and a valuable brownstone quarry, and is in a coal and timber producing region. Pop. (1880) 879; (1890) 2,570; (1900) 3,763. Editor of "Independent Herald."

**Hiodon'tidæ** [from Y, i. e. the U-shaped or hyoid bone, and ὀδούς, tooth]: a family of isospondylous teleocephalous fishes, having a herring-like form; cycloid scales; head scaleless; the margin of the upper jaw formed by the supramaxillaries on the side, and with those bones articulated to the extremities of the intermaxillaries; and the dorsal fin behind the anus; the stomach is not cæcal, and has only one pyloric appendage; the air-bladder is simple; the ovaries discharge their eggs first into the abdominal cavity. This group has been constituted especially for the reception of the "moon-eye herring" (*Hiodon tergisus*) of the lakes and Western rivers, to which it is peculiar. It is most nearly related to the Clupeids (herrings, shad, etc.).

**Hiogo**, hyō'gō: an important town and seaport of Central Japan; on the western shore of the Bay of Osaka, three hours by rail from the ancient capital, Kioto (see map of Japan, ref. 6–C). Hiogo is beautifully situated along a sandy beach at the base of a lofty coast range of hills; it possesses docks, a wharf for ocean steamers, extensive railway fitting-shops, etc. It forms one community with Kobe, which is the settlement of the foreign residents adjacent on the N. With Osaka, distant one hour by rail, Hiogo forms one commercial district, the most important in Japan. It has the reputation of being the most attractive of the foreign settlements in Japan. Since 1880 Hiogo has attracted to itself most of the trade of Nagasaki, once the more important foreign port, and its imports now exceed in value those of Yokohama. These consist mostly of cottons, raw and manufactured, woolens, metals, sugar, chemicals, and kerosene oil. The exports are rice, tea, dried fish, copper, matches, matting, porcelain, umbrellas, camphor, fans, lacquer-ware, Yokohama remaining the silk emporium. There is direct communication by all the more important steamship lines with Europe and America; also direct communication with Australia. There are ship-building yards, two foreign banks, and a large paper-mill. The total tonnage for 1892 of ships of foreign build entering the port amounted to 1,273,300 tons, of which 70 per cent. were British. Exports (1892), $22,345,663; imports, $36,220,175. Hiogo was in 1336 the scene of a famous battle, in which the heroic Kusunoki Masashige fell fighting in support of the rightful emperor. Pop. of Hiogo (1892) 80,545; of the prefecture, 1,554,697; foreign residents (not Asiatic), 623. J. M. Dixon.

**Hip** [M. Eng. *hepe* < O. Eng., *hēope*, hip, bramble: M. H. Germ. *hiefe*, bramble]: the fruit of the rosebush. Hips are used in pharmacy as a material for making "confection of hips" (*confectio rosæ caninæ*), the *Rosa canina*, or dog-rose, and *R. pomifera* of Europe, furnishing the most of the fruit. The seeds are taken out, and the hips beaten in a mortar with white sugar—2 lb. of sugar to 1 of hips. This makes a pleasant sourish confection. The more fleshy and juicy sorts of hips are in some places preserved or dried, and in winter are boiled in pottage, after taking out the seeds and bristly substance within them. In the northwestern part of the U. S. and in Canada rose-hips are a common food for some wild animals. Revised by L. H. Bailey.

**Hip-joint, Diseases of the**: See Coxalgia.

**Hippar'chus** [Gr. Ἵππαρχος, liter., commander of cavalry; ἵππος, horse + ἀρχή, rule]: 1. The reputed founder of the science of astronomy; b. at Nicæa, in Bithynia; lived at Rhodes and Alexandria in the middle of the second century B. C. Of his life nothing is known, and of his writings only the least important, *A Commentary on Aratus*, has been left to us. But from the *Syntaxis* of Ptolemy we know that by his great discoveries, and more especially by his method, he actually laid the foundation of the science of astronomy. (See Ptolemy.) 2. A comic poet of Athens, of whose works only titles and insignificant fragments are left. He was probably a contemporary of Menander. 3. A son of Pisistratus, slain by Harmodius and Aristogeiton. (See Harmodius.) In the dialogue entitled *Hipparchus*, and wrongly ascribed to Plato, the author gives an account of the literary activity of Hipparchus. He erected hermæ along the streets and country roads, and inscribed on them elegiac distichs of his own composition, in which he endeavored to inculcate principles of morality. 4. A Pythagorean, who lived about 380 B. C., and was a teacher of Epaminondas. Because he discussed openly the doctrines of Pythagoras, he was expelled from the Pythagorean fraternity, and a monument was erected to him as though he were dead. 5. A kinsman of Aristotle; b. in Stageira, and appointed by Aristotle one of his executors. 6. The title of the commander of cavalry. Revised by J. R. S. Sterrett.

**Hippa'rion**: See Horse, Fossil.

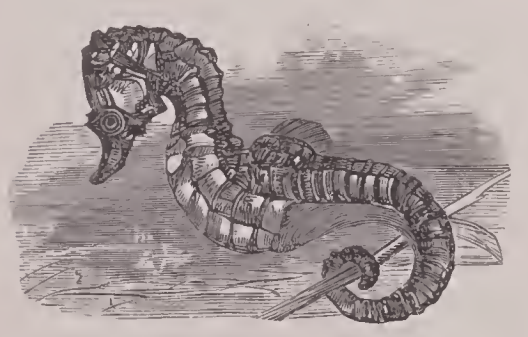
**Hippeau**, ĕĕ'pō', Célestin: author; b. at Niort, Deux-Sèvres, France, May 11, 1803; made his studies in his native city, and filled different positions as a teacher and professor at Poitiers, Napoléon-Vendée, Strassburg, Paris, and Caen.

The most prominent of his writings are *Histoire de l'Abbaye de Saint-Étienne de Caen, 1066–1790* (1855); *Les Écrivains normands au dix-septième siècle* (1857); *Histoire du gouvernement de la Normandie* (9 vols., 1863–73); *Dictionnaire de la langue Française au douzième et treizième siècle* (1873); *Avènement des Bourbons au trône d'Espagne* (1875, 2 vols.); *L'Instruction publique aux États-Unis* (1869), *en Angleterre* (1872), *en Allemagne* (1873), *en Italie* (1874), *en Suède, Norvège, et Danemark* (1876). He received the decoration of the Legion of Honor Aug. 13, 1861. D. in Paris, May 31, 1883.—His wife, Eugénie Hippeau-Delacour, published *Cours d'économie domestique* (1869) and a volume entitled *Mères et nourrices* (1875).

**Hip'pias** (in Gr. Ἱππίας): 1. Son of Pisistratus and brother of Hipparchus. After the death of Pisistratus he became the tyrant of Athens. His rule was in the main mild and beneficent, though some of his acts were tyrannical. He cut down the taxes imposed by his father by one-half. He collected at his court such poets as Anacreon and Simonides, and continued the work of Pisistratus on Homer. After the assassination of Hipparchus (see Harmodius), Hippias ruled with greater sternness because he feared a revolution. Through the tyrant of Lampsacus he entered upon negotiations with the King of Persia in anticipation of his expulsion. In the meantime the exiled Alcmæonidæ had built a temple in Delphi at their own expense, and by this bribe secured an oracle instructing the Spartans to restore them to Athens. Archimolius led the first expedition against Athens and failed, but in the second expedition King Cleomenes was more successful. He captured the children of Hippias, who had been sent away to a place of safety. For their sake Hippias was forced to lay down the tyranny and leave Athens (510 B. C.). He took up his residence at Sigeum, trying in various ways to bring about his restoration, and finally succeeded in persuading Darius to make war upon Athens. He himself acted as guide, and induced the Persians to land at Marathon. According to some he was slain in the battle of Marathon (490 B. C.), just twenty years after his expulsion from Athens, though there seems to be more authority for the statement that he died on the island of Lemnos shortly after the battle of Marathon. 2. A contemporary of Protagoras and Socrates; b. at Elis; lived mostly at Athens. Nothing is known of his life, and none of his writings have been preserved, but his character has been very vividly drawn by Plato in two dialogues. He seems to have been a man of great gifts and comprehensive knowledge, but arrogant, vain, and superficial.

J. R. S. Sterrett.

**Hippocam'pus** [Mod. Lat., from Gr. ἱππόκαμπος, a fabulous sea-monster, half horse and half fish; ἵππος, horse + κάμπος, a sea-monster]: a genus of fishes of the order *Lophobranchii*, family *Syngnathidæ*, distinguished by the prehensility of the tail and the want of a caudal fin, combined with a tubular snout, narrow gill-openings, a single soft dorsal, belonging partly to the abdominal and partly to the caudal portion, and the absence of ventral fins. The males carry the spawn in pouches under the tail till the fry is hatched. All the species are small. The most characteristic and familiar form is the little sea-horse, *Hippocampus hippocampus*, remarkable for the resemblance of its head and neck to those of a horse, and the winding downward and inward of its caudal portion, or tail. *H. hudsonius* is found along the Atlantic coast of the U. S.; other species occur southward. The cut shows *H. brevirostris*, a common European species.



The sea-horse.

Revised by D. S. Jordan.

**Hippoc'rates** [= Gr. Ἱπποκράτης, liter., strong with the horse; ἵππος, horse + κράτος, strength, might]: the father of medicine and the most distinguished of Greek physicians; b. in Cos in 460 B. C. (according to Soranus); the son of Heraclides, one of the Asclepiadæ, and Phænarete, a woman who belonged to the Heracleidæ. Hippocrates studied medicine with his father and with Herodicus of Selymbria; learned rhetoric of Gorgias the Leontine, Prodicus of Ceos, and Democritus of Abdera; practiced his profession chiefly at Cos, and rendered its medical school, already very famous, by far more illustrious than it had ever before been. He traveled much among the Grecian towns, and died at Larissa in Thessaly B. C. 357. (*Clinton.*) Little more than the above facts is known regarding his life, but ancient writers relate of him many fabulous tales. His sons, Thessalus and Draco, and Polybus, his son-in-law, perpetuated his fame, and probably wrote some of the works which bear his name. Those now extant are seventy-two in number (some of them very short), but by far the larger part are either spurious or incorrectly ascribed to Hippocrates. Part or all of the *Aphorisms*, parts of the *Epidemics*, parts of the *Prognostics*, the *Regimen in Acute Diseases*, the treatise on *Wounds of the Head*, and that *On Air, Water, and Places*, are considered genuine works of Hippocrates; and (according to Littré) the treatises *On Ancient Medicine*, on *Joints*, on *Fractures*, on *The Use of the Lever* (in reducing luxations), on *Law*, on *Ulcers*, on *Hæmorrhoids*, on *The Sacred Disease*, on *Fistulæ*, and the *De Medici Officina*, are possibly genuine. As a practitioner, it would be unfair to judge of Hippocrates's merits by any modern standard. His pathological notions were founded mainly on natural analogies and *a priori* reasoning; they consequently have no scientific value, but are memorable as the direct source of the humoral pathology so long dominant in the schools. He also taught the doctrines of *crases*, *coctions*, and *crises*, treated disease chiefly by attention to regimen, and earnestly advocated the expectant treatment in many acute diseases. He was a careful observer and excellent describer of symptoms, and (as his genuine writings show) was a man of the noblest mental and moral qualities. Among the most valued works upon the Hippocratic writings are the commentaries of Galen. The best editions of the entire works are by C. G. Kühn (3 vols., Leipzig, 1825–27), and by Littré, with French translation (Paris, 1839–61, 10 vols.).

Revised by J. R. S. Sterrett.

**Hippocrat'ic Face**: See Facies.

**Hippocratic Oath**: a solemn engagement entered into in ancient times by young men about beginning the practice of medicine, and especially by the Asclepiadæ. The formula itself has been ascribed to Hippocrates, and is certainly very ancient. It was as follows: "I swear by Apollo the physician, by Æsculapius, by Hygieia, Panacea, and all the gods and goddesses, that, according to my ability and judgment, I will keep this oath and stipulation: to reckon him who teaches me this art equally dear to me with my parents; to share my substance with him, and relieve his necessities if required; to look upon his offspring upon the same footing as my own brothers, and to teach them this art, if they shall wish to learn it, without fee or stipulation; and that by precept, lecture, and every other mode of instruction I will impart a knowledge of this art to my own sons, to those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, but to no others. I will follow that system of regimen which, according to my best judgment, I consider best for my patients, and abstain from whatever is injurious. I will give no deadly medicine to any one if asked, nor suggest any such counsel. Furthermore, I will not give to a woman an instrument to procure abortion. With purity and holiness will I pass my life and practice my art. I will not cut a person who is suffering with stone, but will leave this to be done by those who are practitioners of such work. Into whatever houses I enter I will go for the advantage of the sick, and will abstain from every voluntary act of mischief and corruption, and, further, from the seduction of females or males, bond or free. Whatever in connection with my professional practice, or not in connection with it I may see or hear, I will not divulge, holding that all such things should be kept secret. While I continue to keep this oath inviolate, may it be granted me to enjoy life and the practice of my art, respected always by all men; but should I break through and violate this oath, may the reverse be my lot." This oath is not now administered to practitioners, though something equivalent to it was used in the Middle Ages, and especially in the school of Salerno; but every honorable and right-minded physician governs his private and professional life by its noble principles. It is the oldest and one of the best of the codes of medical ethics, there being but one simpler and better code, the Golden Rule of doing as one would be done by.

Revised by J. R. S. Sterrett.

**Hippocre'ne** [= Gr. Ἱπποκρήνη, liter., horse-fountain; ἵππος, horse + κρήνη, fountain]: a fountain upon the side of Mt. Helicon, in Bœotia, believed by the ancients to be a favorite haunt of the Muses and a source of poetic inspiration. It was fabled to have been produced by a stroke of the foot of Pegasus. It is still a fine spring.

Revised by J. R. S. STERRETT.

**Hippoda'mia** (in Gr. Ἱπποδαμεία): daughter of Œnomaus, King of Elis, and Asterope, one of the Pleiades. She was celebrated for her beauty, and her hand was sought by the noblest princes in Greece. But Œnomaus had been forewarned by a prophecy that his death would be brought about by his son-in-law. He determined, therefore, that he would not have a son-in-law, and in order to cool the ardor of the suitors he decreed that all suitors should contend with him in a chariot-race, under the conditions that if the suitor should be victorious he should marry Hippodamia, but if not, he should meet his death at the hands of Œnomaus, who owned horses of exceeding swiftness that had been presented to him by Poseidon. Œnomaus gave the suitors as a start the time it took him to offer a sacrifice to Poseidon; he then mounted the chariot which was guided by Myrtilus, placed his spear in poise, and pursued his would-be son-in-law, whom he transfixed in passing. Sixteen suitors perished in this way. Finally Pelops, son of Tantalus, King of Phrygia, appeared and promised Myrtilus, the charioteer of Œnomaus and himself a lover of Hippodamia, the privilege of one night with her if he would aid him in gaining the victory. Myrtilus agreed, and instead of the iron linch-pin inserted one of wax. Pelops reached the goal, but Œnomaus was dragged to death by his horses. When Myrtilus demanded his reward he was drowned in the sea by Pelops, a crime Poseidon, the father of Myrtilus, resented and avenged. For many years the marriage was a happy one, and many children blessed the union, but Hippodamia induced her sons Atreus and Thyestes to kill Chrysippus, the illegitimate son of Pelops by Axioche. Thereupon Hippodamia and her sons, Atreus and Thyestes, were banished, and fled for refuge to the court of Sthenelus, King of Mycenæ, who assigned them Midea in Argolis as a place of residence. Hippodamia died in Midea, but, in obedience to an order of the oracle, Pelops brought her bones back to Elis, and erected a heroon in her honor. J. R. S. STERRETT.

**Hippodrome** [from Gr. ἱππόδρομος, hippodrome, liter., place to race horses; ἵππος, horse + δραμεῖν, run]: the name anciently given in Greece and Constantinople to the ground where chariot and other horse-races took place. Of these races, those in chariots were the most popular. In these races many competitors for the prize entered the race, which was consequently attended with much danger to the drivers —a danger much increased by the limited size of the hippodrome and the consequent necessity of frequent turning of goals. The hippodrome at Olympia was long the most famous. Pausanias describes it, and though he gives much information in regard to the construction of the hippodrome, still the subject is full of difficulties. In Olympia the double race-course was about 4 stadia, or, in other words, the length of the hippodrome was about 1,200 feet, or 400 yards by 125 yards in width. The hippodrome in Constantinople was vaster still; it was begun by Septimius Severus and finished by Constantine the Great. It was so vast that the palace of the emperors and the great Church of St. Sophia had to be oriented with reference to it. It was adorned with the works of Grecian artists in marble and bronze, and one of the most venerable relics of antiquity, the bronze serpent dedicated at Delphi by assembled Greece in commemoration of the victory at Platææ, still stands in the hippodrome. Naturally the hippodrome acquired great renown, and the whole populace of the empire was divided in its social and political relations by factions (the Blues and the Greens), which had their origin in the hippodrome. The remains of it (still called At Meïdan, the Turkish equivalent of hippodrome) are considerable, but its exact dimensions can not be given until excavations on the site shall have been made. See Curtius, *Olympia* (Berlin, 1852); Grosvenor, *The Hippodrome of Constantinople* (London, 1889); Pollack, *Hippodromica* (Leipzig, 1890).

**Hippolyté**, Louis M. F.: See the Appendix.

**Hippol'ytus** [Gr. Ἱππόλυτος, loosing horses; ἵππος, horse + λύειν, let go, loose]: according to the Grecian mythology, was a son of Theseus by the Amazon princess Antiope. After her death Theseus sent the child to Troezen to be cared for by his own mother, Æthra. In the meantime Theseus married Phædra, the second daughter of Minos, King of Crete. When Hippolytus, now grown to manhood, came to Athens to be present at the celebration of the mysteries, his stepmother, Phædra, fell in love with him, and accused him to his father in order to avenge herself for his coldness. Theseus then cursed his son, and asked Poseidon to destroy him, but after the death of Hippolytus the king learned the innocence of his son and fell into great grief; Phædra killed herself. The story has been told in the *Hippolytus* of Euripides and in the *Phèdre* of Racine. According to the Roman mythology, Hippolytus was restored to life by Æsculapius, and placed in a grove at Aricia by Diana, where he received divine worship under the name of Virbius.

Revised by J. R. S. STERRETT.

**Hippolytus**, SAINT: bishop and martyr. There is some uncertainty about the dates and the events of his life, but probably he was born after the middle of the second century, and in Italy, though he traveled in the East, and was also a disciple of Irenæus of Gaul. His diocese was probably at Portus Romanus, 15 miles from Rome, at the northern mouth of the Tiber. In 235, under the Emperor Maximinus, he was banished, along with the Roman bishop Pontianus, to Sardinia, and is supposed to have suffered martyrdom by drowning in the year following, but whether in Sardinia or after returning to Italy can not be determined. His statue, in a sitting posture, with a list of his writings inscribed upon the back of the chair, was dug up in 1551 near the basilica of San Lorenzo in Rome. By far the most important of his writings is the *Philosophumena, a Refutation of All Heresies*, in ten books. Until recently only the first book was known to be extant, and this was ascribed to Origen. The second, the third, and the commencement of the fourth book are still wanting. The rest were discovered at Mt. Athos in 1842 by Minoides Mynas, a learned Greek, sent by M. Villemain, Minister of Public Instruction under Louis Philippe, to make researches in the Greek monasteries. *Philosophumena* was first published at Oxford by Miller in 1852, as a work of Origen. But the best edition is that of Duncker and Schneidewin (Göttingen, 1859). This treatise is one of great value historically, philosophically, theologically, and critically. The works of Hippolytus are in Migne, *Pat. Gr.*, x.; Eng. trans. in vol. v. of *The Ante-Nicene Fathers* (New York). See also monographs by Baron Bunsen (London, 1852; 2d ed. 1854); Döllinger (Eng. trans. Edinburgh, 1876); Wordsworth (London, 1853).

Revised by S. M. JACKSON.

**Hippo'nax** [= Gr. Ἱππῶναξ]: a Greek satirical poet of the sixth century B. C., of whom about 100 lines are still extant. He was banished from his native city, Ephesus, on account of his satires, and lived afterward at Clazomenæ. Ugly, scrawny, misshapen, he was a fine subject for the chisels of Bupalus and Athenis, and in revenge for their caricatures Hipponax lampooned the two sculptors so severely that they are said to have hanged themselves. He was a hard hitter and merciless foe of everything except freedom, a hopeless vulgarian, and hence a curiosity in Greek literature. On the verse which he invented, the *choliambus* or *Hipponacteus*, see CHOLIAMBUS. The fragments were collected and edited by F. G. Welcker (Göttingen, 1817, 4to); also in Bergk's *Poetæ Lyrici Græci*.

Revised by B. L. GILDERSLEEVE.

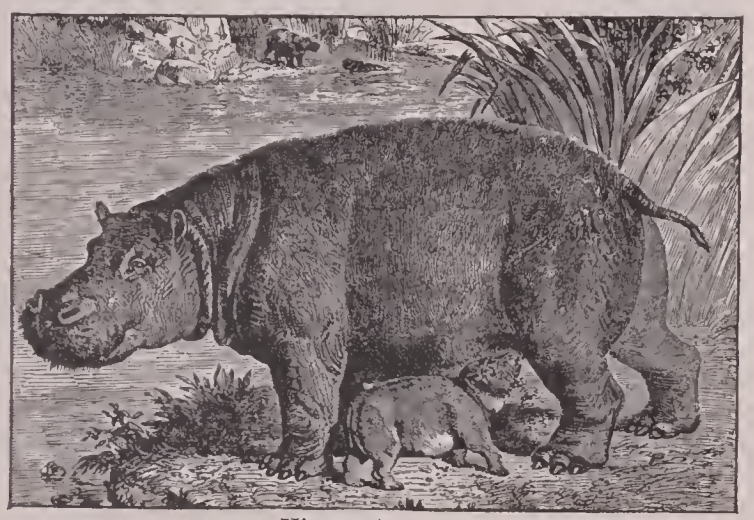
**Hippoph'agy** [from deriv. of ἱπποφάγος, horse-eating; ἵππος, horse + φαγεῖν, eat]: the eating of horseflesh. From the earliest times the northern races of Europe ate the flesh of the horse, and, in consequence of religious associations, sacrificed it to their gods. Owing to this, early Christian missionaries made the abstinence from horseflesh a test of religion. In the eighth century the popes anathematized it, and Gregory III. declared *immundum est et execrabile*—"it is foul and vile." In the Njall saga a converted Icelander, taunting an enemy, tells him that he has but lately eaten horseflesh. In time it was popularly believed that horseflesh was unwholesome. The French were the first to doubt this, and in the retreat from Moscow Larrey killed his horses to make broth for the sick. According to experiments and reports made by Baron Guerrier de Dumost, horseflesh contains one-seventh more nutriment than its equivalent weight of beef. In 1842 Dr. Perner, of Munich, began to combat the prejudice against horseflesh, and in 1845 the sale of it was legalized in Bavaria. At the same time hippophagic societies were formed in Paris and Berlin. Since 1855 horse-butcheries have been established throughout Germany. In Paris the first were opened in 1865 in the

quarters of St.-Marceaux and Popincourt. But it was not until the privations of the siege of 1870-71 had taught all Paris by experience the real excellence of horseflesh that it became popular, and from that time the sale has increased rapidly. Horseflesh has a pleasant taste, and expert cooks in Paris excel in dressing it so as to make it resemble venison. The meat is dark in color, but, taking it of relative ages and feeding, it is better than beef under the same conditions. Since 1889 the law in Great Britain requires that all horseflesh exposed for sale shall be plainly labeled.

**Hippopotam'idæ** [Mod. Lat., liter., belonging to the hippopotamus tribe; Gr. *ἱπποπόταμος* (see HIPPOPOTAMUS) + patronymic ending *-ίδαι*, descended from]: a family of artiodactyl ungulates distinguished by the massive body, phalangigrade feet, and well-developed external toes, round snout and nostrils opening upward and sidewise, overhanging upper lips, and inguinal mammæ. The canines are very large and furrowed along their posterior surfaces. This family includes two recent genera, which are so different as to have been differentiated as distinct sub-families—HIPPOPOTAMUS (*q. v.*), including a large species, and *Chœropsis*, established for a smaller species found in Liberia. Only two living species are known, both of which are confined to Africa; one (*Hippopotamus amphibius*) is the animal often seen in menageries, and is found in most of the African rivers; the other (*Chœropsis liberiensis*) is a very small species confined to Liberia. In geological epochs the family was widely extended, and remains have been found in England and other parts of Europe, as well as in India. The nearest relations of these animals are the hogs (*Suidæ*); they have no affinity with the rhinoceroses or tapirs.

Revised by F. A. LUCAS.

**Hippopot'amus** [from Gr. *ἱπποπόταμος*, river-horse, hippopotamus; *ἵππος*, horse + *ποταμός*, river]: the common as well as generic name of a large, even-toed mammal (*Hippopotamus amphibius*) once inhabiting most of the rivers and lakes of Africa from the Nile to the Cape of Good Hope, and occasionally known to visit the salt water. In many localities it has become rare or even exterminated. It is one of the largest of existing quadrupeds, the bulk of its body being only little inferior to that of the elephant. The largest males sometimes are 10 or even 12 feet long. This animal



Hippopotamus.

is only 5 feet high, and, its legs being very short, its belly almost touches the ground. The color is reddish brown, and the body is covered with a dark, oily exudation. It is usually inoffensive and quiet, but has been reported as occasionally attacking beasts, and even men, with unaccountable fury. It is an unwieldy beast, living chiefly upon soft water-plants, but quite often visiting cultivated fields, where it does sad havoc, trampling under foot even more than it eats. It is hunted for its flesh, which somewhat resembles pork, and for its skin, which is tanned and makes leather sometimes an inch thick, used as a material for buffing-wheels and heavy belts, and for other mechanical purposes. Its teeth also furnish a very considerable amount of the best ivory, used in making philosophical instruments, etc. Its fat, of which a thick layer is found immediately under the skin, is salted and eaten under the name of lake-cow bacon.

Revised by F. A. LUCAS.

**Hip'po Re'gius**: the royal city of the Numidian kings, and a Tyrian colony on the west side of the Gulf of Bona. The flourishing period of its history belongs to the first centuries of our era, and it was famed as the see of St. Augustine, who died there Aug. 28, 430. It was captured by the Vandals, after a siege of fourteen months, in Aug., 431. About the middle of the seventh century it was destroyed by the Arabs, and its materials were used in building Bona, the present Algerine city, 2 miles N. of the ancient site.—HIPPO ZAR'ITUS, or DIAR'RHYTUS, now *Bizerta*, was a Tyrian and afterward a Roman colony, near the extreme northern point of Africa, on the sea, at the entrance to a lagoon called *Hipponitis Palus*.

Revised by G. L. HENDRICKSON.

**Hippu'ric Acid** [*hippuric* is from Gr. *ἵππος*, horse + *οὖρον*, urine]: an acid ($HC_9H_8NO_3$) existing in the urine of herbivorous animals, and in small quantity in that of man. Hippuric acid is readily converted into benzoic acid, the change often taking place in the animal organism. When horses are kept in the stable or lightly worked the urine contains hippuric acid; when they are put to hard work it contains benzoic acid. Cows' urine contains about 1·3 per cent. of hippuric acid; that of oxen sometimes as much as 2·1 to 2·7 per cent.; of horses, 0·38; the quantity varies with the food and other conditions. Benzoic acid taken into the alimentary canal appears as hippuric acid in the urine; the same is true of quinic acid. Hippuric acid is readily separated from cows' urine in an impure form by the addition of an excess of hydrochloric acid. When purified and recrystallized, it forms colorless, transparent crystals. Its taste is bitter; it reddens blue litmus, dissolves in 600 parts of water at 32° F., is readily soluble in boiling water and in alcohol. Like uric acid, it dissolves readily in water containing ordinary phosphate of sodium, in such quantity as to change the reaction from alkaline to acid. Liebig attributes to this fact the acid reaction of fresh urine. Hippuric acid is converted by a ferment in the presence of an alkali, and by boiling with strong acids, into benzoic acid and glycin:

Hippuric acid. Glycin. Benzoic acid.

$$HC_9H_8NO_3 + H_2O = C_2H_5NO_2 + HC_7H_5O_2.$$

Revised by IRA REMSEN.

**Hippuri'tes** [Mod. Lat., from Gr. *ἱππουρις*, horse-tailed; *ἵππος*, horse + *οὐρά*, tail]: a remarkable genus of fossil bivalve shells, characteristic of the Cretaceous strata. The Hippurites, with Radiolites and Sphærulites and a few related forms, constitute the unique family of Lamellibranchs called Rudistes by Lamarck and Hippuritidæ by Woodward. The whole family is confined to the Cretaceous system, and became extinct at its close. They are characterized by the great development of the lower attached valve, which in some Hippurites was a meter in length and of inverse conical form, the peculiar lid-shaped, free upper valve, the deep pit-like cavities in the lower shell, and extravagant processes extending downward from the inside surface of the free valve. The texture of the shell is also quite different from that of most mollusca. The Hippurites were marked on the exterior by three inflexions of the shell, and are mainly confined to the Upper Cretaceous, though less common in the Middle Cretaceous. In Radiolites there are no inflexions of the surface, and it ranges throughout the Cretaceous.

H. S. WILLIAMS.

**Hi'ram**, called also **Hirom** and **Huram** [Phœnic. *Chīrōm*, for *Achīrōm* (?), friend of the noble one (Baal); Heb. *Chīrōm*, *Chīram*, *Chūram*; Gr. *Εἵρωμος*, *Εἵραμος*]: a King of Tyre, contemporaneous with David and Solomon, and the ally of both. He sent a supply of cedar timber, with skilled craftsmen, to assist David in constructing his palace (2 Sam. v. 11), and in Solomon's reign supplied timber, treasure, and men for the temple at Jerusalem (1 Kings v. 10; 2 Chron. ii. 11, *sqq.*; 1014 B. C., Ussher). He is likewise spoken of as having been himself a great builder at Tyre, and is said to have reigned thirty-four years; he had a treaty of peace and commerce with Solomon, and was son and successor of Abibal.

**Hire**, LAURENT, de la: classical painter; b. in Paris, France, in 1606; studied under Vouet, but endeavored to form a style of his own. His works are to be seen in Paris in the Carmelite and Capucine churches, as well as in others; his easel pictures were much prized and his landscapes are highly finished. He was one of the first members of the Academy of Painting and Sculpture, founded in 1648, and which is known now as the Academy of Fine Arts. D. in 1656.

**Hire and Purchase Agreements**: See the Appendix.

**Hir-Hor**: See HER-HOR.

**Hiring**: a contracting for the use of labor or property; specifically a species of bailment by which the use of a chat-

tel is contracted for, or labor or services affecting it are stipulated to be given for a compensation, express or implied. In this sense alone will the subject of hiring be here considered. Reference may be made for its other applications to the titles AGENT, CHARTER-PARTY, LEASE, MASTER AND SERVANT, and SHIPPING. Hiring as a form of bailment is of three varieties, whose names are expressed in Latin phrases: (1) *Locatio rei*, the hiring of a thing for temporary use; (2) *Locatio operis faciendi*, the hiring of work and services or care and attention to be bestowed upon articles delivered by the hirer to the person whose labor is engaged; (3) *Locatio operis mercium vehendarum*, the hire of the transportation of goods from one place to another, for the treatment of which see CARRIERS, COMMON.

(1) *Locatio rei.*—The hire of things constitutes a contract for the mutual benefit of both parties, since the owner receives a compensation, while the hirer becomes entitled to the use of the property; and the latter is accordingly bound to ordinary care and diligence, and is liable only for ordinary neglect; that is, he must exercise such care and diligence as a man of ordinary sagacity and reasonable soundness of judgment would exercise considering the nature of the property hired and the circumstances of the case. (See NEGLIGENCE.) But if injury is occasioned by some accident which a reasonable foresight could not have anticipated, or by theft or violence against which proper measures of protection had been taken, the hirer is not responsible, but the owner must bear the loss. The hirer becomes invested with a special property in the goods for the period during which his right of temporary use is to continue, and for any interference with his possession or injury to the property by third persons he has a right of action to recover damages for the loss sustained. If the hiring be for a definite time, as is usually the case, any attempt even by the owner to retake the property or to prevent its intended use will give the hirer a claim for redress. This rule is, however, subject to the qualification that if the hirer makes any unwarrantable misuse of the property the owner has a right to retake it, if he can do so peaceably, or to bring an action for its immediate recovery. The articles hired must only be used for the purposes contemplated by the contract, and the hirer's exclusive interest is defined and limited precisely by the stipulations agreed upon. They must be used also in the manner ordinarily appropriate, and must be surrendered when the time of the hiring has expired. The obligations of the owner of the property, other than those already stated, have not yet been definitely settled at common law. If he lets the property for a particular purpose he is liable, if he knows it to be unfit and does not disclose the defect, for injury sustained by the hirer in consequence; but it has been held that there is no implied warranty against injuries arising from latent defects. The contract of hiring may be terminated by the expiration of the time for which the contract was made, or the completion of the intended purpose, or a breach of the contract of hiring by the hirer, when the property reverts to the owner, who has a claim for whatever compensation was agreed upon, or, if no definite arrangement had been made, to whatever sum might be deemed reasonable under the circumstances.

(2) *Locatio operis faciendi.*—The degree of *care* required of a person whose labor and services are hired is governed by the principles which apply in the case of *locatio rei.* Ordinary care is required, and the measure of obligation is estimated by the value and nature of the articles delivered.

The degree of *skill* required also constitutes a large part of the obligations of the workman. He is held responsible for the exercise of such a degree of skill and careful workmanship in fulfilling the task imposed upon him as is requisite in the ordinary labors of his trade or profession. In accepting an engagement to perform a particular kind of work he impliedly represents himself as competent for such an undertaking, and may be made to respond in damages for injuries sustained through any exhibition of unskillfulness or incapacity. If, however, his incompetence were known to the person engaging his services, the hirer must suffer the consequence without remedy. If any instructions be given to the workman as to the manner in which his labor is to be performed, they must be adhered to strictly. If there be a material deviation from them, he can recover nothing for his services, unless the deviation be attributable to some unavoidable cause or be acquiesced in by his employer. The employer's assent need not be indicated by any express agreement, but may be presumed from his conduct, if he has knowledge of the deviation from the terms of the contract before its execution is completed, and makes no objection.

The *compensation* ordinarily depends upon the completion of the work. If the bailee only completes a portion of the desired work, he can claim a proportionate compensation if the benefit of what was actually performed was received in its incomplete state by the assent of the employer; but if the employer insist on full performance or declines to make compensation on account of some substantial imperfection in the workmanship or some injury which the goods have sustained, the workman is not only entitled to no reward, but may even be held liable for the original value of the goods. The acceptance of the goods by the employer is not of itself sufficient to constitute an assent to a deviation from the contract, since an owner has a right to the possession of his goods. If the property is destroyed by some unexpected casualty, without any fault on the part of the workman, or is carried away by robbers notwithstanding the use of reasonable precautionary measures for security, since the absolute ownership remains continually in the employer he must sustain the loss. If any labor has been expended upon it before the disaster occurs, the workman is, according to the general rule of the common law, entitled to a proper recompense for services actually rendered, unless the entire fulfillment of his engagement had been made a condition precedent to payment. Under the French law and the Code of Louisiana the employer in such a case loses the value of his materials and the employee the value of his labor.

The *loss of the property* falls upon the employer when the contract is strictly in the nature of bailment; and interesting questions sometimes arise as to whether a delivery of articles to a workman and an engagement of his services constitutes this relation. If cloth be given to a tailor or gold to a jeweler, and the identical piece of cloth is to be returned in the form of a suit, or the same gold to be made into an article of ornament, it is a case of bailment, even though additions be made to the original article delivered in the course of its alteration. But if the workman has liberty to expend his labor upon other materials of the same kind as those delivered, being under no further obligation than to return articles similar to those which would be made if the employer's goods were used, this is not generally considered as constituting a bailment, but only a species of barter or sale. The employer makes use of his goods to purchase others of the same nature in an altered form. The workman therefore owns the goods until his labor is complete and the finished product accepted; and if they are destroyed before that time the loss is his alone, and the employer has still a claim for the delivery of the article ordered. A similar question arises when grain is deposited in a warehouse or elevator with the understanding that a similar amount of the same quality may be returned instead of the very same grain delivered. The courts have generally adjudged an agreement of this kind to be a sale, and not a bailment, so as to make the bailee responsible in case of accidental loss. In all cases where a person is to furnish materials himself, and expend labor upon them, the contract is evidently not one of bailment, but rather one of sale, so that the employee is subject to all the obligations of a vendor.

The law concerning warehousemen, wharfingers, and innkeepers is also included under the head of *Locatio operis faciendi*, since such persons devote care and attention to the objects intrusted to them, but their liabilities will be considered under these several names respectively.

Revised by F. STURGES ALLEN.

**Hirn**, GUSTAVE ADOLPHE: French engineer; b. at Logelbach, near Colmar, Alsace, Aug. 21, 1815; made his first investigations in the dyeing-room of his father's cotton-mill, and afterward took charge of the mechanical department of the establishment. In 1845 he published his first essay *On the Mathematical Theory of Fan-blowers*, and in 1854 his well-known *Interpretation of the Phenomena caused in a Steam-engine by the Pressure of the Jacket.* His study of the steam-engine was conducted in so thorough and systematic a manner that, for the first time, it revealed to the engineering world the extent of the wastes of the modern engine. His principal papers are found in the *Bulletin de la Société Industrielle de Mulhouse.* D. Mar. 12, 1890. C. H. THURBER.

**Hiroshima**, hĕĕ-rō-shee'ma: a city of Japan, in the department of Aki; situated on the Inland Sea (see map of Japan, ref. 7–B). A military center. Close by, on an island, is the Imperial Naval College, removed hither in 1890 from Tokio. Pop. (1895) 100,015.

**Hirpi'ni**: an ancient people of Italy of Samnite race, inhabiting the central group of the Apennines between Lucania, Apulia, and Campania, and deriving their name from *hirpus*, the Samnite name of a wolf. They were subjugated by the Romans (probably together with the other Samnite tribes) before 268 B. C., at which time the Roman colony of Beneventum, which formed the strategical key to their country, was established. Immediately after the battle of Cannæ (216 B. C.) they declared in favor of Hannibal, but when he (in 209 B. C.) was driven toward the southern part of Italy, they bought peace on good terms from the Romans by betraying the Carthaginian garrisons in their cities. In the Social war (90 B. C.) they were among the first who took up arms against Rome, but they were soon reduced by Sulla, and after the end of the war their name as an independent nation is not mentioned.

**Hirsch**, Joseph: civil engineer; writer on steam and steam-engines; b. at Lyons, France, May 22, 1836; graduated at the École des Ponts et Chaussées, 1857; engineer-in-chief 1882; constructed a portion of the Canal de l'Est of France, and invented the Mittersheim siphon; director of the metallurgical works of Ars-sur-Moselle. He is professor on steam-engines at the École des Ponts et Chaussées and at the Conservatoire des Arts et Métiers, succeeding Gen. Morin and Gen. Tresca at the latter. He has translated Thurston *On the Steam-engine*, and published several scientific works of great value. W. R. Hutton.

**Hirsch**, Maurice, Baron: financier and philanthropist; b. in Bavaria in 1831 of Jewish parentage; his father, a wealthy merchant, was ennobled in 1869. Baron Maurice Hirsch accumulated a great fortune in the banking-house of Bischoffsheim & Goldsmid, and in various enterprises, such as building railways in Hungary. His gifts to the cause of education were very large. He endowed the schools in Galicia with $2,000,000; offered to give $10,000,000 to Russian schools if no distinction of race or religion were made therein; in 1891 spent about $15,000,000 in charity; and in 1892 gave $2,500,000 for the benefit of Russian Jewish emigrants to the U. S. D. at Presburg, Hungary, Apr. 20, 1896.

**Hirschberg**: a railway junction and manufacturing town of Prussian Silesia, beautifully situated at the foot of the Riesengebirge Mountains, 1,116 feet above the sea, and at the confluence of the Zacken and the Bober, 30 miles S. W. of Liegnitz. It has a Protestant church, a large Gothic edifice built in 1709 (one of the six so-called churches of mercy), four Roman Catholic churches, a synagogue, a gymnasium, an orphan asylum, and a chamber of commerce. It has a large trade in grain, linen, cement, and wine, and extensive manufactures of linen, cotton, lace, paper, wooden-ware, boxes, porcelain, artificial flowers, cigars, wine, and cider. Hirschberg is a very ancient town. Its prosperity dates from the introduction of linen and veil works in the sixteenth century. Pop., including garrison (1890), 16,214. B. B. H.

**Hirschberg**, Julius, M. D.: ophthalmologist; b. in Potsdam, Germany, Sept. 18, 1843; educated at University of Berlin; lecturer on Ophthalmology, University of Berlin, 1869–79, and professor since 1879; author of *Beiträge zur prack. Augenheilkunde* (3d ed. 1878); *Mathematische Grundlagen der medizinischen Statistik* (1874); *Wörterbuch der Augenheilkunde* (1887); *Electromagnet in der Augenheilkunde* (1885); *Einführung in die Augenheilkunde* (1892); editor of *Centralblatt für Augenheilkunde* since 1877. C. H. T.

**Hirst**, Thomas Archer, Ph. D., F. R. S.: scientist; b. Apr. 22, 1830, in Yorkshire, England; early made the friendship of John Tyndall, and went in 1849 to join him in the study of mathematics, physics, and chemistry at the University of Marburg; studied in Berlin; succeeded Tyndall as professor at Queenwood College; Professor of Mathematics in University College, London, 1867; director of studies at the Royal Naval College 1873–83; one of the original members of the London Mathematical Society, and its president from 1872–74; member of numerous scientific societies. He is the author of a large number of original papers in mathematics and physics, published in the *Proceedings* of various societies. These include *On the Quadric Inversion of Plane Curves* (1865); *On the Correlation of Two Planes* (1875–77); *On Cremonian Congruences* (1883); *On Congruences of the Third Order and Class* (1885); and *On the Cremonian Congruences which are Contained in a Linear Complex* (1887). D. Feb. 16, 1892. C. H. Thurber.

**Hir'tius**, Aulus: soldier; belonged to a plebeian family, but played a conspicuous part in Roman politics on account of his personal friendship and intimate political connection with Cæsar. He served him in Gaul as legate, but after the outbreak of the civil war he seems to have been almost constantly at Rome, serving the interests of Cæsar. He lived much on his Tusculan estates, in the neighborhood of the villa of Cicero, with whom he was on friendly terms, and in whose correspondence his name frequently appears. He was chosen consul for the year 43 B. C., and with his colleague Pansa took the field against Antony, although at first, as a friend of Cæsar, he had taken sides with him. They led their armies before Mutina, where Antony held Dec. Brutus in siege, and on one day fought a double battle, in which the defeat of Pansa was retrieved by the victory of Hirtius, who perished, however, in a subsequent assault on the enemy's camp. He was a man of refined tastes and literary accomplishments, and the eighth book of Cæsar's *Commentaries* is generally supposed to have been written by him.
Revised by G. L. Hendrickson.

**Hirudinei**: See Leech.

**His**, hees, Wilhelm, M. D.: anatomist; b. in Basel, Switzerland, July 9, 1831; educated at the Universities of Berlin, Würzburg, Prague, Vienna, and Paris; Professor of Anatomy and Physiology, Basel, 1857–72; Professor of Anatomy, University of Leipzig, since 1872; author of *Crania helvetica* (Basel, 1864, with Rütimeyes); *Unsre Körperform und das physiolog. Problem ihrer Entstehung* (Leipzig, 1874); *Anatomie menschlicher Embryonen* (Leipzig, 1880–85); coeditor of *Zeitschrift für Anatomie*. C. H. T.

**Hispania**: the Latin name of Spain (*q. v.*).

**Hispaniola**: See Haiti and Santo Domingo.

**Hissar'** [i. e. fort]: province of Bokhara, occupying the region on the north side of the Oxus or Amu-Darya, between lons. 66° 30′ and 70°, and S. of the mountain range bordering the Oxus valley on the N. It is well watered and mountainous, with a healthful climate, and contains many flourishing towns, some of them of great antiquity; among them Hissar town, Shirabad, Baisun, and Kulab. The population is chiefly Uzbek, with many Tajiks and some Jews, Hindus, gypsies, Afghans, and others. Cotton and cereals are grown, and there is a considerable production of sheep and salt. Transportation is very primitive, wagons being unknown. Hissar has been long known in history, but has been explored only since 1875. In 1869–70 it was annexed by the Amir of Bokhara. Mark W. Harrington.

**Hissar**: a division, district, and town of the Punjaub, British India. The division contains the three districts of Hissar, Rohtak, and Sirsa; area, 8,355 sq. miles; pop. 1,350,000. The district forms the eastern portion of the Bikanir desert, and lies between lats. 28° 36′ and 29° 49′ N., and lons. 75° 16′ and 76° 22′ E. It is a sandy plain, insufficiently watered by the Ghuggur, a branch of the Indus, and diversified by scattered brushwood and rocky hills. Rice is the staple crop, and cotton is extensively grown, both by irrigation. Area, 3,540 sq. miles; pop. about 500,000, mostly Hindus. The climate is very dry, with hot westerly winds; the rainfall is about 15 inches. The Western Jumna Canal crosses the district from E. to W., and a railway from N. W. to S. E. The capital is Hissar, on the railway and canal. Pop. 15,000. Mark W. Harrington.

**Hissarlik**: site of *Ilium novum*; a few miles S. of the Dardanelles and N. of the modern village of Burnabashi. It was thought by Schliemann to be the site of ancient Troy (see his *Trojanische Alterthümer*, 1874), but the latter is now believed to have been farther S. M. W. H.

**Histiæa** (in Gr. Ἱστίαια): town, on the bank of the Calla river, in the broadest and most fertile plain (Hellopia) of Northern Eubœa. It was one of the oldest (mentioned by Homer) and most important towns of Eubœa. It became subject to Athens during the Persian wars, but at the instigation of Sparta it revolted in 446 B. C. By means of bribery Pericles brought about the return of the Spartan army and reconquered Histiæa; a colony of Athenian cleruchs was settled at Oreus (Ὠρεός) on a lofty hill a few miles W. of Histiæa. Later on the colony was transferred to the old site, which henceforth was called Oreus. It is now called Orcus. J. R. S. Sterrett.

**Histiæ'us** (in Gr. Ἱστιαῖος): tyrant of Miletus, under the suzerainty of Persia. He won the attachment and gratitude of Darius by guarding faithfully the bridge of boats over which the Persian army crossed the Danube on its expedition into Scythia in 513 B. C.—a service by which he saved

the army and the life of the Persian king. His adventurous and ambitious character, however, could not help exciting suspicion, and he was detained at the Persian court for thirteen years. At last he succeeded in raising his Greek countrymen in Ionia against Persia, but Darius had still so much confidence in him as to send him to put down the rebellion. The rebellion itself failed utterly, and the treachery of Histiæus was discovered by Artaphernes, the Persian satrap of Sardis. He now fled from place to place, stirring the different Greek colonies in Asia Minor into premature insurrections; but at last he was captured and put to death by Artaphernes, who sent his head to the Persian king. Darius, however, mourned deeply, buried the head with honors, and blamed Artaphernes for having acted hastily.

Revised by J. R. S. STERRETT.

**Histol'ogy** [Gr. *ἱστός*, web + *λόγος*, discourse]: that branch of anatomy which treats of the minute structure of the tissues of which living beings are composed. It is subdivided into *Human histology*, which treats of the tissues of man; *Comparative histology*, which treats of the tissues of the lower animals; and *Vegetable histology*, which treats of the tissues of plants. Each of these subdivisions may be again divided into *Normal* and *Pathological* histology—the first referring to the healthy tissues, the second investigating the changes they undergo in disease.

Histology may be said to date back only to the appearance of the *Anatomie Générale* of Bichat in 1801, for although many interesting observations had previously been made by Malpighi (1628–94), Leeuwenhoek (1632–1723), Swammerdam (1637–80), Ruysch (1638–1731), Lieberkühn (1711–58), Hewson (1739–74), and others, yet Bichat was the first who treated the subject in a comprehensive way, classifying according to their structure, so far as it was then understood, all the tissues of the human body, and giving a general view of their relations, both in health and disease. His work gave a great impulse to the study of the tissues, but the imperfect condition of the compound microscope at that time was a serious obstacle to progress, and it was not until the opticians succeeded in devising efficient methods of correcting the spherical and chromatic aberrations of that instrument that histology made any important advance beyond the position in which Bichat left it.

The next epoch in the development of histology is marked by the appearance of the works of Schwann (1838–39), who endeavored to show that the observations of Schleiden in vegetable histology were substantially true for animals also; that all tissues are formed by the transformation of nucleated cells; and that these arise *de novo* under favorable circumstances in a formless nutritive fluid or blastema. This theory was extended to pathological anatomy by Johannes Müller, and continued to be almost universally accepted until the appearance of the cellular pathology of Virchow (1858), which was speedily followed by the very general acceptance of his doctrine, that cells can only arise out of preexisting cells, and that in both normal and pathological growth the cells of the growing part multiply by division, and thus give birth to all the elements ultimately produced. This doctrine seemed to be permanently established on a sure foundation, when the discovery of the wandering cells in living connective tissue by von Recklinghausen (1863), and the demonstration by Cohnheim (1867) that these movable elements are in fact white blood-corpuscles which have migrated from the blood-vessels, compelled a modification of opinion, and showed that the actual details of the growth and nutrition of the tissues are much more complex than had been previously supposed. Since the time of Schwann the number of histological investigators of reputation has multiplied so greatly that it would occupy more space than can here be given even to enumerate them. The names of a few of the more prominent living histologists are Kölliker, Ranvier, Stricker, Waldeyer, Meynert. Toldt, Retzius, Schwalbe, Leydig, Flemming, Stöhr, Klein, Schäfer, Golgi, Raymon y Cajal. In the present article a sketch of some of the more important and best-established elementary facts with regard to normal human histology is all that can be attempted in connection with the description of structure here given. The reader is referred to the articles under the names of the individual organs; those desiring more detailed information are referred to the special treatises and monographs.

*The Elementary Tissues.*—The structural unit of all living organisms, whether animal or vegetal, is *the cell*; in the lowest forms of life, represented in the animal kingdom by the primitive amœba, a single cell constitutes the entire organism, maintaining not only the life, but performing the functions of growth and reproduction, improvising such organs as may from time to time become necessary. In the higher animals the manifold needs of the complicated economy result in the corresponding multiplication and specialization of the structural elements, which are united into tissues and organs designed for the performance of some certain definite share of the whole labor of the organism.

In spite of its apparent complexity of structure, the body is resolvable into a very small number of elementary tissues, which may be conveniently grouped as—

1. *Epithelium*, forming tissues for covering, protection, and secretion.
2. *Connective substances*, for the support, attachment, and union of the more delicate and important structures.
3. *Muscle*, for the production of motion, whether voluntary or involuntary.
4. *Nervous tissue*, for the origination (the nerve-cells) and the transmission (the nerve-fibers) of nervous impulses.

Every tissue consists of two parts—the cells and the intercellular substance; upon the former depend the vitality and the growth, upon the latter the physical characteristics of the tissue.

*The Cell.*—The cell being the primary element, not only of the tissues, but for the entire organism, its nature and structure first claim our attention. In its simplest form, as seen in the colorless blood-corpuscle, a cell may be defined as *the smallest primary nucleated mass of living protoplasm, capable of the essential vital manifestations of assimilation, growth, and reproduction.* In the simple form instanced, the cell when active has no definite shape, since its outline continually changes; when at rest, this cell becomes an irregular spherical mass of granular *protoplasm.* Such elements, from their close resemblance to that primitive form of unicellular animal life, the amœba, are termed *amœboid cells.* The typical cell consists of (1) the body or *cell-contents*, embracing the general mass and determining the form of the element; (2) the *cell-wall*, usually a delicate, by no means constant, envelope surrounding the exterior of the cell, and formed by the specialization of the outer zone of the cell-contents; (3) the *nucleus*, a small vesicular body, oval or circular in outline, situated within the body of the cell of which it usually forms a conspicuous part, and from which it is separated by the *nuclear membrane*; and (4) the *nucleolus*, a minute variable body, sometimes multiple, lying within the nucleus in close relation to the nuclear network. While these parts may all be present in the typical cell, the absence of the cell-wall and nucleolus is common, the presence of essential parts—the cell-contents and nucleus—alone suffiing for thee integrity of the cell. It is now customary to use the term *protoplasm*, as synonymous with the body or cell-contents of the cell; in this sense it will be here employed.

FIG. 1.—Diagram of young cell: *p*, protoplasm composed of spongioplasm network and hyaloplasm; *n*, nucleus with intranuclear fibrils; *n'*, nucleolus.

*Protoplasm* composing living cells was long regarded as a homogeneous or finely granular substance, containing a variable number of larger granules, and often minute particles of oil, pigment, or other foreign matters; the improvement on the means and the methods of histological investigation during the last decade, however, have shown that protoplasm is not as simple in structure as was formerly supposed. It is now recognized that protoplasm consists of two parts: (*a*) the *spongioplasm*, occurring as fibrils arranged as a more or less perfect network throughout the body of the cell; and (*b*) the *hyaloplasm*, which occupies the interspaces between the threads of the spongioplasm. The irritability and contractility characteristic of the living cell are probably chiefly resident within the *spongioplasm.*

The *nucleus* likewise is composed of two parts: (*a*) an imperfect network of nuclear fibers composed of *chromatin*, a substance staining deeply in certain dyes and playing a most important part in the division of the cell; and (*b*) the less active *nuclear juice*, occupying the interspaces between the chromatin fibers, and, from its slight affinity for stains, called *achromatin.* The nucleus is defined from the remainder of the cell by the *nuclear membrane.* Both the

protoplasm and the nucleus of the cell therefore consist of active fibers, by which contraction and other vital manifestations are produced, and the more indifferent substances which occupy the intervals between the active fibers.

*Multiplication of Cells.*—Division or reproduction is the highest function of the cell, since by this process are pro-

Fig. 2.—Colorless blood-cell undergoing direct division.

duced the additional elements necessary for the formation of the new organism, as well as for the repair and maintenance of that already existing. The truth that all cells are derived from pre-existing elements, and never spontaneously. was long ago formulated by Virchow in the now classic phrase, *Omnis cellula e cellula*; to this law there are now

Fig. 3.—Indirect or karyokinetic cell-division as seen in the skin of salamander larva. The various phases of karyokinesis are shown, beginning with the resting condition of the parent cell (*a*) and ending with the formation of the new daughter cells (*q*).

admitted no exceptions. Multiplication of cells takes place in two ways: (1) by *direct* or *amitotic*, and (2) by *indirect* or *mitotic*, division. The direct method, formerly regarded as the usual manner of division, is now known to occur only among lowly organized cells and animals represented by the amœboid type; the division of the great majority of cells of the higher animals occurs only after the completion of the elaborate cycle of nuclear changes, presently to be described. In the *direct division* of the cell, such as the colorless blood-corpuscle, a portion of the protoplasm becomes constricted, and, after a longer or shorter interval, separated from the parent mass as a new element, capable of maintaining an independent existence and of performing all the functions of its ancestor.

The *indirect* or *mitotic* division of cells depends upon the active participation of the nucleus in a definite series of change, consisting in the temporary rearrangement of the chromatin fibers, which results in an accurate partition of the chromatin of the original nucleus between the two daughter nuclei of the new cells. The sequence of these changes is briefly as follows:

0. The nucleus in a condition of rest, presenting its usual appearance, the chromatin threads forming an irregular network throughout the nucleus. When the latter is about to undergo division, an increase in its size and chromatin fibers foreshadows the coming changes; the nucleolus disappears and the chromatin becomes arranged as

1. *The close skein*, consisting of densely convoluted threads. These become thickened, shortened, and straightened, and consequently more loosely disposed, resulting in

2. *The loose skein.* The chromatin filaments now gradually assume a grouping with reference to the already indicated pole of the nucleus. The peripheral ends of the loops now become divided, and the closed ends of the V-loops converge toward the clear area or *polar field* occupied by the pole of the nucleus, thus forming

3. The *mother star* or *aster.* When seen from the polar surface, this star appears as the wreath or rosette, sometimes described as a special nuclear figure. The nuclear membrane has entirely disappeared by this time. Shortly before the rearrangement of the V-loops about the polar field, the *polar spindle* appears within the last-named area, as a delicate elongated diamond of faint lines within the achromatin, the poles of the spindle coinciding with the positions of the future new nuclei. Following these changes,

4. *The longitudinal cleavage* of the V-loops takes place, by which the number of chromatin filaments is doubled. This is preparatory to

5. The *migration* of the V-loops toward the poles of the new nuclei along the guiding lines of the polar spindle. During the divergence and passage of the fibrillæ they are massed toward the center of the cell in a broad figure, known as the *equatorial plate.* The loops now pass toward the new poles, about which they converge, forming in reversed order

6. The daughter stars or diaster;

7. The loose skeins;

8. The close skeins; and finally pass into

9. The resting condition of the new nuclei.

About the time of the completion of the division of the nucleus, the body of the parent cell becomes constricted, and later divided into two parts, each of which incloses one of the new daughter nuclei.

*Epithelial tissues* constitute the coverings of those surfaces of the body which are directly or indirectly in communication with the atmosphere; such surfaces, in addition to the integument, are termed mucous membranes. The epithelial tissues are remarkable for the small amount of intercellular substance which they contain, this element being reduced to a minute layer of cement substance uniting the closely placed cells. Epithelium, therefore, is sometimes described as a tissue composed entirely of cells. The epithelia are divided, according to the character and arrangement of their cells, into the squamous and columnar varieties, each of which occurs as a single layer—*simple* or, as a multiple layer, *stratified.* By mutual pressure the surfaces of contact of the cells become straight lines, the cell territories appearing as polyhedral areas when viewed from the surface; it is evident that this appearance may be produced by both co-

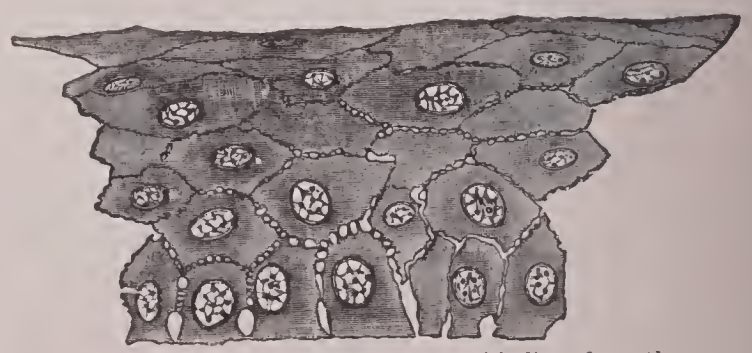


Fig. 4.—Section of stratified squamous epithelium from the cornea of the eye.

lumnar and squamous elements, hence the terms *pavement* or *tessellated* are not distinguishing. The most usual variety of squamous epithelium is the many-layered or stratified,

examples of which cover the skin and portions of the digestive and genito-urinary tracts; the columnar variety, on the contrary, frequently occurs as a single layer, covering,

FIG. 5.—Section of salivary gland showing glandular epithelium. *a a'*, terminal compartments of the gland, lined by the secreting cells; *d d'*, the ducts, clothed by the epithelial cells (*b*).

among others, the surface of the entire digestive tract from the stomach to its lower termination. The stratified columnar type exists upon the respiratory and some other surfaces.

An interesting modification of epithelial cells is found in connection with the depressed extensions of mucous surfaces constituting glands, the cells lining which are epithelial elements specialized to undertake secretion, hence called *glandular epithelium.* The most conspicuously modified cells of this class occur in connection with the organs of special sense, where as *neuro-epithelium* they constitute the essential part of the structures for the reception and translation of the impulses resulting in the special senses. The cells occupying the free surface of certain mucous membranes, as that lining the respiratory tract and part of the reproductive organs, are distinguished by the possession of minute hair-like appendages, or *cilia*, which during life are in constant agitation, producing definite currents of service in freeing the mucous membrane from foreign particles.

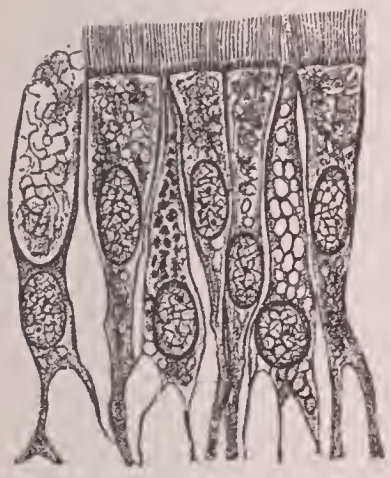


FIG. 6.—Ciliated columnar epithelium from the trachea; goblet-cell containing mucus on the left.

*Connective Substances.*—Under this name is included a large and exceedingly important group of tissues, which have in common an origin from the great mesodermic tract of the embryo; at first sight they seem to differ widely, but their variations, when critically examined, are found to depend chiefly upon differences in the physical character of the intercellular portion of the adult tissue rather than upon any inherent difference in the nature of the tissues themselves. This group may be divided into

1. Loose connective tissues, represented by the subcutaneous and intermuscular areolar tissues as well as by those uniting organs with surrounding structures and supporting their more essential parts.

2. Dense connective tissue, occurring as the densely felted structures forming the fasciæ, ligaments, tendons, and denser parts of various organs, as the outer coat of the eye.

3. Modified connective tissues, of which adipose tissue is an important representative, others being pigmented tissue, hyaline or glassy membranes.

4. Cartilage, in which the intercellular substance is still further condensed, the fibers being fused together by a cementing material into a ground substance or matrix which varies from being distinctly fibrous to apparently homogeneous in character.

5. Bone and dentine, in which group the connective tissues reach their greatest density and hardness, since the matrix becomes additionally impregnated with calcareous salts, resulting in the characteristic hardness of the members of this group.

From their close genetic relations the blood and lymph may with propriety be included within the connective-tissue group; it is, however, as a matter of convenience usual to consider these separately.

In all connective tissues the cells closely correspond, with the variation that in the looser forms the cells are larger and approximate more nearly their younger forms. The *cellular* elements of connective tissues are of two kinds: the connective-tissue cells proper or *fixed cells*, and the *wandering* cells, whose presence within these tissues is but an incident in their migrations. When young the connective-tissue cell is a plate-like body, which later becomes usually branched or stellate, and in the denser forms finally fusiform and greatly reduced in size. The wandering cells are small amœboid elements, which, while partly originating

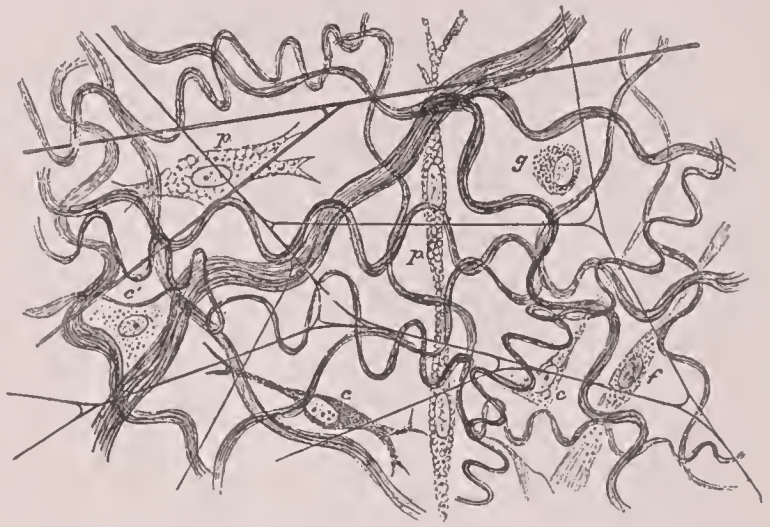



FIG. 7.—Young subcutaneous areolar tissue highly magnified; various forms of connective-tissue cells lie among the fibrous elements.

from the division of connective-tissue cells, are chiefly derived from the blood and lymph as migrated leucocytes.

*Loose connective* or areolar tissue enjoys the widest distribution, being present in some form in every organ of the body. In its typical condition, as seen in the subcutaneous or intermuscular tissue, it consists of wavy bundles of white fibrous tissue, loosely felted together, among which lie the fixed cells, with an occasional wandering element, the entire tissue being traversed by an open network of elastic fibers. Membranous envelopes of similar tissue, often, however, considerably condensed, form the capsules of the various organs, from whose exterior partitions of fibrous tissue extend toward the interior, while the delicate extensions of the same form the supporting framework of the softer and more important portions of the organs.

Dense connective tissue occurs as tendons and ligaments, as well as other robust structures forming parts of various organs. In tendons the white fibrous tissue predominates, and is disposed in long cylindrical parallel bundles, on

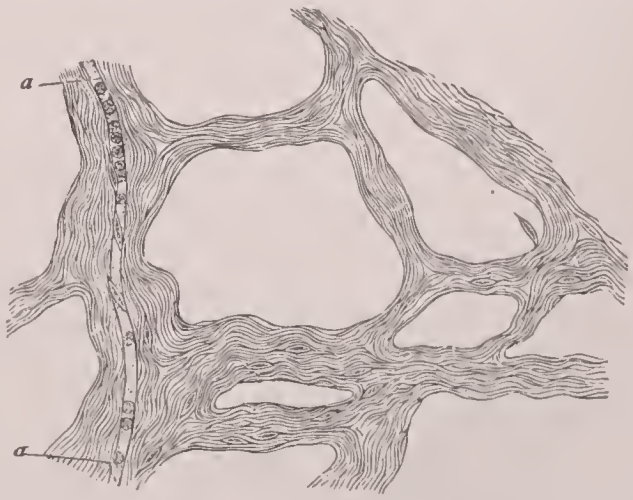



FIG. 8.—Dense adult fibrous connective tissue, containing few cells; *a*, capillary blood-vessel.

whose surfaces the connective-tissue elements, here called *tendon-cells*, are applied. Some ligaments, on the contrary,

are composed almost entirely of yellow elastic tissue, the cells, imbedded within a small amount of fibrous tissue, occupying the interspaces between the elastic fibers. In the denser connective tissues the fixed cells lie within cavities in the ground substance of corresponding shape; the minute channels or *canaliculi* which extend in all directions from these *cell-spaces* unite to form an intercommunicating system of nutritive *juice-canals* throughout the tissue; these spaces are also occupied in part by the wandering cells. A conspicuous example of this arrangement between the ground substance and the cells is seen in the relation of the corneal corpuscles and spaces. In some localities, particularly the eye, the connective-tissue corpuscles contain dark-brown particles which give to the entire cell the dark color characteristic of *pigment-cells*.

*Adipose Tissue*.—In many parts of the body the areolar connective tissue incloses in its meshes groups of cells containing fat. These cells, which are modified connective-tissue elements, are round or oval, sometimes polygonal, as from mutual pressure, and ·001 inch to ·005 inch in diameter. The presence of the fat conceals their nuclei, but after its extraction by ether, and the staining of the tissue by carmine, a nucleus can generally be observed in each, occupying the periphery of the cell. The groups of fat-cells contained in individual areolæ of the connective tissue are designated fat-lobules. Each is supplied with blood by one or more arterial twigs, whence proceed numerous capillaries so arranged that each of the larger cells at least is surrounded by its own capillary loops. In their embryological condition the fat-cells are at first nucleated masses of protoplasm, like other connective-tissue cells. The fat makes its appearance in the substance of the protoplasm in small drops, and there finally coalesces into a single large one, occupying the central portion of the cell. As the fat-drops grow still larger, the protoplasm becomes greatly distended, until only a thin membranous peripheral zone remains, with the nucleus imbedded in it.

A notable modification of the usual form of the connective-tissue cells is seen in the single layer of irregularly polyhedral plates covering the surfaces of cavities *not* in communication with the atmosphere. Such cells are termed *endothelium*, while the surfaces are *serous membranes*; these structures resemble in appearance the epithelium of the mucous membranes, but their true nature as elements nearly related to the connective tissues is demonstrated by a study of their mode of development as well as by the observation of direct transitions between the endothelial plate and the branched connective-tissue cell. Endothelium lines the heart, blood, and lymphatic channels, the large peritoneal, pleural, and pericardial cavities, the joints, and other closed cavities. The demonstration of these cells by silver and subsequent staining shows these cells to be closely united by lines of intercellular cement substance, and to possess oval nuclei. The peritoneal, pleural, and pericardial sacs represent the originally single general body-cavity or *cœlom*, which later becomes subdivided.

*Cartilage*.—This form of dense connective tissue consists of cells imbedded in an intercellular substance or matrix; the latter may be homogeneous, elastic, or fibrous, and accordingly three varieties of cartilage are recognized—hyaline, elastic, and fibrous cartilage. Hyaline cartilage forms the cartilages of the ribs, the ensiform cartilage, the articular cartilages of the bones, the cartilages covering the opposed surfaces of the symphyses, the nasal cartilages, the principal cartilages of the larynx, and the cartilaginous rings of the trachea and bronchial tubes. In this variety of cartilage the cells (cartilage corpuscles), when single, are usually oval, on an average from ·005 inch to ·001 inch in long diameter, and consist of a delicate granular protoplasm containing a large oval nucleus. They lie in cavities, or *lacunæ*, hollowed out in the matrix. Sometimes the lacunæ are of larger size and contain two or more cells, which have resulted by the division of the original element. Sometimes groups of two, four, or more such cells, with their adjacent sides flattened, lie quite near together, but are separated by a narrow layer of matrix. In living or perfectly fresh cartilage the cells almost entirely fill the cavities in which they lie, but on the addition of water, or even of indifferent fluids, and after death the cells shrivel and separate from the walls of the lacunæ, so that they appear to be surrounded by a clear transparent space; or they may shrivel irregularly, remaining attached at points so as to present a stellate appearance. At the same time the matrix becomes more or less distinctly granular. The matrix when fresh is apparently homogeneous and quite transparent, no traces of the existence of fibers or cell-territories being observable even

Fig. 9.—Section of hyaline cartilage from the ribs; cells are arranged in groups, separated by the cartilage-matrix.

with the highest powers. After the action of certain reagents, however, the matrix indicates its true structure of fibrillæ united into an apparently homogeneous ground-substance. It is not improbable that minute canals connect the adjacent lacunæ. If cartilage be boiled in water for some time, the matrix yields chondrin, just as white fibrous tissue produces gelatin.

Where cartilage is continuous with connective tissue there is no abrupt boundary between the two, but the one passes by a gradual transition into the other. As we proceed from the cartilage to the connective tissue, the matrix becomes first indistinctly, then distinctly fibrillated, and is continuous with the connective-tissue matrix, while the cells are more and more elongated until they present the character of connective-tissue corpuscles. The cartilage of certain localities, as in the epiglottis, external ear, etc., differs from the ordinary hyaline variety in the character of the matrix, which in these cases is permeated with numerous elastic fibers, giving rise to *elastic cartilage*. Immediately around the cartilage-cell, however, the matrix retains its hyaline character, the elastic fibers being limited to the spaces between the homogeneous areas. The third variety, *fibrous cartilage*, closely resembles, in the general character of its matrix, fibrous connective tissue, the fibrous tissue, at first sight, appearing to constitute the entire matrix; this, however, is not entirely true, for around the nests of cartilage cells limited homogeneous areas represent the clear matrix of the hyaline type. Fibrous cartilage is limited in its distribution, being found in the intervertebral disks and interarticular cartilages.

*Fibro-cartilage* (*Reticular Cartilage, Yellow Cartilage*).—The cells of fibro-cartilage are quite like those of hyaline cartilage, but the matrix consists chiefly of a plexus of anastomosing fibers resembling elastic fibers. Between these, however, a homogeneous substance similar to the matrix of reticular cartilage no doubt exists, since these cartilages yield a small proportion of chondrin on boiling. This homogeneous substance, in certain situations, is most abundant immediately around the cells, where it is visible under the microscope as a clear or slightly granular area in which no fibers are discerned. When fibro-cartilage is anatomically continuous with connective tissue, the fibers of the matrix are continuous with the yellow elastic fibers. Fibro-cartilage, as above described, forms the cartilages of the ear and of the Eustachian tube, the epiglottis, the cartilages of Wrisberg, and a part of the intervertebral cartilages. Cartilage contains neither blood-vessels, lymphatics, nor nerves.

*Bone*, like cartilage, consists of a dense connective tissue, whose cells are imbedded in a compact matrix, apparently homogeneous but really fibrous, in which a deposition of calcareous salts has taken place, to the presence of which mineral matter the well-known hardness of the tissue is due. (See Bone.) In thin sections of dried bone the position of the cells is marked by the presence of small stellate cavities

about ·0008 inch in average length, and rather less than half as broad—the *bone-lacunæ*, from which radiate delicate canals, ·00005 inch in diameter, the *canaliculi*. The cana-

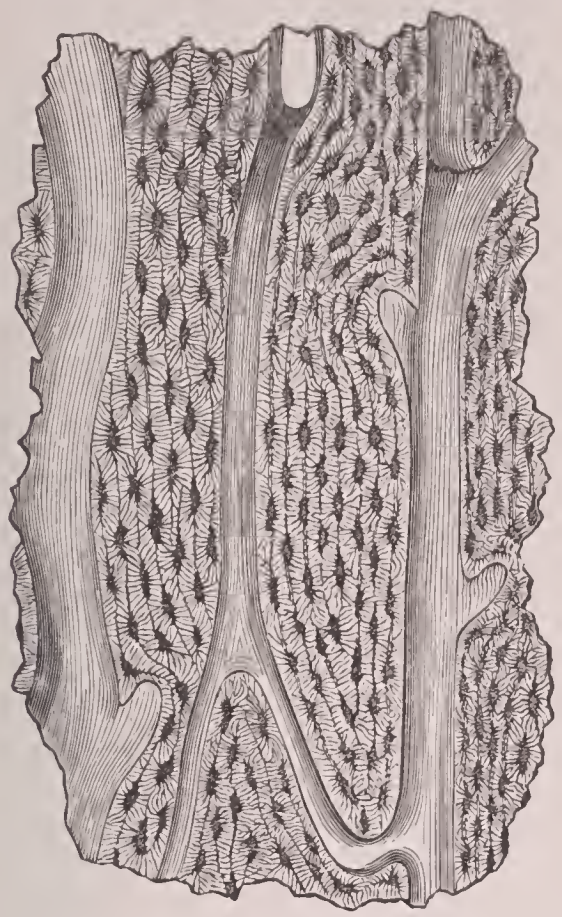


Fig. 10.—Longitudinal section of bone.

liculi of adjacent lacunæ anastomose freely. Examined by transmitted light, the lacunæ and canaliculi appear dark, the matrix transparent; by reflected light the former appear white and opaque, the latter translucent. These appearances depend upon the fact that in dried bone the lacunæ and canaliculi are hollow and contain air, as may be demonstrated by first flowing turpentine upon a thin section while under microscopical observation, and then permitting it to dry. In recent bone, and especially in growing bone, the lacunæ are filled with nucleated masses of protoplasm, which send processes into the canaliculi; these are the proper *bone-cells*. Osseous tissue is very vascular, the capillaries in the compact substance of the long bones occupying a series of longitudinal anastomosing channels—the canals of Havers—which are continuous with the larger canals containing the nutritive arteries, with the areolar spaces of the spongy extremities of the bones, and with the marrow cavities. In transverse sections of the compact shafts of the long bones the Haversian canals appear as rounded or oval openings, with the lacunæ arranged regularly around them in concentric rows. In longitudinal sec-

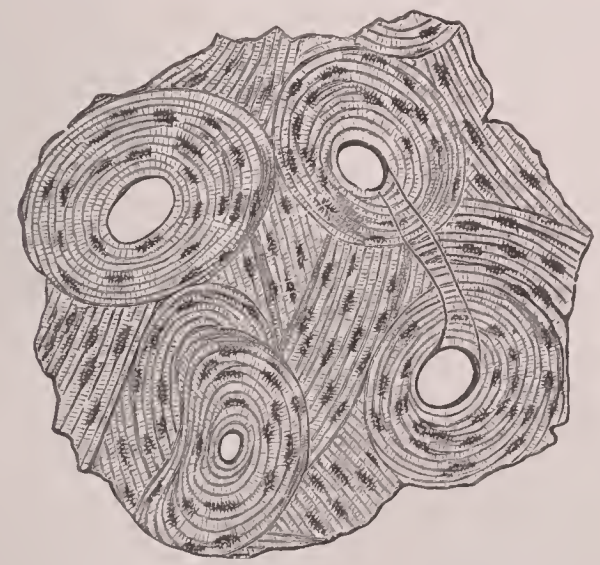


Fig. 11.—Transverse section of decalcified bone.

tions, on the contrary, the canals appear as a network with elongated interspaces, in which the lacunæ lie in rows parallel to the canals. In the cancellous or spongy bone occupying the extremities of the long bones and forming the chief mass of many irregular bones, thin sections display an irregular reticulum of osseous trabeculæ, in which the lacunæ, with their bone-cells, are arranged more or less in rows parallel to the margins of the bony trabeculæ.

If bone be treated with dilute acids the earthy matter of the matrix is dissolved, and a material resembling cartilage is left behind, which, however, does not yield chondrin on boiling, but gelatin. When transverse sections are made through the shaft of a long bone so treated the matrix no longer appears homogeneous, but is disposed in a number of thin concentric layers, *Haversian lamellæ*, around each Haversian canal, the sum of the lamellæ about each canal constituting a *Haversian system*. The spaces between the systems of lamellæ thus formed are occupied by *intermediate* or *ground lamellæ*, which run without any definite relation to the course of the adjoining Haversian lamellæ, representing the remains of the original network of the primary spongy bone; lastly, just beneath the periosteum is a series of *circumferential lamellæ*, the course of which is parallel to the surface of the bone.

The medullary cavities of the long bones are filled with a delicate, very vascular connective tissue, rich in fat-cells—*the marrow*. The areolæ of the spongy extremities of the long bones and of the spongy bones also contain a delicate vascular connective tissue, which contains very few fat-cells, and is therefore called the *red* marrow, in contrast to the yellow color of the tissue filling the shafts of the long bones; this tissue abounds in round granular cells and masses of protoplasm, some of which, *the myeloplaxes*, contain many nuclei. The red marrow plays an important *rôle* in producing the colored blood-cells after birth.

*Development of Bone.*—In early fœtal life the skeleton is entirely cartilaginous, and bone first makes its appearance by a transformation of the cartilaginous skeleton, commencing at certain definite centers or points of ossification. There are usually several such centers to each bone, which are separated by cartilage until the growth of the bone is complete. The cartilaginous septa thus left, of which those between the epiphyses and shafts of the long bones may be taken as types, maintain their dimensions by a continual growth, while their margins are constantly being transformed into bone. Besides this development of bone in cartilage or *endochondral formation*, it is also developed in connective tissue—*intermembranous formation*. This is the case with the thin cranial and certain facial bones, in which a primordial cartilaginous stage does not exist. A similar formation of bone from connective tissue takes place beneath the periosteum of all growing bones. It is by this *periosteal* formation, for example, that the long bones increase in thickness, while their increase in length takes place by the growth and ossification of the cartilages between the shaft and epiphyses. The earlier histologists supposed that the formation of bone from cartilage occurred by a deposit of earthy salts in the matrix of the cartilage, transforming it directly into bone-matrix, the cartilage-cells at the same time being metamorphosed into bone-cells. Subsequent observations have shown, however, that the process is by no means so simple. The first formation of bone in the fœtal cartilaginous skeleton is preceded by an ingrowth of blood-vessels, surrounded by a delicate layer of cells (fœtal marrow), into the substance of the cartilage, which is absorbed to permit the entrance of the new tissue. Shortly after a deposit of earthy salts takes place in the matrix of the cartilage at the point of ossification, forming the *zone of calcification*.

The cartilage-cells, meanwhile, have enlarged and arranged themselves in perpendicular rows, while the lacunæ of those next the newly formed marrow cavity open into the latter by the absorption of the interposed matrix. As the result of this process, the zone of calcification consists of irregularly outlined processes of calcified matrix, which extend into the marrow cavity as a ragged fringe, the individual processes being separated by the broken down and absorbing cartilage lacuna; the cartilage-cells which these spaces contain disappear, and are probably disintegrated when the areolæ are opened. The vascular tissue occupying the primary marrow cavity contains great numbers of small active cells, which arrange themselves as a layer covering the surface of the processes of calcified cartilage matrix.

Through the agency of these young connective-tissue cells the layer of new osseous tissue is deposited *upon* the free surface of the old cartilage trabeculæ, a certain number of the cells themselves becoming gradually inclosed within

the new bone matrix; these marrow elements, from their active participation in the formation of the bone, are called *osteoblasts*; the inclosed osteoblast within the bone matrix becomes the *bone-cell*. As the layer of new bone upon the cartilage trabeculæ increases in thickness by the deposition of new laminæ, the inclosed masses of calcified cartilage gradually undergo absorption, so that at a certain distance away from the zone of calcification the cartilage remains no longer are present, the entire trabeculæ being composed of the new bone, by their union forming the central network of primary spongy bone. The latter, however, is only transient, since soon after its formation it is absorbed in the

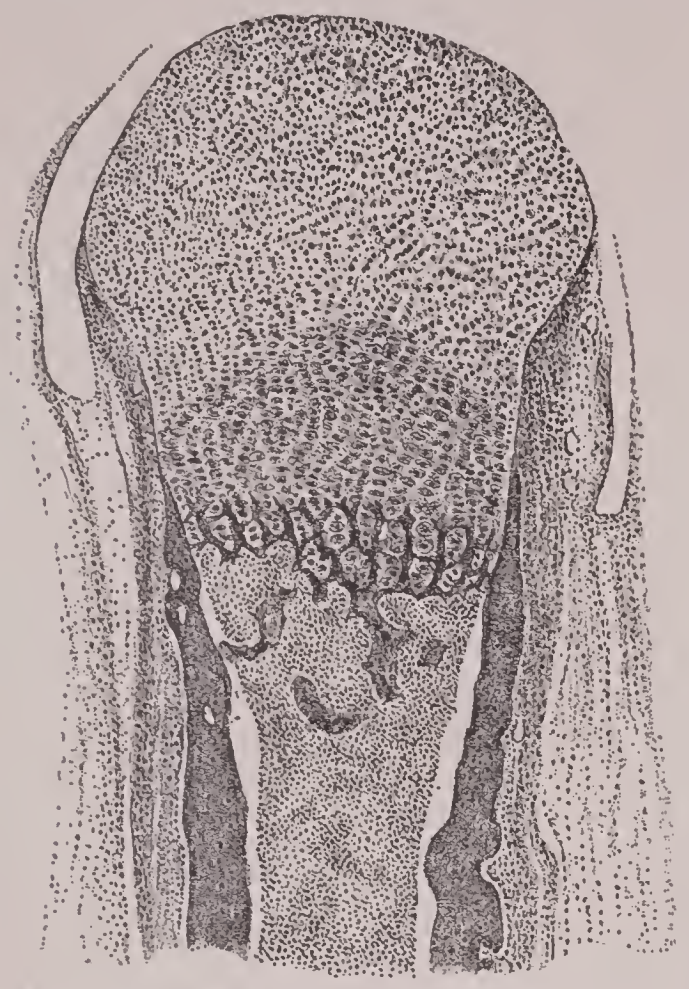


FIG. 12.—Longitudinal section through part of developing finger-bone. The upper rounded zone is the embryonal cartilage; the slightly darker area is the zone of calcified cartilage, which is followed by the network of trabeculæ of new bone. The center is occupied by the marrow-tissue, bounded laterally by the new periosteal bone.

center of the long bones, its space being occupied by the central mass of primary marrow; this absorption keeps pace with the formation of new bone at the ends of the shaft, resulting in the extension of the central marrow cavity toward the ends of the bone. The only remains of the primary central spongy bone in the young subject are found as the spongy bone of the extremities. Coincident with the changes producing the bone in the axis of the shaft, at the periphery, the periosteum has been active in forming an outer zone of osseous tissue, which incloses that occupying the middle of the bone. The details of the formation of this periosteal bone are practically the same as those described, with the omission, of course, of everything pertaining to the cartilage, which in this process does not take part. At certain stages of the development, therefore, a transverse section of the young bone shows a peripheral zone of spongy periosteal osseous tissue, within which lies a central mass of endochondral bone. As already indicated, practically all the central bone is absorbed; this fate also awaits the inner zones of the periosteal bone, since the layers next the marrow cavity must disappear to compensate for the additions made to the outer surface, since the shaft of the bone is not solid but remains tubular. The periosteal bone, which is originally also spongy, becomes compact by a secondary deposition of lamellæ within spaces between the partially absorbed trabeculæ of the spongy structure; by this deposition on the walls of these spaces a system of concentric lamellæ is formed within each of these cavities in the center of the series, a cylindrical channel marking the position of the remains of the original space; these concentric lamellæ constitute the Haversian system surrounding the Haversian canal, while the remains of the trabecula of the original spongy bone are the ground or interstitial lamellæ. The intramembranous formation of bone is very similar to the periosteal, in both cases the cartilage being uninvolved. In these processes, whenever osseous tissue is removed, it is by the agency of large multinucleated cells, which from their function of bone-destroyers are called *osteoclasts*.

*Muscular Tissue.*—There are two varieties of muscular tissue, the *non-striated* and the *striated*; the former is also called *involuntary*, since it is beyond the influence of the will, while the latter is the *voluntary* muscle, because usually responsive to volition. The *non-striated* muscles are composed of spindle-formed contractile fiber-cells with elongated or rod-like nuclei. These occur in the muscular coats of the intestinal canal, the middle coat of the arteries and veins, the posterior part of the walls of the trachea and bronchial tubes, the ciliary muscle and the iris, the skin (where they constitute especially the minute muscles erecting the hairs), the lymphatic glands and spleen, the walls of the gall-bladder and biliary ducts, the ureters and urinary bladder, the uterus and Fallopian tubes, etc. The fiber-cells are composed of a contractile substance, which is either homogeneous or faintly striated longitudinally; in this, besides the nucleus, a number of strongly refractive granules are imbedded, a pyramidal group of them generally appearing at each extremity of the nucleus. Sometimes the extremities of the fiber-cells are divided into two or more branches. In length these cells for the most part range between ·0015 and ·008 inch; their average breadth is about ·0004 inch, and their nuclei range from ·0005 to ·001 inch in diameter. They are united into larger or smaller fasciculi by a delicate connective tissue consisting of a homogeneous matrix, with scattered stellate, anastomosing cells. On a transverse section through these fasciculi the divided fiber-cells present irregular polygonal outlines. The fasciculi are

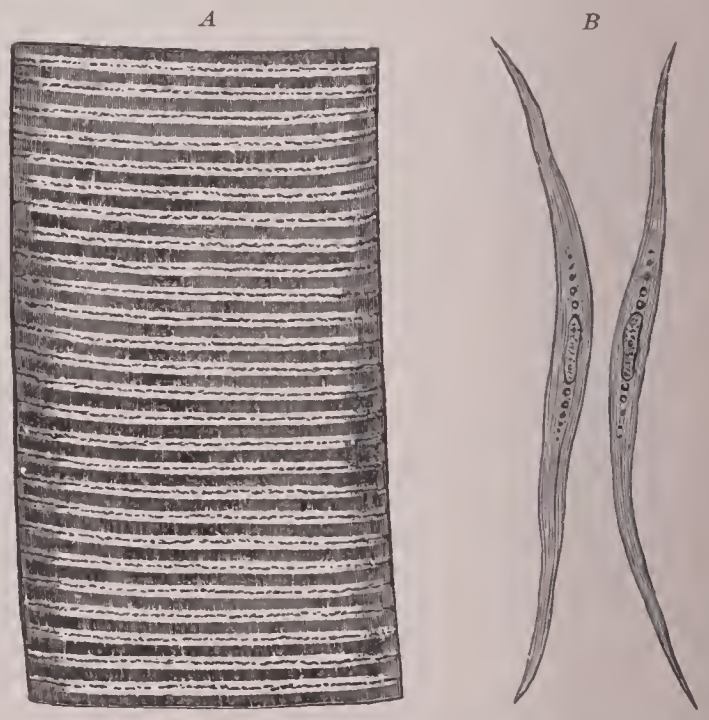



FIG. 13.—*A*, Portion of muscle-fiber very highly magnified, showing the striations. *B*, Isolated cells of involuntary muscle.

united by septa of ordinary fibrillar connective tissue. The arteries and veins supplying the muscular tissue lie in these septa; the capillaries enter the muscular fasciculi and are distributed between the fiber-cells. The relation of the muscular fiber-cells to the nerves will be described in connection with the nerves. The *striated muscles* consist of cylindrical or somewhat fusiform fibers, ·0004 to ·0025 inch in diameter, which in short muscles extend from one insertion of the muscle to the other; in long ones, seldom exceed an inch and a half in length. These are marked transversely by close parallel lines, the well-known transverse striæ. Each fiber is invested by a delicate structureless sheath, the sarcolemma, beneath which, and on the exterior of the muscular substance proper, over nuclei, the so-called muscle-corpuscles are scattered at irregular intervals.

While the appearance of the characteristic light and dark striæ has long been known, the interpretation of these in the structural details of the tissue is far from easy, and has been the subject of patient investigation and even more extended discussion and disagreement; without attempting a

review of the several theories concerning the structure of striated muscle, recent investigations warrant the acceptance of the following view as being the most trustworthy. Within the nucleated envelope of the fiber, the sarcolemma, two substances are contained: the one, the *sarcoplasm*, is a clear, singly refracting indifferent substance, in which the second, in the form of the highly specialized, doubly refracting, *contractile elements* are imbedded; upon the latter the characteristic contractility of the tissue depends. The contractile substance is disposed as delicate filaments composed of spindle-shaped segments whose ends are connected by bridging threads of great delicacy; the lateral apposition of numbers of these filaments produces the appearance of a dark band corresponding to the position of the thickest part of the contractile filaments, while a clear band appears opposite the position of the delicate bridging threads; the faint line of dots—Krause's membrane—seen within the clear band depends upon the pearl-like enlargements upon the delicate threads. The contractile elements are separated laterally by a thin zone of sarcoplasm, while several elements are grouped into delicate bundles which, in turn, form the larger colonies, producing, in transverse sections of muscle-fibers, the fields of Cohnheim, while the smaller bundles correspond to the dots of which the fields are made; all these groups are separated by the clear, indifferent sarcoplasm. The muscular fibers are bound together into fasciculi by a delicate connective tissue resembling that which unites the fiber-cells of organic muscles. The fasciculi are united by septa of ordinary fibrillar connective tissue, in which the nutritive blood-vessels lie. The latter give off a system of capillaries which form a network between the individual muscular fibers. The termination of the nerves in striated muscular fibers will be described hereafter. All the voluntary muscles of the body, and certain of the involuntary ones also, among which the most notable is the heart, consist of striated muscular fibers. In the heart the muscular fibers offer several marked peculiarities. They are without sarcolemma; their nuclei are not limited to the periphery and surface of the fiber, but may occur at any depth within the muscular tissue; they branch and anastomose with each other, forming thus a continuous network, and they are divided by highly refractive transverse lines into segments ·002 to ·003 inch in length, each of which has a single nucleus in its center, so that they have been described as chains of muscle-cells. Besides this, they frequently contain numerous fat-molecules, even when apparently quite healthy. In their transverse striation, and most of the details of their minute structure, however, they resemble the other striated muscles. Heart-muscle must be regarded as a form of contractile tissue midway in its development between the ordinary voluntary muscle and the more lowly differentiated non-striped type.

FIG. 14.—Portions of medullated nerve-fibers; *R*, nodes of Ranvier, at which medullary substance is wanting and the axis-cylinder is seen crossing the intersegmental substance; *a*, neurilemma; *c*, nerve-nuclei.

*Nerves and Nerve-centers.*—The nervous system consists of a series of branching cords, the nerves, which originate in the brain, spinal marrow, and ganglia, and are distributed to the tissues, where, for the most part, they end in certain special terminal organs. The *nerves* consist either of single nerve-fibers, or of fasciculi, of fibers united by vascular connective tissue. In most of the cerebro-spinal nerves, with the exception of their central and peripheral terminations, the nerve-fibers consist of a central portion, the *axis-cylinder*, surrounded by the medullary substance, the white matter of Schwann, and this again covered by a delicate investing membrane, the sheath of Schwann, or *neurilemma*. Such fibers are designated medullated nerve-fibers. The neurilemma is a transparent, structureless membrane, like the sarcolemma of the muscular fibers. The medullary sheath is a peculiar, highly refractive, oily substance containing protagon, which, when the fibers are torn across, exudes from their extremities as the so-called myelin drops. The axis-cylinder consists of a bundle of extremely minute fibrils united by a delicate granular material; the axis-cylinder is probably inclosed within a special sheath, the *axilemma*. Medullated nerve-fibers range for the most part from ·0002 to ·0008 inch in diameter; when perfectly fresh they appear smooth and round, with here and there an oval nucleus, but in a short time the medullary substance undergoes a kind of coagulation, changing it into a granular semi-transparent mass, which shrinks away from the peripheral sheath in some places and encroaches upon the axis-cylinder in others, so as to present very irregular contours. Medullated nerve-fibers branch toward their peripheral terminations, the axis-cylinder dividing into two or more portions, each of which is invested with a medullary layer, and a sheath of Schwann continuous with those of the primitive fiber. The secondary nerve-fibers thus produced are individually smaller than the one from which they spring, but in the aggregate the thickness of the branches is usually greater than that of the original fiber. Still further toward the periphery both the neurilemma and the medullary substance disappear, the latter sometimes before the former, and the axis-cylinder which alone remains then divides and subdivides until it is broken up into its primitive fibrillæ, which are extremely minute, ·00002 inch or less in diameter, and often present a delicate beaded appearance. Another variety of nerve-fibers

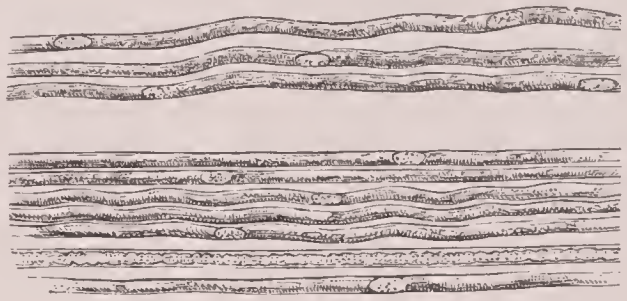


FIG. 15.—Non-medullated nerve-fibers.

is found in the branches of the great sympathetic nerve, which, on account of the absence of the medullary substance, have been called *non-medullated fibers* (also Remak's fibers). These correspond in size for the most part to the medium and smaller medullated fibers, and when fresh are smooth or somewhat granular, often marked by faint longitudinal striations. They consist of a peripheral sheath, identical with that of the medullated nerve-fibers, enveloping a bundle of primitive nerve-fibers united by a finely granular interfibrillar substance. The medullated nerve-fibers of the brain and spinal cord are destitute of the neurilemma, to the absence of which, together with the delicacy of the tissue in which they are imbedded, the softness of the white matter of the nerve-centers is due. From the foregoing it will be understood that the primitive nerve-fibrils are the characteristic elements of all nerve-fibers. After leaving the nervous centers, the nerve-fibers become associated into groups or bundles, the *funiculi*, which in turn are united by connective tissue to form the nerve-trunk, such as the sciatic or other nerve. The individual fibers are held together by delicate tissue, the *endoneurium*; the funiculi are enveloped by a fibrous sheath, the *perineurium*; while the general connective tissue of the trunk is the *epineurium*. The nerve-fibers in transverse section appear as minute round cells, the deeply stained apparent nuclei of which are the cut axis-cylinders.

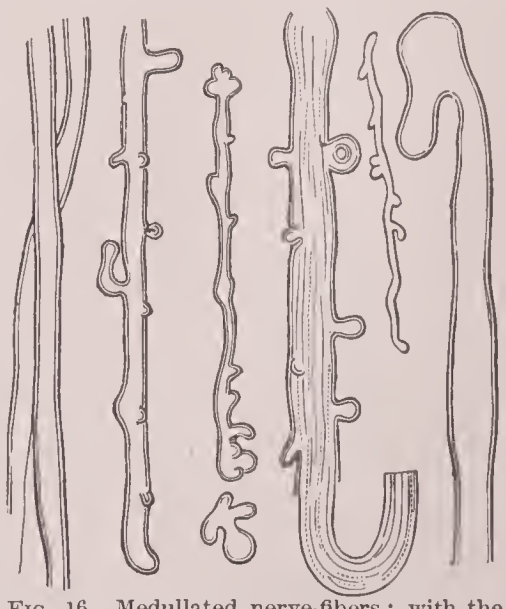


FIG. 16.—Medullated nerve-fibers; with the exception of those on extreme left, the fibers show post-mortem change.

*The Nerve-centers.*—The brain and spinal marrow consist, in addition to the medullated and non-medullated nerve-fibers, of numerous nerve-cells, characteristic elements in which nervous impulses originate; both cells and fibers

are united and supported by the delicate sustaining tissue, the *neuroglia*, augmented in places by additional bands of connective tissue. The nerve-cells are rounded, oval, or stellate bodies ·0002 to ·003 inch in diameter, consisting of a granular protoplasm, with a round or oval nucleus which usually contains a nucleolus. Each cell gives off one or more protoplasmic processes many times longer than the diameter of the cell. According to the number of these the cells are called unipolar, bipolar, or multipolar. The large multipolar nerve-cells in the anterior horns of the gray matter of the spinal cord are particularly available for study. In each of these cells all the processes but one branch frequently, until finally the ramifications escape observation. The exceptional process, as first demonstrated by Deiters, pursues its course without branching, and becomes ultimately the axis-cylinder of the medullated nerve-fiber.

FIG. 17.—Nerve-cell from spinal cord; numerous branched protoplasmic processes: at *a*, the axis-cylinder process is seen.

Like the axis-cylinder, this process consists of delicate fibrils united by a granular interfibrillar material. Cells essentially similar to these, though smaller, are found in the gray substance of the cerebrum and cerebellum. Besides these, there are, in the gray substance of the brain especially, an immense number of small cells in which peripheral processes are demonstrated only after certain stainings; recent methods of Golgi have shown that branched protoplasmic processes are in general much more numerous than was supposed, and, further, that they end in the finest fibrillæ without apparently joining with other processes; in many cases, moreover, the axis-cylinder process breaks up into a number of fibrils without joining a nerve-fiber.

The nerve-cells and nerve-fibers of the brain and spinal cord are imbedded in a delicate supporting tissue, the *neuroglia*, consisting of branching cells and delicate elastic fibers imbedded in a finely granular matrix. The sympathetic ganglia are traversed by medullated and non-medullated fibers, and contain numerous nerve-cells, which, like those of the spinal cord, give origin to fibers, all being united by delicate connective tissue. Some of the nerve-cells are multipolar, while others are unipolar; in this case the single process, like the peripheral process of the cells of the spinal cord, is continuous with the axis-cylinder of a nerve-fiber. Beale has described a form of cell in the sympathetic ganglia of the frog which gives off two processes, one of which winds spirally around the other.

*The Peripheral Terminations of the Nerves.*—The terminations of the sensory nerves occur either as free-endings or in connection with some form of special terminal structure; in the former, and most usual, case the axis-cylinder divides into the fibrillæ, which join to form a delicate plexus immediately beneath the epithelium, from which terminal threads extend into the epithelial layer, to end between the cells of the same. The special nerve-endings are found in almost all localities endowed with a high degree of sensibility, as well as in connection with the organs of special sense. A number of these nerve-endings will be described in connection with the several organs, the termination of the nerves in muscle and in the Pacinian bodies alone finding place here. In the case of the voluntary muscles, medullated nerve-fibers terminate in peculiar organs, or *muscle plates*,

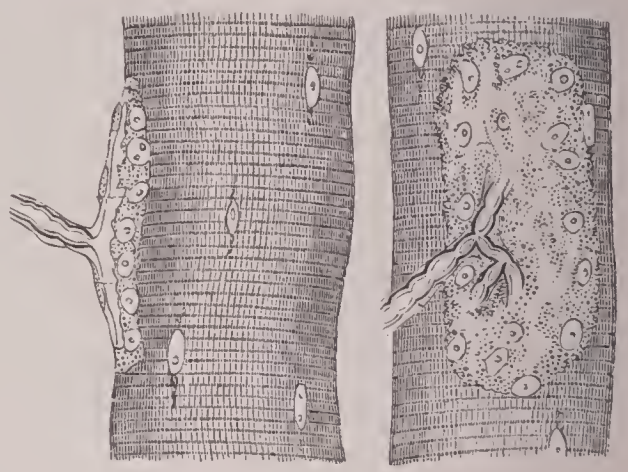


FIG. 18.—Termination of nerve in voluntary muscle.

situated immediately beneath the sarcolemma. At the point where the nerve-fiber joins the muscular fiber the neurilemma becomes continuous with the sarcolemma, while the medullary substance ends abruptly, and the axis-cylinder, penetrating beneath the sarcolemma, expands into a delicate, more or less branched terminal figure, which is separated from the striated substance of the muscular fiber by an elliptical granular protoplasmic mass in which several nuclei are imbedded. Every striated muscular fiber has at least one of these end-plates, while the longer fibers receive several of them. In the case of the non-striated muscles the nerve-fibers first lose their medullary sheaths, then branch, and finally split up into their ultimate fibrils, which form a plexus between the fiber-cells of the muscle; from this plexus, short delicate branches are given off which terminate between the muscle-cells without entering their substance. The Pacinian bodies are peculiar terminations of

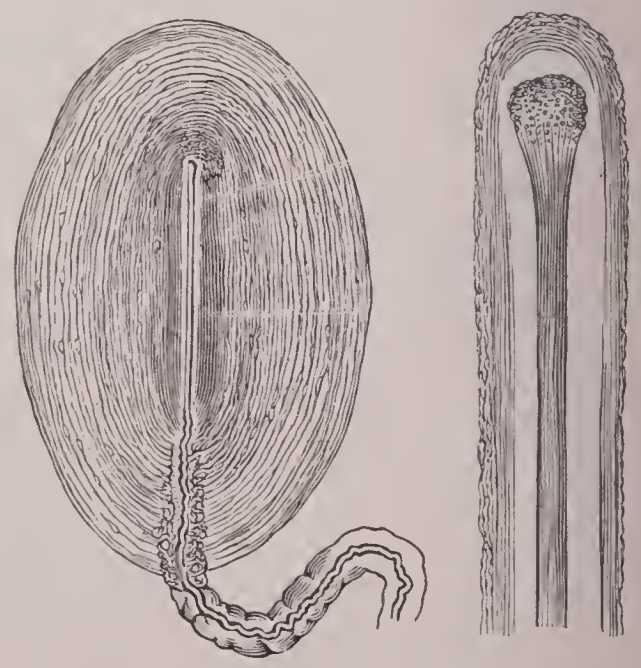


FIG. 19.—Pacinian body.

the sensory nerves, which in man are found in the subcutaneous connective tissue of the sides of the fingers and toes, in the intermuscular spaces, in the vicinity of joints, and in a number of other localities. They are elliptical bodies

·04 to ·1 inch in long diameter, which consist of numerous concentric layers of delicate connective tissue, forming a laminated capsule with a narrow elongated central cavity. A single medullated nerve-fiber enters one extremity of the capsule. Its external and medullary sheaths disappear shortly after its entrance, while the axis-cylinder penetrates the central cavity, and having extended nearly its whole length, forms a terminal expansion. In addition to the corpuscles of Pacini and the tactile corpuscles of the integument (Meissner), a number of other special nerve-endings have been described, the more important of which include the simple and compound end-bulbs, the corpuscles of Grandry (in birds), the spherical end-bulbs, the cylindrical end-bulbs, and the corpuscles of Herbst (in birds). For an account of the structure of these complicated bodies, the reader is referred to the special text-books.

The *blood* consists of a colorless liquid, the liquor sanguinis or blood-plasma, in which float two kinds of cellular elements, the red and white corpuscles, with which a third element, the *blood-plates*, must be recognized. When the blood coagulates, fibrin in a more or less distinctly fibrillated condition separates from the plasma, entangling the corpuscles in its meshes. The remaining fluid portion or serum consists of albumen and certain salts dissolved in water. The *red blood-corpuscles* in man are flattened biconcave disks, the average diameter of which is usually stated at $\frac{1}{3200}$ of an inch. Welcker makes them ·00774 of a millimeter, or ·0003 inch very nearly, the usual variations being between ·0064 and ·0086 of a millimeter. Their number has been estimated by Vierordt at 5,000,000 to a cubic millimeter. They consist of a homogeneous colored matrix in their adult condition, are destitute of a nucleus, and are not invested with a special membrane or cell-wall. In the majority of mammals the blood-corpuscles are similar in form to those

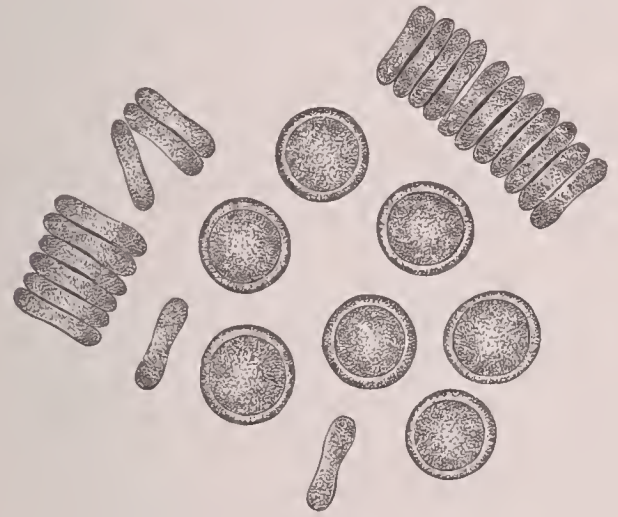


Fig. 20.—Human red blood-corpuscles.

of man, but differ somewhat in size. On this diversity in size alone the attempts to identify human blood by the microscope for legal purposes are based. It should be remembered, however, that the corpuscles of certain animals, particularly the monkey and the dog, so closely approximate the dimensions of those of human blood that it is quite impossible to discriminate between them by the microscope even in fresh blood; since after soaking out a blood stain the original size of the blood-corpuscle is not always exactly reproduced, it becomes even more difficult to distinguish human blood under such conditions from the blood of a considerable number of animals, the corpuscles of which approximate those of man in size. In the camel and llama the corpuscles are elliptical, but possess no nuclei. In birds, reptiles, amphibians, and fishes the corpuscles are elliptical flat disks possessed of an oval nucleus, which, when the edge of the corpuscle is turned toward the eye, is seen to project on each side above the surface of the disk. The largest red blood-corpuscles at present known are those of the amphiuma, one of the tailed amphibians; the hugh oval nucleated blood-cells of this animal measure ·075 mm. in length by ·046 mm. in breadth, being readily distinguishable by the unaided eye. The following are the mean dimensions of the corpuscles of a few animals, as given by Welcker, in decimals of a millimeter:

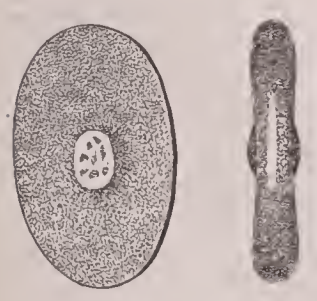


Fig. 21.—Red blood-corpuscles from a reptile.

| *Circular Corpuscles.* | | *Elliptical Corpuscles, long diameters.* | |
|---|---|---|---|
| Man | ·0077 | Llama | ·0080 |
| Dog | ·0073 | Pigeon | ·0147 |
| Cat | ·0065 | Frog | .0223 |
| Rabbit | ·0069 | Triton | ·0293 |
| Sheep | ·0050 | Proteus | ·0582 |
| Moschus javanicus | ·0025 | Sturgeon | ·0134 |

The *white blood-corpuscles*, as seen circulating in the living blood-vessels, are spherical granular bodies, most of which in man have rather greater diameter than the red (on the average nearly ·0004 inch). Each is a little mass of protoplasm which contains one or more nuclei. When a drop of human blood is watched with the microscope while the temperature is kept about 100° F. and evaporation is prevented (by means of the hot stage and moist chamber), it will be observed that the majority of the white corpuscles assume the most diverse forms, and very slowly creep across the field of view with a motion resembling that of the amœba. Similar amœboid motions are observed in transparent living tissues in white blood-corpuscles which have migrated from the vessels. The so-called third corpuscular elements of the blood, the *blood-plates*, are difficult of observation, since they very readily undergo disintegration unless special precautions are taken for their preservation. These bodies are colorless disks, about one-quarter to one-third the diameter of the red corpuscles; they readily break down into granules which become aggregated into irregular masses. The blood-plates are supposed to bear a close relation to the coagulation of the blood, but regarding their exact nature much remains to be learned. Lastly, the blood contains considerable numbers of still more minute particles which result from the disintegration of cells. The white corpuscles in all vertebrated animals are essentially similar to those of man, but the amœboid motions in those of the cold-blooded animals take place at a lower temperature. Their differences in dimensions in the various classes of animals are much less than in the case of the red corpuscles. The white corpuscles are much less numerous than the red. Welcker estimates the proportion at 1 to 335, but it varies with age and sex, and indeed in different individuals and in the same individuals at different times, being greatly influenced by the processes of digestion.

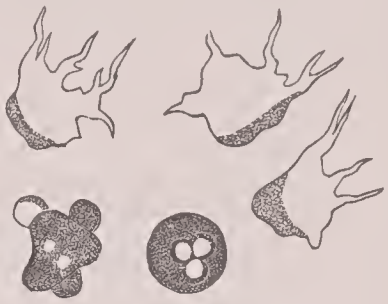


Fig. 22.—Colorless blood-corpuscles showing amœboid movements.

*The Blood-vessels.*—The heart and blood-vessels, including the capillaries, are lined throughout by an endothelium consisting of a single layer of flattened nucleated cells, the boundaries of which are best displayed by the imbibition or injection of dilute solutions of nitrate of silver and subsequent exposure to light. The nuclei may afterward be demonstrated by carmine staining. These cells range usually from ·001 to ·004 inch in length; the nuclei on an average are about ·0005 inch long. The walls of the true capillaries appear to consist merely of this single layer of cells, which are irregular in outline, and vary considerably in form in the capillaries of different organs. As the capillaries pass into the small arteries the endothelial cells become more fusiform; in the small veins they approach an irregularly polygonal form. In the line of junction between these cells

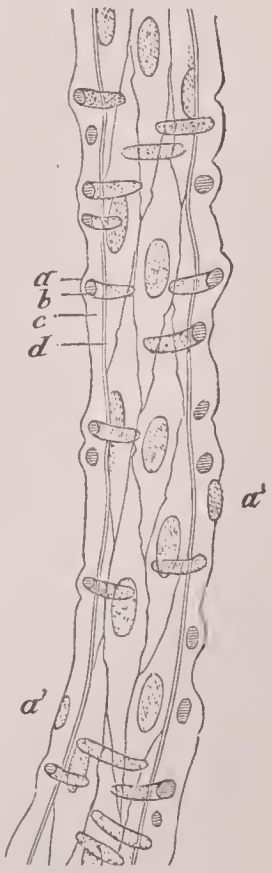



Fig. 23.—Small artery: *a*, tunica adventitia; *a'*, nucleus of tunica adventitia; *b*, muscle nucleus; *c*, elastic internal tunic; *d*, lining membrane of endothelial cells.

small irregular openings, the so-called stomata, are mapped out by the action of silver, especially on the smaller veins. Proceeding from the capillaries toward the heart, both veins and arteries acquire an investment if connective tissue, in which a layer of circular muscular fiber-cells soon makes its appearance. After this three distinct coats can be distinguished in both arteries and veins; the inner or *intima* consisting of the endothelial lining, reposing upon a thin layer of connective tissue, rich in elastic fibers, many of which run longitudinally; the *media* or muscular coat, consisting of involuntary muscular fiber-cells disposed circularly and united together by connective tissue abounding in elastic fiber; and the external coat, or adventitia, composed of fibrillated connective tissue. The coats of the veins are considerably thinner than those of arteries of the same size, and contain less elastic tissue. On the other hand, the thick middle coat of the larger arteries is distinguished by the great quantity of elastic tissue which it contains. Longitudinal muscular fiber-cells occur in the adventitia of some of the larger arteries and veins. The coats of the veins within the cranium, in the bones, and in the maternal portion of the placenta contain no muscular fibers. The larger arteries and veins are nourished by a system of vessels, the *vasa vasorum*, which ramify in the external coat and send capillary branches to the muscular layers beneath. Nerves enter the middle coat of both larger and smaller vessels (with the exception of the true capillaries), and terminate in the muscular fiber-cells in the manner already described.

FIG. 24.—Lymphatics: central tendon diaphragm of rabbit: *a*, lymph-vessels; *c*, connective tissue with serous canals, into which larger channels open at *b*.

The *lymphatics*, like the blood-vessels, are lined by a single layer of flattened endothelial cells, the boundaries of which are best displayed by the action of silver, while their nuclei can be demonstrated by the subsequent use of carmine. In the smaller lymphatics and in the lymphatic capillaries these cells are distinguished by the sinuous character of their margins, and by the large size and great number of the stomata between them. The larger lymphatics possess a middle muscular and an external connective-tissue coat, resembling the corresponding tunics of the veins. The stomata of the lymphatic network communicate with the system of spaces already described as existing in the connective tissue. These form a system of plasma or juice canals, which vary in size and form in various parts of the body, and are best demonstrated by the action of silver, which blackens the intervening matrix, leaving the plasma canals uncolored.

A peculiar form of tissue, consisting of a reticulum crowded with small cells, known as *lymphatic* or *adenoid* tissue, exists widely distributed throughout the body. In many localities special masses of such tissue occur, and are called *lymphatic "glands,"* from the fact that the older anatomists gave them this name; such structures are not, however, to be confounded with the true secreting glands. (See GLAND.) The lymphoid tissue composing the glands presents variations in its density; in the compound glands, when a number of simple follicles are grouped together, the denser tissue occupies the central parts of the divisions of the organs. The *lymphatic glands* are interposed in the course of the lymphatics. When these vessels, on their way from the peripheral portions of the body, arrive at a gland (vasa afferentia), they ramify on its surface, and enter its substance from the periphery. The branches leading from the gland toward the larger lymphatic trunks (vasa efferentia) escape from the hilus of the gland. The lymphatic glands are invested by a capsule of connective tissue, and consist essentially of a delicate reticulum of connective tissue, the meshes of which are filled with small granular cells resembling the white corpuscles of the blood. The connective-tissue capsule gives off to the interior of the gland a series of trabeculæ which forms a network of interlacing imperfect partitions, dividing the gland into a number of intercommunicating compartments occupied by the lymphoid tissue. This latter is not of uniform density throughout the compartments, but is much denser in the center of these spaces than next the connective-tissue trabeculæ; near the periphery of the organ these dense masses are called *cortical follicles*, while their elongated continuations within the center of the gland form the *medullary cylinders*; the spaces between these dense tracts and the trabeculæ are occupied by a much looser form of lymphoid tissue, and constitute the *lymph-sinuses*, being the paths through which the lymph traverses the gland. The lymphoid elements of this coarse reticulum within the lymph-path are easily detached, and are constantly carried away by the current of the lymphatic circulation, and as constantly renewed. The lymph-sinus communicates directly with the vasa afferentia at the periphery of the organ, and with the vasa efferentia at the hilus. Connected with the lymphatic plexuses of the mucous membrane of the alimentary canal especially are certain glandular bodies, the *lymphatic follicles*, the parenchyma of which is very similar in its structure to that of the cortical follicles just described, and which, for this reason, and on account of their relations to the lymphatic vessels, are to be regarded as minute lymphatic glands. The solitary glands and glands of Peyer in the intestines, the closed follicles of the tonsils, pharynx, and back of the tongue, are of this nature.

FIG. 25.—Lymphatic gland: *a*, cords of dense lymphoid tissue; *b*, trabeculæ; *c*, lymph-sinus.

The *lymph* is the colorless, slightly opalescent fluid contained within the lymphatics. Its morphological elements, the lymph-corpuscles, are in all respects identical with the white corpuscles of the blood, which in fact are continually recruited by the lymph-corpuscles entering the subclavian veins through the thoracic duct and the lymphatic duct of the right side; on the other hand, white blood-corpuscles which have migrated from the blood-vessels into the serous canals of the connective tissue continually enter the lymphatic capillaries and become once more lymph-corpuscles. The lymph which leaves the lymphatic glands by the vasæ efferentia is so much richer in corpuscles than that which enters them as to leave no doubt that these glands constitute an important seat of the formation of the lymph-corpuscles, and consequently of the colorless blood-cells. They originate by the multiplication of the cells of the parenchyma, a similar formation of white corpuscles taking place in the spleen,

and probably also in the lymph-follicles and the marrow of the bones.

The *serous membranes* consist of a thin layer of connective tissue coated on the side next the serous cavity by a single layer of endothelial cells. These are flattened polyhedral, nucleated elements, generally with sinuous margins, which are best displayed by the action of silver. It is then seen also that numerous sharply defined, rounded, or irregular spaces, the so-called stomata, exist between the margins of the cells. The membrane on which this endothelium reposes consists of a network of interlacing bundles of fibrillar connective tissue with stellate fixed corpuscles and elastic elements. It contains, besides blood-vessels and nerves, a rich plexus of lymphatic capillaries, which appear to communicate freely with the serous cavities by means of the stomata. In consequence of this arrangement, milk or colored fluids, such as carmine solution, introduced during life into serous cavities—as, for example, the peritoneum or the pleural sacs—are speedily taken up by the lymphatics, a natural injection of which may thus be effected. The lymphatic capillaries may also be demonstrated by soaking the membrane in nitrate of silver and exposing it to the light. The connective-tissue matrix is thus blackened, while the blood-vessels and lymphatics appear as light-colored channels lined by their characteristic endothelium. From the abundance of these lymphatics, and the readiness with which they take up fluids introduced into the serous cavities, the latter are regarded as belonging to the lymphatic system.

*The Spleen.*—The spleen is invested externally by the peritoneum, immediately beneath which is a firm connective-tissue capsule. From the inner surface of the capsule numerous processes (trabeculæ) proceed into the substance of the organ, uniting with each other to form a network, the areolar interspaces, which are filled with the splenic pulp. Both the capsule and the trabeculæ contain a considerable number of involuntary muscular fiber-cells and elastic elements. The splenic pulp consists of lymphoid elements resembling those of the lymphatic glands; these elements are united by a delicate reticular, tenacious intercellular substance. In the mass thus formed, according to Frey, an anastomosing system of passages, lined by an imperfect endothelium consisting of a single layer of plate-like cells, is hollowed out. These passages communicate with both

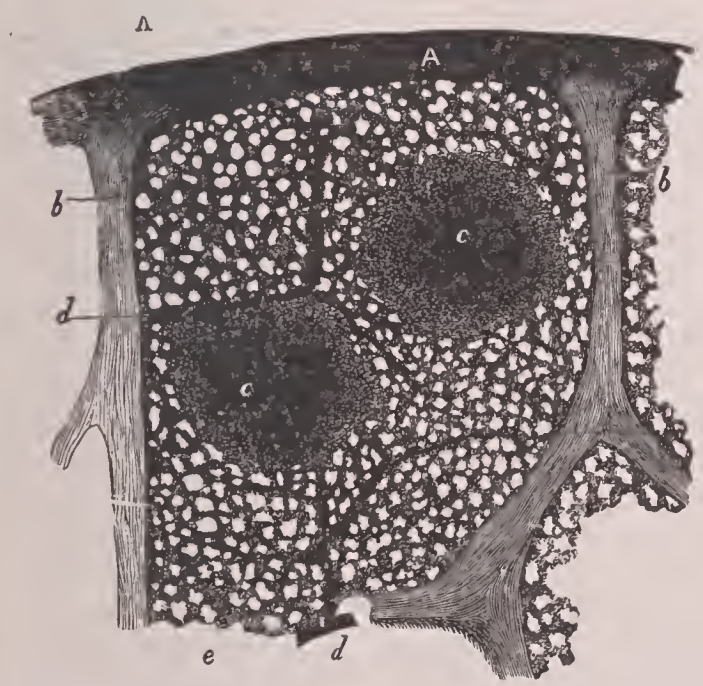



FIG. 26.—Section of human spleen: A. capsule: *b*, trabeculæ; *c c*, Malpighian corpuscles; *d*, injected arterial twigs; *e*, splenic pulp.

the arteries and veins, and serve for the transmission of blood. The splenic artery, after entering the organ, breaks up into smaller branches, some of which continue throughout the entire extent of the trabeculæ, fading away into the vascular channels of the splenic pulp when the supporting tissue passes into the delicate reticulated tissue; other branches of the splenic artery diverge and enter the pulp to become ensheathed by cylindrical masses of dense lymphoid tissue; these masses constitute the characteristic Malpighian bodies of the spleen. These are from ·01 to ·04 inch in diameter, and are readily recognized by the naked eye on account of their whitish color. They consist of cells resembling those of the splenic pulp, closely held together by a fine intercellular reticulum, which, toward the periphery, becomes denser, without, however, forming a complete capsule; the parenchyma of the Malpighian bodies is thus continuous with the splenic pulp. The arteries and veins of the spleen are united by a plexus, imperfectly defined channels, which ramify in the substance of the splenic pulp. The lymphatics of the spleen form a close plexus in the capsule of the organ, whence numerous branches are given off into its interior; there a second plexus is formed, the larger branches of which for the most part accompany the arteries.

*The Skin and its Appendages.*—The skin consists of a superficial epithelial layer, the *epidermis*, and a deeper layer, the *corium* or true skin. The corium is from ·02 to ·1 inch thick, and is composed of dense connective tissue, many of the fixed corpuscles of which are stellate, especially in its more superficial portions, where also they are smaller and more numerous. The fibrillated matrix of this connective tissue is so disposed as to form a dense network with small intercommunicating meshes, which are largest in the deeper parts of the corium, and there contain groups of fat-cells. Still deeper, the network becomes continuous with the loose connective tissue of the subcutaneous fat. Networks of

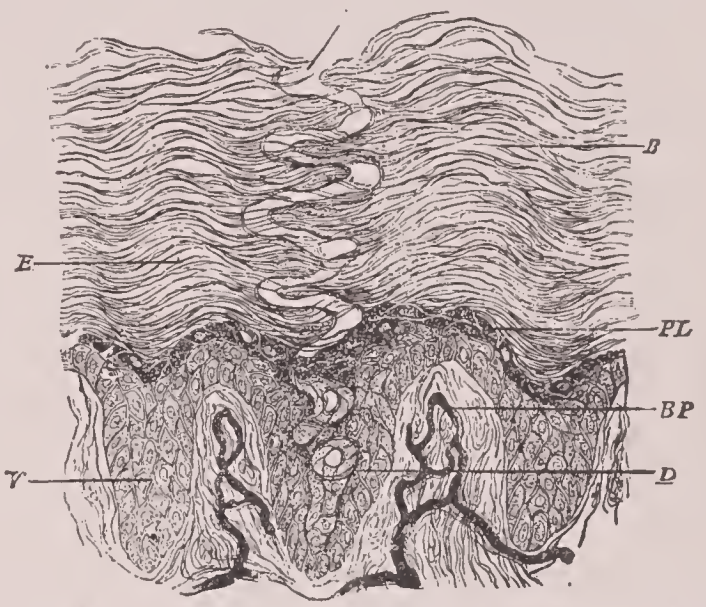



FIG. 27.—Section of skin: BP, vascular papillæ of the corium of true skin; all above these represents the epidermis, of which the outer layer (E) is the superficial horny stratum corneum; V, deepest layer of epithelial cells; PL, stratum granulosum; D, duct of sweat-gland opening on free surface at *p*.

coarse and fine elastic fibers mingle with the bundles of fibrous tissue. On its exterior surface the corium presents great numbers of little elevations, the *papillæ*. These are merely rounded projections over the greater portion of the body, but in some situations, especially in the palmar surface of the hands and fingers, become conical elongated processes ·004 inch in length or longer. They are divided into vascular and nervous, the first containing capillary loops, the second the terminations of nerves. The blood-vessels of the corium form in its deeper portion a close plexus, whence numerous branches are given off toward the surface. These form, in the most superficial portion of the corium, a second still closer plexus, from which the capillary loops of the papillæ are derived. There are also two plexuses of lymphatics, a superficial and a deep—the first situated just beneath the superficial plexus of blood-vessels, the second just beneath the deep vascular plexus. The lymphatic capillaries of these plexuses communicate with the communicating areolar interspaces of the connective tissue of the skin, which here, as elsewhere, are to be regarded as lymphatic passages.

The nerves of the skin are composed of medullated nerve-fibers, part of which terminate in the peculiar corpuscles of Meissner and Pacini, situated within the nervous papillæ, while others loose their medullated sheath, and, after breaking up into bundles of fibrils, form a plexus in the superficial portion of the corium. Innumerable single fibrils, given off from this plexus, penetrate the epidermis, and terminate between the epithelial cells of its deeper layers. The corpuscles of Meissner (tactile corpuscles) are contained in the nervous papillæ, and are most numerous in the palmar surface of the hand and fingers. They are oval bodies about as long as the papillæ in which they are contained, but rather narrower, composed of a modified connective tissue with transversely disposed nuclei, and marked superficially with trans-

verse lines. Each is penetrated at its inferior extremity by a medullated nerve-fiber which runs toward the opposite extremity, either straight or in a spiral manner, terminating in a mode not yet fully made out.

FIG. 28.—Tactile corpuscles: *a*, vascular papilla; *b*, nerve-papilla; *c*, blood-vessel; *d*, medullated nerve-fiber; *e*, tactile corpuscle; *f*, transverse section of contained nerve-fiber.

The *epidermis* varies in thickness from ·002 to ·15 inch, and is composed of numerous strata of epithelial cells, the deeper ones being soft and polygonal, while the more superficial are flattened and horny; it is hence divided into a mucous and a horny layer. The cells of the mucous layer are nucleated masses of granular protoplasms. Those of them which are immediately in contact with the corium are elongated or columnar, and about ·0004 inch in average length. Next above these the cells have about the same diameter, but are rounded or polygonal from mutual pressure, and succeeding strata increase in size toward the surface of the mucous layer, becoming more and more flattened, till the uppermost cells have a transverse diameter of ·001 inch or more, with less than half the thickness. The horny layer consists of strata of cells flattened into mere polygonal scales, ·001 to ·0015 inch or more in diameter, and extremely thin. In most of them no nucleus can be made out. The most superficial cells of this layer are constantly being thrown off, while the superficial cells of the mucous layer continually undergo the horny transformation, and thus replace the loss. To maintain this process a constant development of new elements goes on in the deeper parts of the mucous layer.

The dark color of the skin in certain races is due to the deposit of pigment-granules in the cells of the lower part of the mucous layer.

The *hairs* consist entirely of modified epidermic cells, the corium taking no part in their formation. These structures vary considerably in thickness in different situations, the long soft hairs of the head, beard, etc., usually range between ·0015 and ·004 inch in thickness; the short stiff hairs of the eyelashes, eyebrows, nostrils, and auditory meatus, from ·0025 to ·006 inch; and the downy hairs of the general surface of the body from ·0005 to ·001 inch. The proper substance of all these varieties of hairs can be broken up by the action of sulphuric acid into flat elongated fiber-cells ·002 inch in average length. Each hair is coated externally by a *cuticle* composed of a single layer of flattened scales, which overlap each other like the shingles on a roof; internally, in the coarser hairs, at least, is a central *medulla* or *pith*, composed of granular polygonal cells ·0006 to ·0008 inch in diameter, in the midst of which in many hairs, but by no means in all, masses of air are contained. The color of the hair is due to pigment-granules deposited both in the medulla and the proper hair-substance. Each hair is surrounded throughout its imbedded portion by a modified epithelial structure, the *hair-follicle*, derived from the ingrowth of the epidermis; at its bulbous extremity the hair-follicle is indentated by a projection of the surrounding connective tissue, which forms the papilla in which a vascular loop is contained. The hair-follicles are from ·08 to ·25 inch long, and extend deep into the corium—in the case of the larger hairs quite through it. The connective tissue of the corium immediately adjoining them is so condensed as to form an external sheath, the fibers of which run parallel to the hair. The portion of this sheath nearest to the follicle is more homogeneous, and is known as the glassy membrane. The mucous layer of the epidermis is continued into the sheath, which it lines as far as the papilla, lying next to the vitreous membrane, and is called the *external root-sheath*. Between the latter and the hair is a second thinner stratum, composed of the two delicate layers of Henle and of Huxley, which together are designated the internal root-sheath. The hair-papillæ are vascular processes of connective tissue which project into the bottoms of the follicles; they are conical in shape, with constricted necks. At the bottom of the follicle the cells of the outer root-sheath pass uninterruptedly over the hair-papillæ, at which point they are cylindrical and rapidly undergo specialization; those cells over the summit of the papillæ are converted into the fiber-cells of the hair-substance, while those more laterally placed are converted into the cuticle of the hair and into the inner root-sheath. Two small arteries enter each papilla; these usually unite to form a single trunk, which break up into a capillary network from which two emergent veins proceed. A small artery and vein also ramify in the substance of the external sheath of the follicle. Nerves have been traced as far as the outer root-sheath, but their mode of termination remains uncertain. When the hair has completed its life, the root undergoes degeneration, its place, however, after a time being taken by a new hair, which grows from the remains of the old follicle; the new shaft finally displaces the former hair, which then drops out.

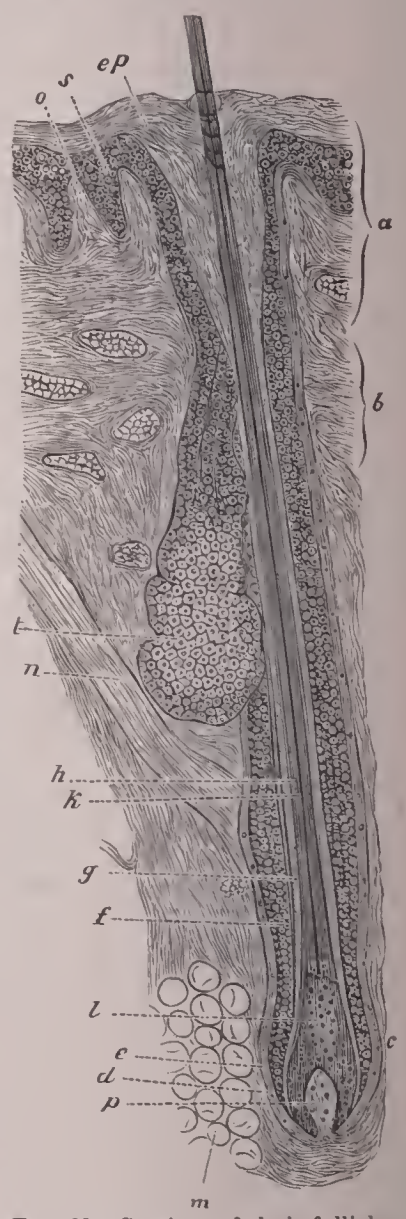



FIG. 29.—Section of hair-follicle: *a*, orifice of hair-follicle; *b*, neck of follicle; *c*, bulbous extremity of follicle; *d*, outer layer of fibrous sheath; *e*, inner or glassy layer of same; *f*, outer root-sheath; *g*, inner root-sheath; *h*, substance of hair; *k*, medullary substance of hair; *l*, root of hair; *m*, adipose cells; *n*, arrector pili; *t*, sebaceous gland; *o*, papillæ of skin; *p*, hair-papilla; *s*, mucous layer; *ep*, horny layer projecting into mouth of hair-sac.

The *erector muscles of the hair* are narrow bands of muscular fiber-cells ·0018 to ·009 inch in thickness, which arise in the upper part of the corium and run obliquely inward to be inserted into the hair-follicles just below the sebaceous glands. Each hair-follicle enters the skin obliquely, forming an acute angle with the surface, and, as the muscle lies in the corresponding side, its contraction erects the hairs in the opposite direction, producing the so-called "gooseflesh."

One or more *sebaceous glands* open into each hair-follicle just below the level of the general surface of the corium. Each of these glands consists of from two to twenty somewhat oval saccules ·005 to ·014 inch in long diameter, composed of a transparent basement membrane, filled with nucleated cells, resembling the cells of the mucous layer of the epidermis. The cells nearest the walls of the sacculi often contain no oil, while in the more central cells oil is usually present in drops of various sizes imbedded in the cell-substance. The size of the sebaceous glands is quite independent of the size of the hairs with which they are connected, and sometimes, though rarely, they open directly upon the surface of the skin without being connected with any hair.

The *sweat-glands* are modified simple tubular glands, each consisting of a delicate sheath, lined by a single or

double layer of low columnar nucleated cells, which leave in the center a narrow cylindrical passage. The diameter of the tube averages about ·0025 inch; its deepest extremity forms a coil or glomerulus ·008 to ·016 inch in diameter, which is surrounded by a plexus of blood-vessels, and lies in the lower part of the corium or in the subjacent adipose tissue. From this coil the tube pursues a nearly straight path to the surface of the corium, where both the sheath and the columnar cells terminate, and the central passage becomes continuous with a spiral canal hollowed out between the cells of the epidermis, which opens on the external surface of the horny layer. The hairs, sebaceous glands, and sweat-glands are developed from the mucous layer of the epidermis, cylindrical outgrowths of which invade the corium and undergo the requisite transformations. Simultaneously, the adjacent layers of the corium are metamorphosed into the outer fibrous sheaths of the hair-follicles and glands.

The *nails* are to be regarded as special modifications of the epidermis, and consist, like it, of a mucous and a horny layer, the latter being the true nail. In the fold of skin from which the root of the nail grows the corium is elevated into papillæ projecting forward, which in the true bed of the nail are replaced by a series of parallel longitudinal ridges or laminæ ·002 to ·008 inch high. These papillæ and ridges are abundantly supplied with blood-vessels, and numerous medullated nerve-fibers exist in the subjacent connective tissue, which lose their medullary sheath on entering the corium, and break up into fine branches, the ultimate termination of which is not fully known. An active development of cells takes place in the mucous layer at the hindmost part or root of the nail; as a similar development occurs, though less actively, in the mucous layer of the nail-bed, the nails are at once pushed forward and increased in thickness toward their free margins. The horny layer, or nail-substance, is composed of irregular polygonal cells intimately united, but these can be isolated by reagents, as, for example, by maceration in solution of potash.

*The Digestive Organs.*—The *mouth* is lined by a mucous membrane which is directly continuous with the skin, and like it consists of a vascular layer of connective tissue beset with papillæ and a many-layered squamous epithelium, the superficial cells of which are flattened scales, the deeper ones polygonal, and those next the connective-tissue layer columnar. The connective-tissue layer, however, is much thinner than the corium; in the epithelium a horny layer can not be discriminated as in the epidermis, and the large superficial epithelial scales contain oval nuclei. The papillæ of the mucous membrane vary in size and shape in different parts of the oral cavity; they are particularly conspicuous on the upper surface of the tongue, where three varieties are discriminated—viz., the filiform, fungiform, and circumvallate. The filiform papillæ are pretty uniformly distributed over all portions of this surface. They are conical elevations of the mucous membrane, the apices of which terminate in a number of secondary papillæ, the whole being covered with a thick layer of epithelium, which, at the apices, breaks up into a number of slender processes, each composed of epithelial cells adhering together. The fungiform papillæ are situated at the anterior part of the tongue, chiefly on its tip and edges. They are club-shaped projections of the mucous membrane with narrow necks, beset upon the surface with small secondary papillæ, and smoothly covered over with epithelium. The circumvallate papillæ, from eight to ten in number, are arranged in the form of a Λ at the root of the tongue. They are flattened elevations, somewhat constricted at their bases, beset, like the fungiform, with small secondary papillæ, and surrounded by a circular elevation of the mucous membrane, from which they are separated by a narrow depression. All these varieties of papillæ are provided with both blood-vessels and nerves. Connected with the nerves are special organs of taste, the so-called gustatory bulbs, which are situated chiefly on the sides of the circumvallate papillæ, but also exist, though less plentifully, on the fungiform papillæ. They have the form of round-bellied flasks, about ·003 inch long, and rather more than half as broad, which occupy cavities in the epithelium, resting below on the connective-tissue layer of the mucous membrane. They are composed of flattened, spindle-shaped nucleated integumentary cells, which inclose a number of more delicate columnar elements closely related to the filaments of the nerves of special sense. The central cells of these bulbs are believed to be the true gustatory cells, while the others are regarded as protecting in their nature, and are so arranged as to leave at the apex of the bulb a circular opening about ·00014 inch in diameter, the gustatory pore, through which sapid solutions gain access to the gustatory cells. The oral cavity is provided with a considerable number of small mucous glands ·03 to ·16 inch in diameter, similar in structure to the mucous salivary glands, and designated, according to their situation, labial, buccal, palatine, and lingual glands.

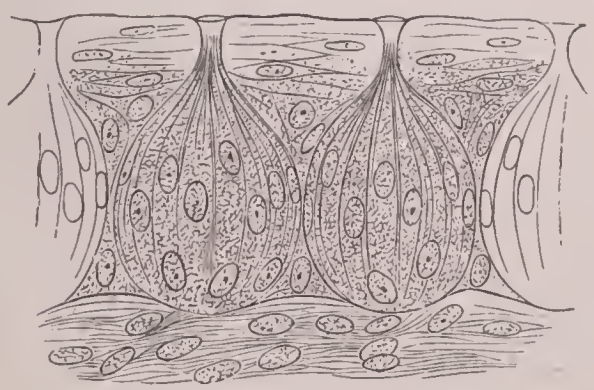


FIG. 30.—Taste-bulbs.

The *salivary glands* are racemose glands, the ducts of which are lined with a cylindrical epithelium and branch in a tree-like manner, terminating finally in sacculi or alveoli ·0015 to ·003 inch in diameter, and lined with polygonal secreting cells ·0004 to ·0007 inch in diameter. The whole is united into a mass by a delicate connective tissue in which numerous blood-vessels and nerves ramify. The alveoli and smaller ducts are limited by a delicate connective-tissue envelope, the membrana propria; in the larger ducts it forms a comparatively thick layer. The secreting cells lining the alveoli vary in appearance according to the character of their secretion; certain of the salivary glands, as the parotid and pancreas, are albuminous or serous in type, while the sublingual and submaxillary glands in man

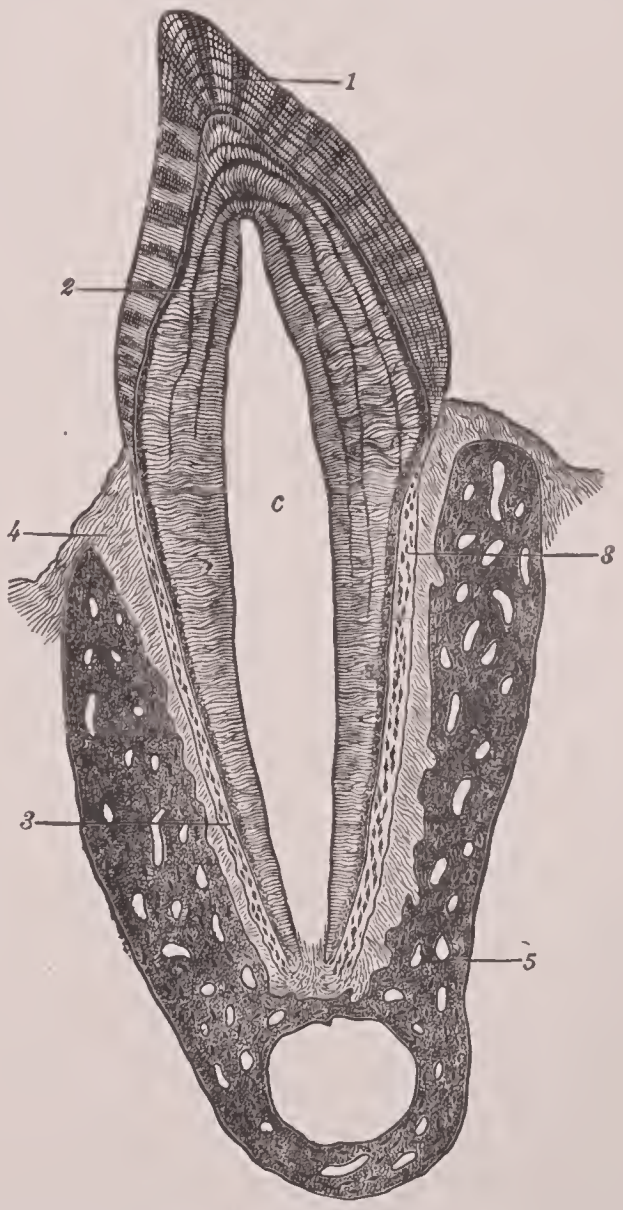



FIG. 31.—Vertical section of tooth *in situ*: *c*, pulp cavity; *1*, enamel; *2*, dentine or ivory, with tubules; *3*, cement or crusta petrosa; *4*, dental periosteum; *5*, bone of lower jaw.

are respectively mucous and muco-serous. In the serous glands the secreting cells are spherical, deeply granular, and conspicuously nucleated; in the mucous type, on the contrary, the cells are more columnar, very clear, with their nuclei displaced and pressed against the basement membrane. The nerves connected with the salivary glands have been traced to the alveoli, which they surround; regarding their supposed termination in connection with the secreting cells little is accurately determined. The oral fluid consists of the secretion of the salivary glands mixed with that of the small racemose glands above described. It always contains large numbers of flattened epithelial cells, derived from the surface of the oral mucous membrane, together with small round granular cells resembling the white corpuscles of the blood after they have been somewhat swollen by immersion in a fluid of the density of the saliva. The latter are known as the *salivary corpuscles*, and are migrated lymphoid cells which escape into the cavity of the mouth from the masses of lymphoid tissue within the oral cavity.

The *tonsils* are two masses of lymphoid tissue, each consisting of from ten to twenty saeculated depressions of the mucous membrane, in the walls of which are numerous oval lymphatic follicles ·008 to ·02 inch in diameter. The parenchyma of these follicles consist of a fine reticulum of connective tissue, the meshes of which are stuffed with lymphoid elements. The follicles are united by a connective tissue rich in blood-vessels and lymphatics. At the root of the tongue there are a number of small lymph-follicles similar in structure to the tonsils, but simpler, each consisting of a single saccular depression of the mucous membrane, the walls of which are lined by lymphoid tissue. The oral mucous membrane is well supplied with lymphatics, which are especially abundant on the surface of the tongue and about the tonsils.

*The Teeth.*—The teeth consist of three substances: The dentine, enamel, and cementum. The *dentine*, or ivory, which constitutes the principal portion of the substance of the teeth, consists of a calcareous matrix containing great numbers of delicate dentinal canals ·00005 to 00015 inch in diameter, which branch and anastomose as they radiate from the pulp cavity toward the periphery of the dentine. The crown of the teeth is covered with a harder material, the *enamel*, made up of hexagonal prismatic enamel-fibers ·00012 to ·00018 inch in diameter, arranged perpendicularly to the surface, or nearly so. The roots of the teeth are covered with a thin layer of true bone, the crusta petrosa, or *cementum*. The tooth-pulp occupies the central cavity of each tooth, and is a delicate mass of connective tissue containing both blood-vessels and nerves. Its external layer consists of large nucleated cells, the *odontoblasts*, provided with long processes which extend within the dentinal canals. In the development of the teeth a longitudinal furrow in the mucous membrane of the gum is formed, from the bottom of which a cylindrical epithelial process grows into the underlying connective tissue; this epithelial structure becomes the *enamel organ*, into which a papillary outgrowth from the adjacent connective tissue extends to form the *dental papilla*. The enamel originates by the transformation of portions of the epithelium of the primary enamel organ, while the peripheral cells of the dental papillæ are transformed into odontoblasts, between the processes of which the calcareous matrix of the dentine is deposited. The permanent teeth are developed in the same manner as the temporary, the enamel organ of the second teeth sprouting from that of the first teeth during the development of the latter.

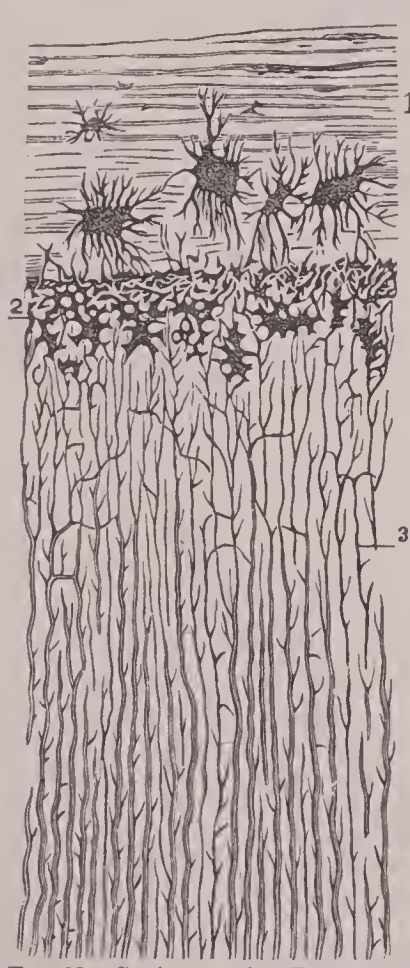


FIG. 32.—Canine tooth: Transverse section of root: 1, cement; 2, interglobular spaces; 3, dentinal tubules.

The *pharynx* is lined by a mucous membrane resembling that of the mouth, except in the portions adjoining the posterior nares and the orifices of the Eustachian tubes where the pavement epithelium is replaced by one composed of ciliated columnar cells like those of the nasal mucous membrane. The mucous membrane is well supplied with vessels, nerves, and lymphatics, and contains a considerable number of racemose glands resembling those of the oral cavity, as also numerous lymphatic follicles, arranged around sacculi like those at the root of the tongue or in the tonsils.

A laminated pavement epithelium, like that of the pharynx, also lines the *œsophagus* as far as the cardiac orifice of the stomach, where it abruptly terminates, and is replaced by the columnar epithelium of the stomach. The œsophageal epithelium reposes upon a vascular layer of delicate connective tissue, the proper mucous membrane, which is separated from the more loosely meshed submucous connective tissue by a thin stratum of muscular fiber-cells, the muscle of the mucous membrane, or muscularis mucosæ, which commences with a few scattered fiber-cells in the upper part of the œsophagus, and becomes a continuous layer farther down. A few small racemose glands lie in the submucosa and open by minute ducts on the mucous surface. The external muscular coat of the œsophagus consists of an internal circular and external longitudinal layer; in its upper third these are composed entirely of striated muscular fibers; in the next third the striated and non-striated varieties of muscle are represented; while in the lower third the muscular coat is wholly composed of the non-striped fiber-cells. Externally the muscular coat is invested by a sheath of fibrillated connective tissue.

The walls of the *stomach* consist of a mucous membrane, a layer of submucous connective tissue, a muscular coat, and the peritoneum. The epithelium of the mucous membrane consists of a single layer of nucleated columnar cells ·0008 inch in average length, among which occur certain peculiar cup-shaped elements, the so-called goblet-cells. Beneath the epithelium and between the gastric glands the mucous membrane resembles lymphoid tissue, consisting of

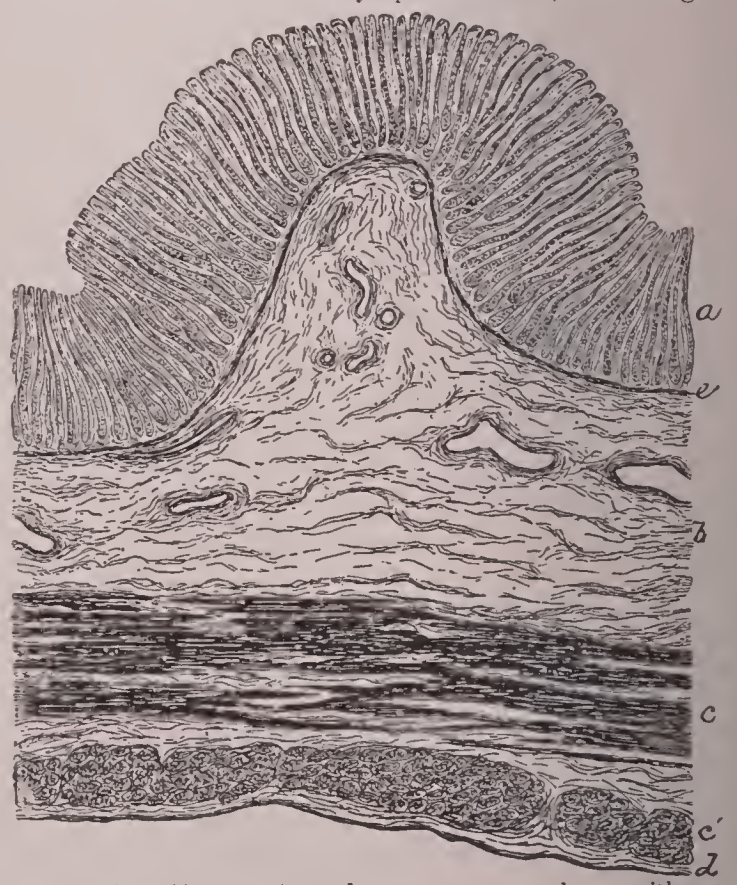


FIG. 33.—Section of human stomach: *a*, mucous membrane with gastric glands; *b*, submucous coat, containing blood-vessels, lymphatics, and nerves; *c c′*, muscular tissue; *d*, serous coat.

a delicate reticulum, the meshes of which are filled with lymphoid elements, as in the lymphatic glands and follicles. In this adenoid tunica propria innumerable tubular glands, ·015 to ·06 inch long and ·002 to ·003 inch broad, are arranged perpendicularly to the mucous surface, and placed so closely

side by side as to occupy more space than the intervening tissue. In the vicinity of the pyloric orifice of the stomach these glands are lined throughout by a columnar epithelium. In the rest of the stomach this columnar epithelium only lines the upper portion of the glands, the rest being filled with spheroidal granular elements. The cells lining the peptic glands consist of two kinds, those situated next to the lumen of the gland and preponderating in numbers, the *chief* or *central* cells; and those situated peripherally, beneath the basement membrane, which in places is bulged out by the cells, called the *acid* or *parietal* cells; these latter are more numerous near the constricted neck of the glands, and do not occur within those of the pyloric end of the stomach. The pyloric glands are usually branched and lined throughout with albuminous cells. The mucous membrane is separated from the submucosa by a stratum of non-striated muscle, on an average about ·002 inch thick, consisting of an internal circular and external muscular layer. The submucosa is a layer of rather loose connective tissue, which unites the muscle of the mucous membrane to the external muscular coat. The latter is ·02 to ·08 inch thick, and consists most internally of an incomplete series of oblique fasciculi, next of a circular layer, and still more externally of a longitudinal layer, all composed of non-striped muscle. Lastly, the serous coat, or peritoneum, which has the structure of serous membranes generally, is united to the external muscular coat by a thin layer of subperitoneal connective tissue. The blood-vessels of the stomach ramify in the submucosa, and there form a network whence numerous small branches proceed to the mucous membrane, where they form a close capillary plexus around the tubular glands. The external muscular coat and the peritoneum are partly supplied by branches given off by the vessels as they pass through them, partly by branches derived from the submucous plexus. The nerves of the stomach form in the submucosa a plexus in which numerous small ganglia are found. A second plexus, also with numerous ganglia, exists between the circular and longitudinal layers of the external muscular coat. The ultimate relations of the nerves to the mucous membrane are yet uncertain. The lymphatics form three networks—one in the mucous membrane between the tubular glands, the second in the submucosa, the third in the peritoneum.

The description of the coats of the stomach just given applies, with certain modifications, to both small and large *intestines*. The lining epithelium is similar throughout, as is the structure of the mucous membrane, except that the tubular glands, which in the intestines are called the glands or crypts of Lieberkühn, are shorter, ·01 to ·02 inch long, do not branch, and are lined throughout by columnar epithelium. What has been said of the muscle of the mucous membrane, the submucosa, the external muscular coat, the peritoneum, and the general distribution of blood-vessels, lymphatics, and nerves of the stomach, will apply with but little alteration to the intestinal canal. The more important points of difference are as follows: In the *small intestine* the mucous membrane, besides being thrown, in its upper portion especially, into numerous transverse folds, the *valvulæ conniventes*, presents a great number of conical elevations ·008 to ·04 inch long, the so-called *villi*. These consist of the adenoid tissue of the mucous membrane, and are coated externally by its cylindrical epithelium. Each contains a central lymph-vessel, here called *lacteal*, which terminates by a slightly expanded blind extremity, which is the commencement of the lymphatics. Between this and the periphery of the villus lie the blood-vessels, consisting of one or more minute arteries which break up into a capillary network, the blood from which is collected by a small vein. Each villus also contains a number of longitudinally arranged muscular fiber-cells, which are continuous below with the muscle of the mucous membrane. The crypts of Lieberkühn open on the surface of the mucous membrane between the villi, and are so arranged that the deeper portions of those adjoining opposite sides of the bases of the villi appear as close together as the others. Lying partly in the mucous membrane, partly in the upper portion of the submucosa, there are a number of lymph-follicles, ·015 to ·08 inch in long diameter, which either occur singly (the solitary follicles), or are aggregated together in groups consisting of twenty or more follicles placed side by side (the patches of Peyer). These follicles are somewhat flask-shaped, their apices penetrating into the mucous membrane almost or quite to the epithelium, while their rounded bases lie in the submucosa. Their parenchyma is identical in structure with other lymphatic follicles. They are surrounded by a vascular plexus which sends capillary branches into their substance, and are partially enveloped by rather wide lymph-channels. Immediately above each follicle the villi are absent. On the surface of the patches of Peyer, however, villi are often found on the mucous membrane between the individual follicles. The solitary follicles are found in all parts of the intestinal tract; the patches of Peyer, on the other hand, occur chiefly in the lower portion of the small intestine, especially in the ileum. In the upper part of the small intestine the submucosa contains a number of small racemose glands about ·04 inch in average diameter, the *glands of Brunner*, the ducts of which perforate the mucous membrane and open into the intestinal canal. The muscular coat of the small intestine is from ·015 to ·02 inch thick, and consists of an internal circular and external longitudinal layer. The lymphatics form a network in the mucous membrane which surrounds the crypts of Lieberkühn, and are continuous with the central lymph-sinuses of the villi and the coarser plexus in the submucosa. The peritoneum has its own plexus of lymphatics, as in the stomach. On account of the milky appearance of their contents during the digestion of fatty matters, the lymphatics of the intestinal mucous membrane and of the mesentery are known as lacteals. As in the stomach, there are in both small and large intestines two nervous plexuses provided with numerous ganglia; the first, situated in the submucosa, is known as the plexus of Meissner; the second, between the circular and longitudinal layers of the muscular coat, is the plexus of Auerbach. In the *large intestine* there are no villi; in other respects its mucous membrane closely resembles that of the small intestine, except that it is rather thicker, the crypts of Lieberkühn somewhat longer, and the muscle of the mucous membrane a little better developed. Solitary follicles rather larger than those of the small intestine, but otherwise resembling them, and having similar relations to the lymphatics, occur at intervals. The external longitudinal layer of the muscular coat is much thinner than the circular, except in three longitudinal bands, in which the two layers are of equal thickness, together measuring about ·025 inch.

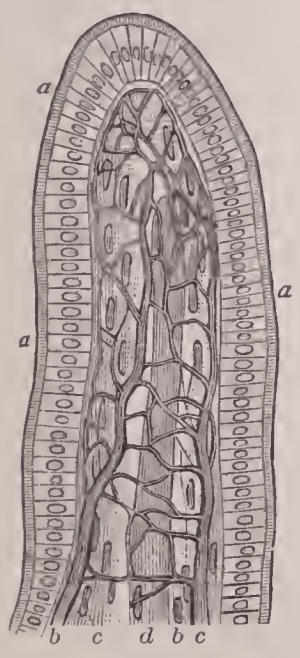



FIG. 34.—Intestinal villus: *a*, cylindrical epithelium; *b*, capillary blood-vessel; *c*, involuntary muscle-cells; *d*, central lymphatic radicle.

*The Liver.*—The liver is the largest gland in the body, and is classed as the modified compound tubular type. Since the blood-vessels largely determine the arrangement of the other parts of the organ, their description is first in order. The connective tissue enveloping the periphery of the organ is continued into the interior, affording a means by which the blood-vessels and bile-ducts enter and escape. Two sets of blood-vessels enter the liver and ramify in it side by side—branches of the hepatic artery and of the portal vein. The blood from these is carried by a common system of capillaries into the radicles of the hepatic vein, the blood brought by the artery being for the nutrition of the tissue alone. The hepatic artery and portal vein are accompanied in their ramifications by the branches of the biliary duct, and the three are united together by a delicate connective tissue, the sheath or capsule of Glisson, in which lie also the nerves and the deep lymphatics of the organ. By the final ramifications of the hepatic artery and portal vein the parenchyma of the liver is mapped out into irregular polygonal lobules or acini, ·025 to ·08 inch in diameter, which, however, in the human liver are not invested with a well-developed connective-tissue capsule, as in the liver of the pig and some other animals, and are consequently but indistinctly defined. The ramifications of the hepatic vein lie in a direction perpendicular to the course of the other vessels, so that their ultimate radicles occupy the centers of the acini, and hence are called *intralobular* veins; while the radicles of the portal veins lying between the lobules are called *interlobular* veins. A capillary network with comparatively small meshes lies in the substance of the acini, and conveys the blood from the interlobular to the intralobular vessels. The parenchyma of the

liver consists of granular polygonal cells, ·0005 to ·001 inch in diameter, containing one or two rounded or oval nuclei, and frequently oil-drops. Between these cells, which occupy the meshes of the capillary plexus of the acini, there ramifies a plexus of extremely fine capillary bile-ducts ·00004 to ·00008 inch in diameter, which do not, however, possess any proper walls, but are bounded by the hepatic cells themselves. The bile capillaries represent the intercellular lumen of the tubular acini of other glands. These bile-channels lie between the adjoining faces of the hepatic cells even more frequently than at their angles, and are arranged in such a manner that every hepatic cell is related, by at least one of its sides, to a capillary bile-duct, which, however, never separates the cell from the capillary blood-vessel. The capillary bile-ducts open, at the periphery of the lobule, into the finest interlobular bile-ducts, which are passages channeled in the connective tissue accompanying the interlobular vessels, and

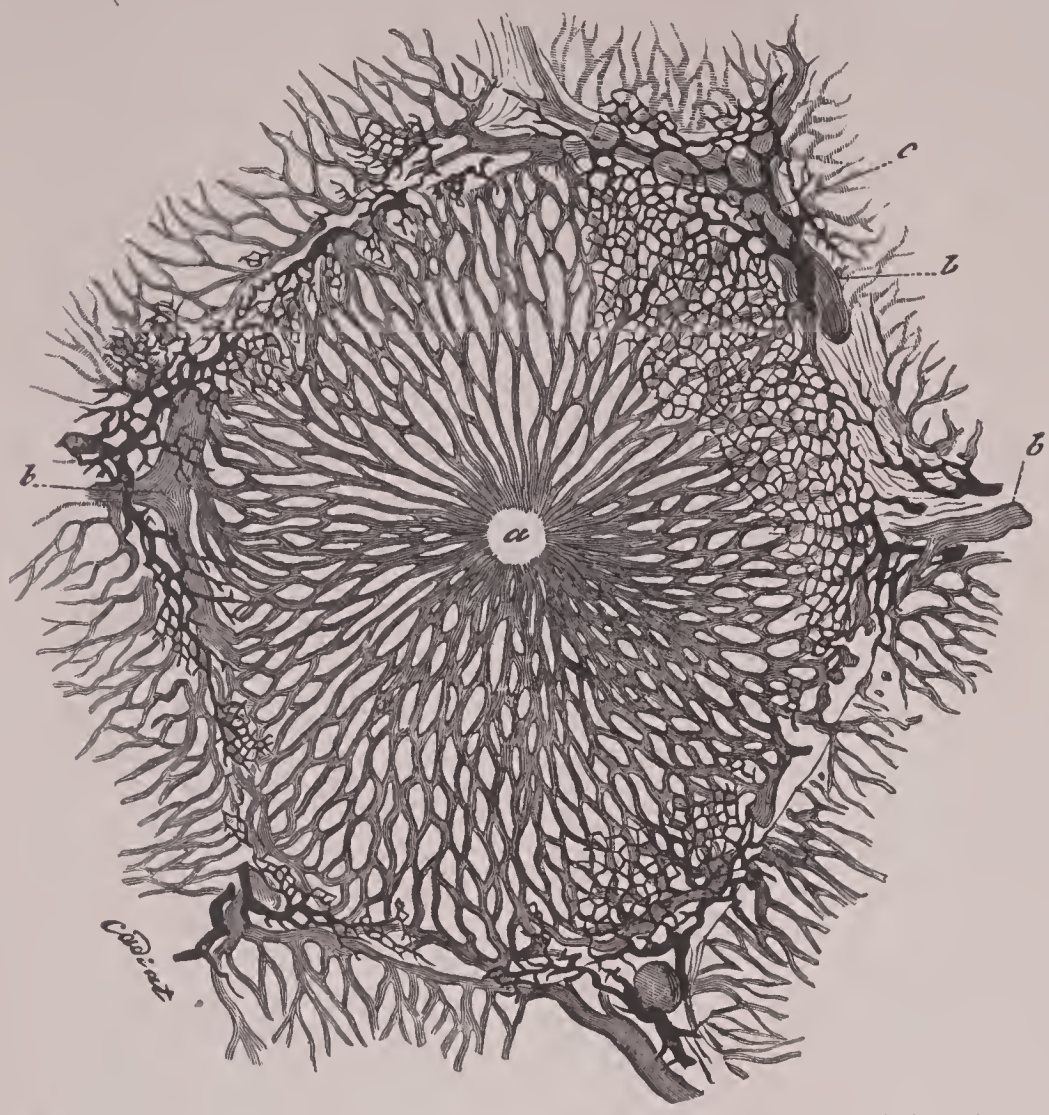



Fig. 35.—Lobule of injected liver: *a*, central vein; *b b*, peripheral or interlobular veins; *c*, interlobular bile-duct.

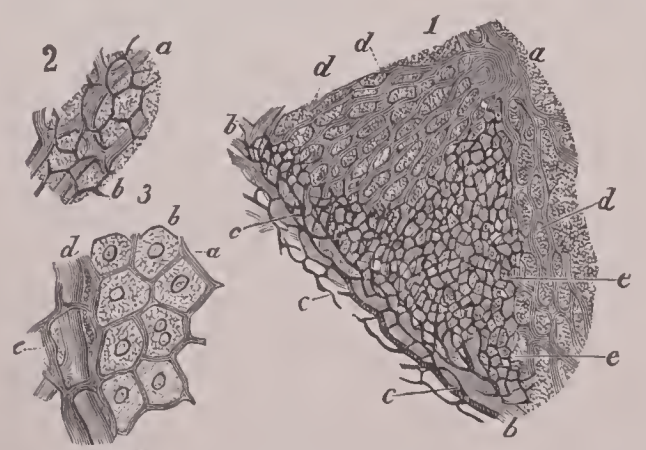



Fig. 36.—Liver of rabbit: 1, part of a lobule—*a*, central vein; *b*, portal vein; *c*, bile-ducts; *d*, capillaries of portal vein; *e*, bile-capillaries. 2. *a*, portal blood-capillaries; *b*, bile-capillaries. 3. *a*, bile-capillaries; *b*, hepatic cells; *c*, bile-ducts; *d*, capillary blood-vessel.

lined by a single layer of polygonal cells. The larger ducts are lined by a columnar epithelium, and have a wall of muscular and connective tissue which becomes thicker as the tubes increase in diameter. In this wall numerous racemose mucous glands are imbedded, the excretory canals of which open into the bile-ducts. The liver is coated externally by a very thin capsule of connective tissue, and this again is covered, over the greater part of the surface of the organ, by the peritoneum. In the peritoneum and the subjacent connective tissue lies an abundant plexus of superficial lymphatics. The deep lymphatics, which penetrate the substance of the organ, lie in the capsule of Glisson, as has already been mentioned. The nerves of the liver are composed chiefly of non-medullated, with a few medullated, fibers. They enter the liver with the portal vein, and for the most part accompany its branches. They have not been traced into the substance of the acini, and their relations to the hepatic cells remain undetermined.

The *gall-bladder* is lined throughout by a single layer of columnar epithelial cells, supported upon a membrane of connective tissue, in which there are numerous decussatory fasciculi of non-striated muscles. Externally, it is in part coated by the peritoneum, in part comes into immediate contact with the hepatic tissue.

The *pancreas* agrees in its structure with the serous salivary glands so closely that no separate description of it need be given.

*The Respiratory Organs.*—The cartilages of the *larynx* are all of the hyaline variety, except the epiglottis and the cartilages of Wrisberg and of Santorini, together with parts of the arytenoid cartilages, which are composed of elastic cartilage. The muscles are of the striated variety. The interior of the larynx is lined by a mucous membrane covered throughout its greater part with ciliated columnar epithelium, and is connected with the cartilages, ligaments, and muscles by a layer of submucous connective tissue. The epithelium of the mucous membrane on the upper part of the larynx and on the principal surfaces of the epiglottis is usually squamous in character. The ciliated epithelium consists of a layer of columnar cells ·001 to ·0016 inch long, attached to the mucous membrane by narrow elongated prolongations, while on their free margins they are provided with a number of hair-like processes about ·00015 inch long (the cilia), which during life keep up a constant waving motion. Between the ciliated cells are occasional goblet-cells containing mucus. The true vocal cords are composed chiefly of yellow elastic tissue, covered by folds of the mucous membrane, on the surface of which the ciliated epithelium is replaced with a layer of pavement cells. A number of small racemose glands are found in the submucous connective tissue of the larynx, and open by their ducts upon the free surface of its mucous membrane. Similar glands occur abundantly in the trachea, which is lined by a mucous membrane in all respects resembling that of the larynx. The rings of the trachea are composed of hyaline cartilage, and are united together by a mixture of connective tissue and elastic fibers. Posteriorly, the rings are incomplete, the spaces thus left being occupied by a layer of transversely disposed involuntary muscle.

*The Lungs.*—On entering the lungs the bronchial tubes branch in an arborescent manner, and finally terminate, when about ·01 inch in diameter, in groups of infundibula, or funnel-shaped terminal expansions, upon each of which open a number of polygonal cavities, the air-vessels or alveoli. The infundibula of each group are connected with the small bronchial tube to which they belong by thin walled passages, the alveolar ducts, which differ from the finest bronchial tubes chiefly in the character of their epithelium, and in having their walls beset by air-vesicles which open into them. Down to about ·04 inch in diameter the bronchial tubes consist of four layers—an external fibrous coat in which are imbedded a series of incomplete rings and plates of hyaline cartilage; a thin layer of involuntary muscle; an

internal fibrous coat rich in elastic fibers; and, lastly, an epithelium similar to that of the trachea. Scattered groups of fat-cells lie in the outer portion of the external fibrous coat; in its inner portion there are a number of racemose

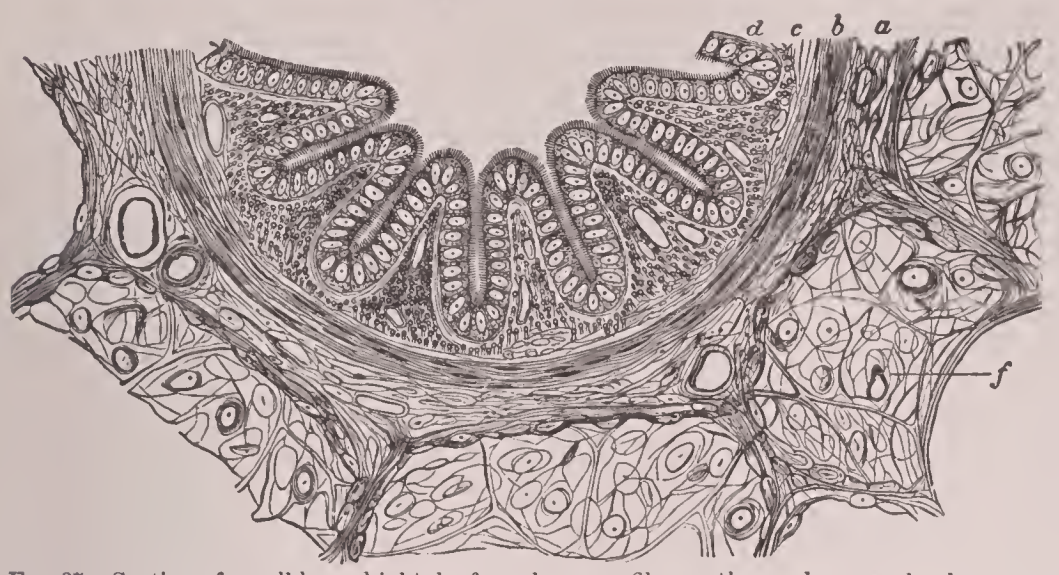



Fig. 37.—Section of small bronchial tube from lung: *a*, fibrous tissue; *b*, muscular layer; *c*, mucous membrane in folds, covered by ciliated cells (*d*); *f*, surrounding alveoli or air-sacs.

mucous glands, the ducts of which open into the lumen of the tube. In bronchial tubes of less than ·04 inch in diameter the external fibrous coat becomes thinner and thinner; the plates of cartilage and the mucous glands become more and more scanty, and finally disappear, and the muscular layer is gradually reduced to a few scattered fasciculi; the elastic inner fibrous coat is, however, prolonged upon the finest bronchial tubes, and is continuous with the elastic walls of the alveoli. The ciliated epithelium also continues in the smallest bronchial tubes, but its cells become shorter and shorter, and finally, at the transition from the bronchial tubes to the alveolar canals, lose their cilia and acquire the characters of the epithelial lining of the alveoli. The bronchial tubes are nourished by branches of the bronchial artery which supply the mucous membrane with a close capillary plexus. Their walls also contain numerous nerves and lymphatics. The air-vesicles, when undistended, measure from ·006 to ·01 inch in diameter, but can be blown up to twice these dimensions, or even more. Their walls are composed of a transparent connective tissue in which characteristically arching elastic fibers are plentifully imbedded, and in which the capillaries derived from the pulmonary arteries form a close plexus with rounded or oval meshes. They are lined at birth by a layer of flat, granular, nucleated, hexagonal epithelial cells, which form a continuous lining for both the air-vesicles and the alveolar passages. After continued expansion by the inhaled air, the cells are transformed into thin expanded plates. This epithelium is best demonstrated by the silver method. The adjacent elastic walls of air-vesicles belonging to the same infundibulum coalesce to form a single septum. The walls of adjacent vesicles belonging to different infundibula are for the most part separated by a small quantity of interstitial connective tissue. The whole lung is made up of the bronchia and infundibula described, with blood-vessels, nerves, and lymphatics, held together by connective tissue. The nerves for the most part accompany the bronchial tubes and blood-vessels, and are largely distributed to their muscular fiber-cells. The lymphatics begin as anastomosing lacunæ in the walls of the air-vesicles, whence proceed lymphatic capillaries, which unite to form trunks accompanying the bronchial tubes and the larger blood-vessels. There is, besides, an abundant superficial lymphatic network which lies just beneath the pleura.

Fig. 38.—Epithelium of air-vesicle of lung.

*Urinary Organs.*—The *kidney* represents a high development of a compound tubular gland, consisting of a great number of secreting tubes lined by epithelium, the tubuli uriniferi. These, with the blood-vessels, nerves, and lymphatics of the organ, are held together by a delicate connective tissue. The entire kidney is composed of two parts —the *cortex*, embracing the outer third of the organ, and the *medulla*, forming the inner part. The cortex appears deeply colored and granular, while the medulla presents series of converging light and darker striæ, which meet in the summits of the Malpighian pyramids which occupy the inner zone of the organ and open into the central cavity, or pelvis. The uriniferous tubules commence in the cortical portion of the organ as globular expansions, the capsules of Bowman, which embrace peculiar tufts of capillaries, the glomeruli of Malpighi. These, which are usually from ·005 to ·008 inch in diameter, consist of a number of capillary loops held together by connective tissue. The capsules of Bowman, which embrace them, are lined by a layer of large pavement epithelial cells, best demonstrated by the action of silver, and are continuous by constricted necks with the uriniferous tubes. Each uriniferous tube, which at first is about ·002 inch in average diameter, pursues for a short distance a very tortuous path, followed by a short spiral course; it then rather suddenly diminishes in size to half its

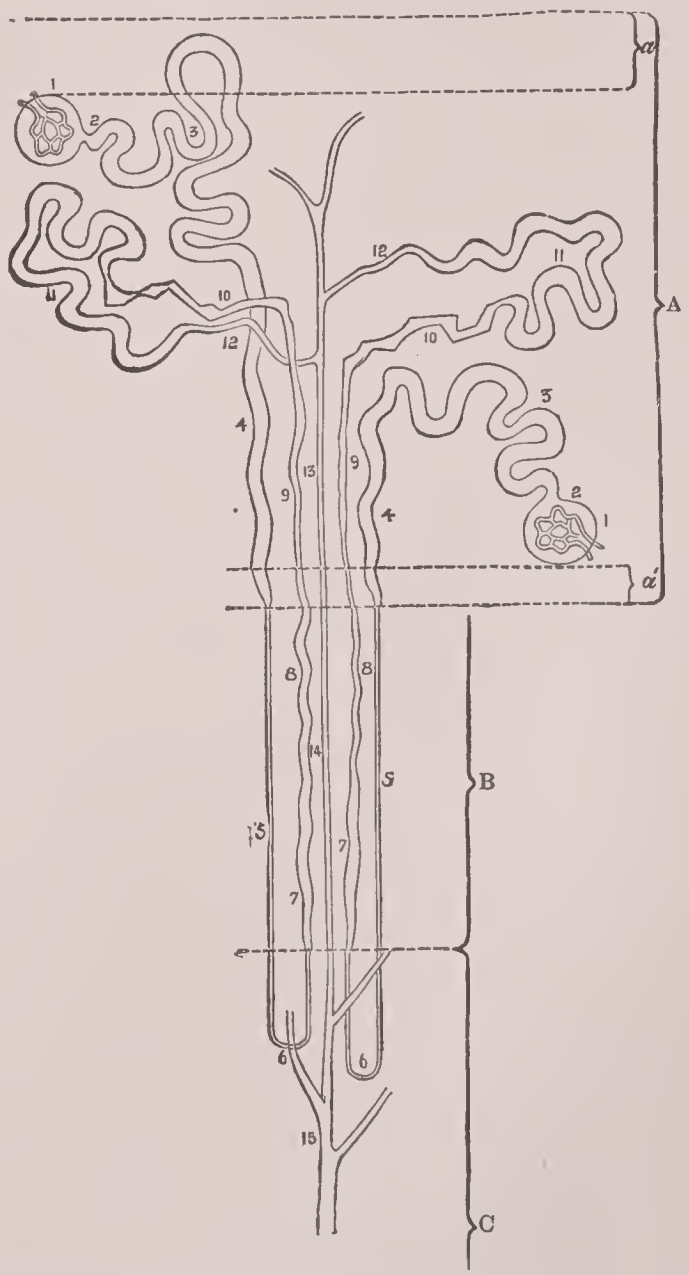



Fig. 39.—Diagram of course of uriniferous tubules of kidney: A, cortex; B C, boundary and papillary zones, together constituting the medulla; *a a'*, layers free from Malpighian bodies; 1, Malpighian bodies, consisting of expanded blind end of tubule—capsule of Bowman—and tuft of blood-vessels, the glomerulus; 2, neck; 3, proximal convoluted tubule; 4, spiral tubule; 5, 6, 7, 8, and 9, various parts of the descending arm, loop, and ascending limb of the loops of Henle; 10, irregular tubule; 11, distal convoluted tubule; 12, arched collecting tubule; 13, 14, 15, parts of collecting tube.

original diameter, or less, and runs in nearly a straight line into the nearest pyramid, in which, at a variable depth, it turns back upon itself, forming a narrow loop (the loop of Henle), and returns to the cortical portion, where, after a time, it again becomes wide and tortuous, then again constricted, and finally unites with one or more tubuli which have pursued a similar course to form a straight collecting tube. This collecting tube runs toward the pyramid, receiving at first a few additional tubuli, after which it pursues a solitary course into the pyramid, where adjacent collecting tubes coalesce in pairs; so that the number of passages which finally open at the apex of each pyramid is very much smaller than the original number of tubuli. When sections of the kidney are examined with a low magnifying power, a number of striæ (medullary rays) are seen proceeding from the bases of the pyramids almost to the surface of the cortical portion. These consist of the straight collecting tubes, of the straight narrow portions of tubuli, returning after having formed the loops of Henle, and of the spiral portion of the tubules. The glomeruli and the convoluted part of the tubuli lie in the parenchyma between these medullary rays, known as the labyrinth. The walls of the uriniferous tubules consist of a delicate basement membrane lined by a single layer of epithelial cells. These consist, in the first tortuous portion of the tubule, of a granular protoplasm, without distinct cell-walls. In the narrow part of the tubule, forming the loop of Henle, the epithelium appears as an attenuated layer of protoplasm, with swellings containing nuclei at intervals. In the loop and its ascending limb the cells assume more of a columnar character, while, when the tube again becomes tortuous, the epithelium again assumes the character it possessed in the first tortuous portion, and finally, in the collecting tubes, is represented by a single layer of well-defined columnar epithelial elements.

The renal arteries divide in the sinus of the *kidney* into a number of branches, which, on reaching the bases of the pyramids, ramify between these and the cortical portion of the organ, and send into the latter a series of straight twigs, the arteriæ interlobulares. These give off a number of short side-branches, each of which supports a glomerulus on its extremity. The efferent vessel of each glomerulus, after leaving it, speedily breaks up into a capillary plexus continuous with that formed by adjacent efferent twigs, and surrounds the convoluted portions of the tubuli uriniferi. The venous radicles which collect the blood from this plexus open into the veins which accompany the interlobular arteries. In the medullary portion of the kidneys the capillary network which surrounds the uriniferous tubules is derived from a series of straight vessels, the so-called arteriæ rectæ, which in part arise from the arterial branches ramifying between the cortical substance and the bases of the pyramids; in part are not arteries at all, but the unusually prolonged efferent veins of the glomeruli adjacent to the bases of the pyramids. A superficial plexus of lymphatics is situated in the fibrous capsules of the kidneys. The deep lymphatics accompany the larger blood-vessels; their ultimate relations to the parenchyma of the organ are not yet known. The same remark applies to the nerves of the kidneys, which also accompany the vessels. A number of small ganglia occur in connection with these nerves.

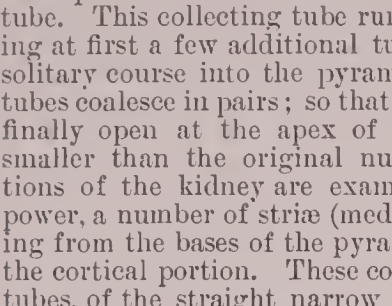



FIG. 40. — Transverse section through the medulla: *a*, collecting tube; *b*, descending arm of looped tube; *c*, ascending arm; *d*, blood-vessel; *e*, connective tissue.

The *ureters* and *urinary bladder* are lined by an epithelium consisting of several layers of cells. The most superficial are polygonal and somewhat flattened; to these succeed a layer of elongated cells, the upper extremities of which are rather broad, while the lower portions are prolonged into narrow processes, between which is a third layer of columnar cells. This epithelium rests on a layer of rather dense connective tissue, beneath which is the muscular coat composed of non-striated muscle. Externally to this is a second layer of fibrous tissue. The fundus of the bladder is, besides, coated by the peritoneum.

*Generative Organs.*—The space assigned to this article permits only a brief sketch of the most characteristic organ of each sex. The *testicle* is another example of a highly developed tubular gland, and consists essentially of a number of secreting tubes lined by epithelium, the seminiferous tubules. The organ is inclosed in a dense capsule of connective tissue, the tunica albuginea, from the inner surface of which a number of septa proceed, dividing the gland into pear-shaped lobules 100 to 250 in number, each containing one to three convoluted tubuli seminiferi. These unite in the corpus Highmori, and form a network whence proceed twelve to fourteen canals, the convolutions of which constitute the epididymis. In the epididymis these canals unite and form finally a single excretory duct, the vas deferens. The tubuli seminiferi in the lobules are ·008 inch in average diameter, and consist of a membrana propria, lined by epithelial cells. The epithelium of the seminiferous tubules is engaged in the complicated process by which the nuclei of the inner cells, produced by the division of those situated more peripherally, are converted into the spermatic filaments, or *spermatozoa*; this process is known as *spermatogenesis*, one of the most complicated series of change presented for study, and one regarding the details of which much still remains to be definitely determined. The spermatozoa are passed into the epididymis while still somewhat imperfectly developed, the sojourn within the long convoluted tube of the epididymis affording ample time for the completion of such changes. The testicles are abundantly supplied with blood-vessels, lymphatics, and nerves. The lymphatics originate in wide passages between the tubuli seminiferi, lined by characteristic epithelium, which forms a partial coating for the tubuli, and which is best demonstrated by the action of silver. The terminal branches of the nerves can be traced to the membrana propria of the tubules. The spermatozoa, the characteristic elements of the seminal fluid, are about ·0016 inch in average length in the human subject, and have the form of thread-like filaments, enlarged at one extremity into an oval *head*, followed by a short *middle-piece* and long delicate *tail*.

The *ovary* consists of a stroma of vascular connective tissue in which are imbedded numerous cyst-like formations of various sizes, the Graafian follicles, containing the ova in various stages of development. The surface of the ovary which projects into the peritoneal cavity is covered by a layer of columnar cells, the so-called germ-epithelium. All the Graafian follicles, and the ova which they contain, are developed from ingrowing buds of this epithelium, which invade the connective-tissue stroma as gland-like tubules. A portion of the epithelial cells of these tubules are transformed into ova, while the remainder retain their epithelial character, and become the lining cells of the Graafian follicles. Thin sections of the adult ovary show great numbers of unripe ova immediately beneath the surface of the organ. They appear as oval, nucleated cells, surrounded by an epithelium-like layer. Deeper in the organ ova are encountered in a more advanced stage of development, surrounded by an epithelial layer of several rows of cells, between which fluid accumulations occur followed by an increase in the size of the follicle. The fully formed Graafian follicles are from ·02 to ·25 inch in diameter. They con-

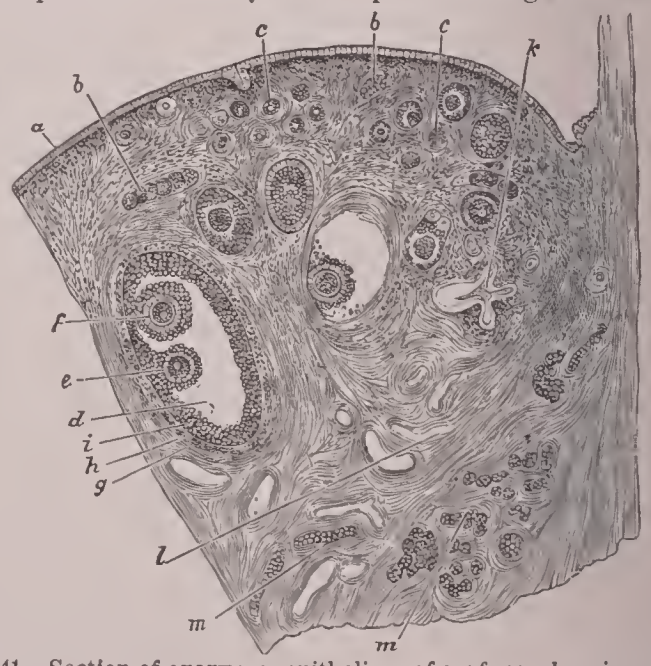



FIG. 41.—Section of ovary: *a*, epithelium of surface; *b*, *c*, immature follicles; *d*, developing follicle containing ova (*e*, *f*); *g*, *h*, *i*, parts of wall of follicle; *k*, degenerated follicle; *l*, blood-vessel; *m*, interstitial cells.

sist of an envelope of connective tissue, which is merely a condensation of the ovarian stroma, lined by several strata of nucleated cells—the epithelium of the follicle or the *membrana granulosa*—and filled with a transparent albuminous fluid—the liquor folliculi. The elements of the epithelium of the follicles are accumulated at some one point into a little mass—the discus proligerus—in which the ovum is imbedded.

The human ovum, when fully developed, is a round or slightly oval vesicle ·008 to ·01 inch in diameter. Its investing membrane, of considerable thickness, exhibits a delicate radial striation, and is known as the *zona pellucida*; this incloses a granular protoplasm, the *vitellus* or yolk, in which is imbedded a distinct round nucleus ·0016 inch in average diameter—the *germinal vesicle*, and this again presents a round prominent nucleolus—the *germinal spot*. The ovum of man and mammals differs from the eggs of birds and reptiles in that in these an ovum similar to that of the Mammalia is surrounded by a quantity of secondary yolk, as well as by additional protecting layers acquired during its passage through the oviducts. As fluid continues to accumulate in the cavity of the ripening Graafian follicle, it approaches more and more to the surface of the ovary, until, finally, it ruptures and permits the ovum to escape. This is followed by hæmorrhage from the vascular walls of the follicle, which is speedily filled with coagulated blood; numbers of proliferated cells shortly after penetrate the clot, and an organization of its constituents takes place, which acquires a yellow color, the structure being then known as the *corpus luteum*. Subsequently, connective tissue is developed in the substance of the corpus luteum, which becomes smaller and smaller until finally a mere cicatrix remains.

*Organs of Special Sense.*—A brief account of the special nerve-terminations in the organs of touch and taste has already been given. We recognize as the essential organs of *smell* certain nerve-terminations in the nasal mucous membrane. This mucous membrane is coated for the most part by a ciliated epithelium, closely resembling that of the respiratory organs; but in the proper olfactory region, which is limited to the uppermost part of the nasal cavities, extending downward three-quarters of an inch to an inch from the cribriform plate of the ethmoid bone, the epithelium covering the olfactory region is modified, representing the highly specialized neuro-epithelia; this consists of two varieties of cells—tall columnar elements with oval nuclei, which support the less conspicuous olfactory cells, and are therefore known as the *sustaining cells*; and the slender, elongated elements, with round nuclei, which are those especially related to the nerves of smell, and hence are called the *olfactory cells*. These latter are usually assumed to be connected at their inner ends with the filaments of the olfactory nerve; while such a relation is probable it has not been, so far, directly demonstrated.

In the case of the *eye* space permits only brief descriptions of the cornea, the crystalline lens, and the retina, and the reader is referred to the article Eye for other details. The *corneæ substance* proper is composed of connective tissue with stellate cells and a homogeneous matrix. It is coated anteriorly with a laminated squamous epithelium, consisting of a stratum of columnar cells, several layers of rounded or polygonal cells, and several layers of flattened cells; posteriorly it is covered by an elastic membrane and a single layer of flattened endothelial cells. The stellate cells of the proper substance of the cornea are designated corneal corpuscles. They are granular, flattened cells about ·001 inch in long diameter, containing rounded, oval, or irregular nuclei. Each gives off a variable number of protoplasmic processes which anastomose with those of the adjacent cells. Besides these fixed cells, a certain number of wandering leucocytes are always present. The corneal corpuscles are not visible in perfectly fresh corneæ, but become so after the lapse of a short time. When the cornea is soaked in a solution of nitrate of silver and exposed to sunlight, the matrix is stained brown, and a series of light-colored, stellate, anastomosing figures make their appearance, which are the corneal spaces. These represent the serous canals of the matrix, in which the corneal corpuscles lie. The exquisite sensibility of the cornea is explained by its rich supply of nerves, best demonstrated by the action of gold, which gives them a dark-purple color. Twenty or thirty medullated nerve-fibers enter at its margin, and soon lose their medullary sheaths, while the axis-cylinders break up into fasciculi composed of a number of ultimate fibrils, with oval nuclei scattered along their course. These fasciculi branch and anastomose, forming a rich plexus in the cor-

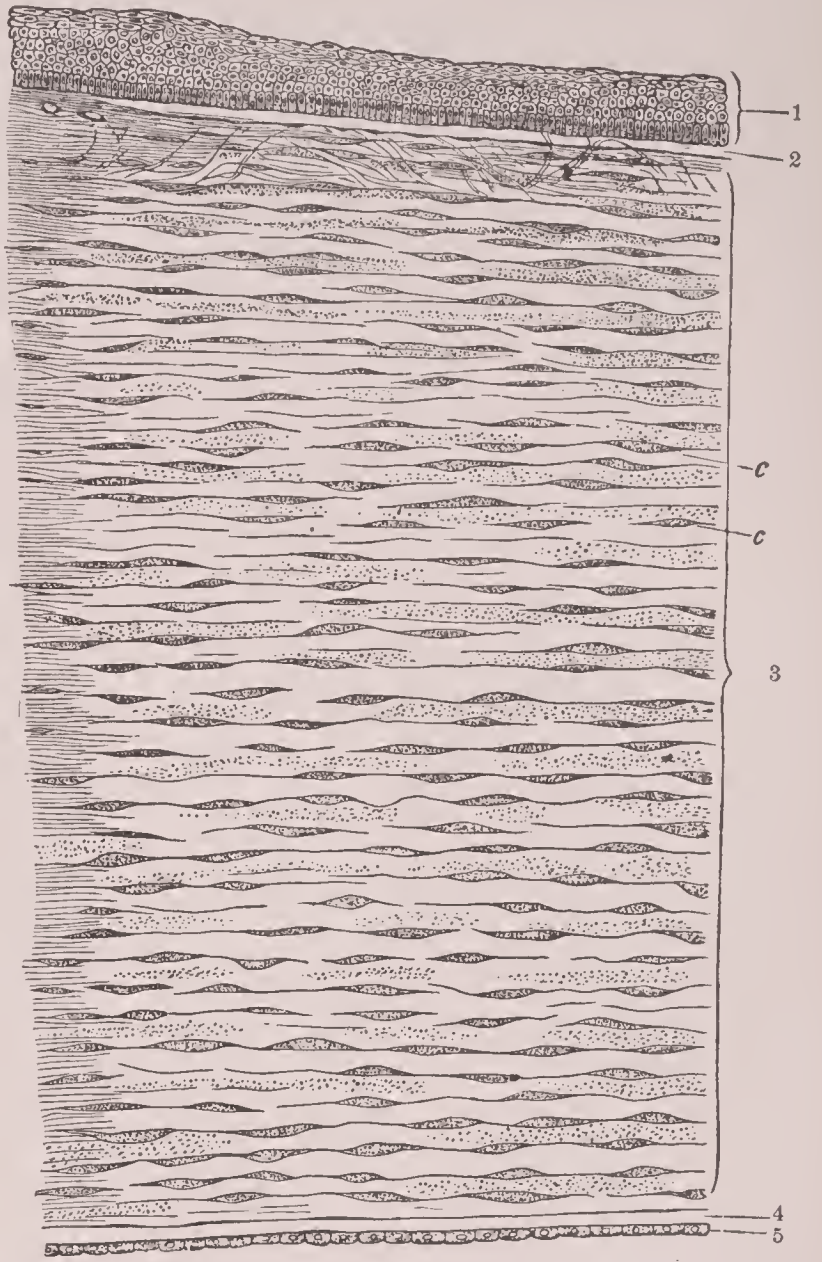



Fig. 42.—Vertical section of cornea: 1, epithelium; 2 3 4, connective tissue forming the substantia propria, condensed at 2 and 4 into the anterior and posterior elastic lamina; 5, layer of endothelium covering the inner corneal surface; *c*, corneal corpuscles lying in spaces between the lamellæ of fibrous tissue.

neal substance, and finally break up into ultimate nerve-fibrils, the extremities of which are lost between the epithelial cells on the anterior face of the cornea. The *crystalline lens* consists of an extremely thin anterior and a thick

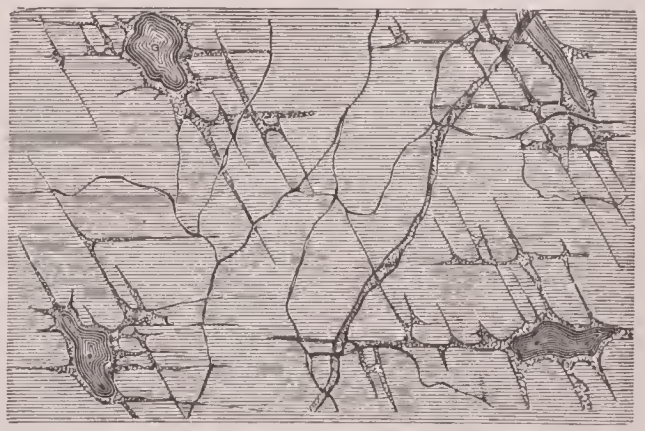


Fig. 43.—Corneal corpuscles within the fibrous substance; numerous nerve-fibers are also seen.

posterior layer. The former is composed of a single layer of flattened, polygonal, nucleated cells, which toward the margins of the lens become more and more elongated, and finally, at its equator, pass by gradual transitions into the lens-fibers, of which practically the entire lens is composed. The fibers of the lens are flattened, six-sided elements ·0002 to ·0004 inch in breadth, and rather less than half as thick, and

unite to form curved lamellæ which cover each other concentrically, somewhat like the coats of an onion. The lens is developed from an ingrowing bud of the epidermis of the embryo, and its fibers are to be regarded as greatly elongated epithelial cells. It is inclosed in a transparent, apparently structureless capsule. The *retina* is composed of the special terminal elements of the optic nerve, united together by delicate supporting tissue, the whole forming a layer ·008 inch thick in its posterior portion and less than half as thick anteriorly. Its intricate structure has been the object of many investigations, of which those of Max Schultze are classic.

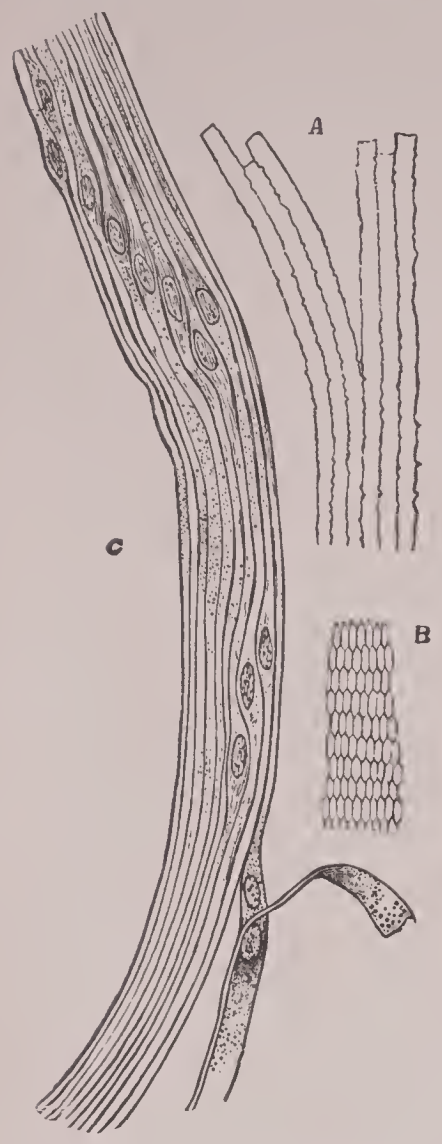



Fig. 44.—Fibers of the crystalline lens: A, fibers in longitudinal section, showing serrated outlines; B, fibers in transverse section; C, fibers in longitudinal section from equator of lens, containing nuclei.

The retina consists of three parts: (1) Of the outer *pigment layer*, which receives the ends of the percipient elements; (2) of the *neuro-epithelium*, comprising the layer of the rods and cones and the external nuclear layer; and (3) of the *cerebral portion*, consisting of the terminal filaments and associated ganglion cells of the optic nerve; this portion embraces several layers usually named as the nerve-fiber layer, the layer of ganglion cells, the inner reticular layer, the inner nuclear layer, and the external reticular layer. Space forbids any attempt to describe these structures in detail. Suffice it to say that the retina presents two sets of elements, those especially concerned in the appreciation and transmission of the stimulus produced by the light-waves and those supporting the more delicate parts. While the relation between the rod and cone visual cells and the filaments of the optic nerve must be a close one, yet regarding their exact anatomical connections we are at present uninformed. The rods and cones are not equally distributed, the cones in man appearing alone in the area of most acute vision—the fovea centralis; while toward the periphery the rods are more numerous. Regarding the other important structures of the eye, whose consideration space forbids, it may be noted that the outer coat, composed of the sclerotic and cornea, are made up of dense connective tissue; the middle coat, embracing the choroid ciliary body and iris, is essentially the vascular tunic, and consists of numerous blood-vessels supported by a delicate connective-tissue stroma, in addition to which in the iris and ciliary body masses of involuntary muscle are present. The pigment layer, belonging to the inner nervous tunic, is closely applied to the inner surface of the vascular coat, and contributes the characteristic dark color of this tunic seen on opening the organ. The vitreous body is a modified connective tissue, while the chamber of the aqueous humor is regarded as a lymph space.

In connection with the *ear*, space permits only a brief mention of the *organ of Corti*, which appears to be to the sense of hearing what the retina is to the sense of sight. For other details regarding the organ of hearing, the reader is referred to the article Ear.

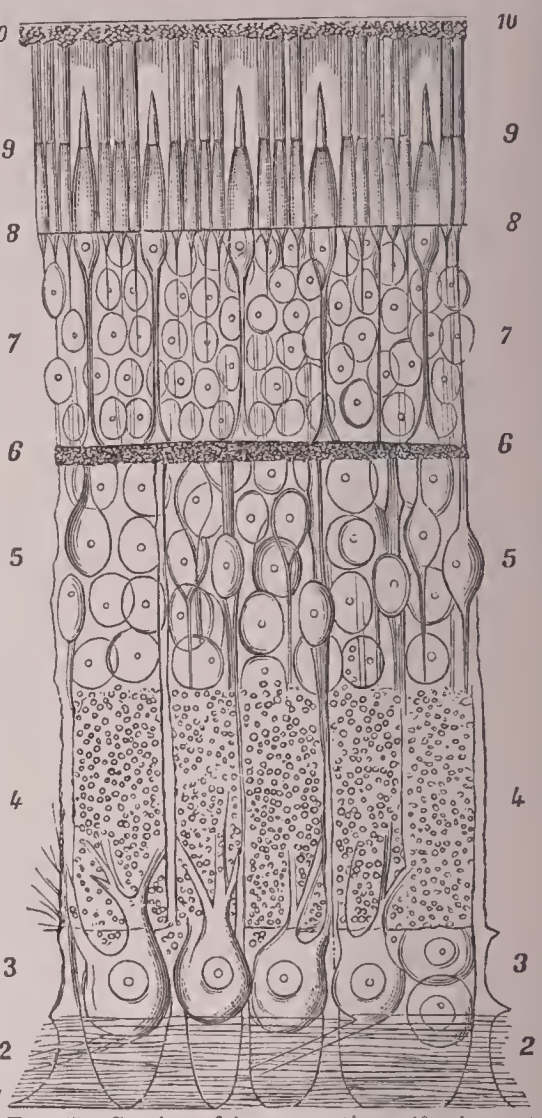



Fig. 45.—Section of human retina: 10, pigment layer; 9, layer of rods and cones, including the outer and inner segments of these structures; 8, external limiting membrane; 7, outer nuclear layer, composed of the nucleated inner portions or body-fibers of the visual cells; from 9 to 7, inclusive, represents the neuro-epithelium; 6. outer reticular layer; 5, inner nuclear layer, composed largely of nerve-cells; 4, inner reticular layer, through which extend the long supporting fibers of Müller; 3, layer of ganglion-cells, with which fibers of optic nerve connect; 2, layer of nerve-fibers, pierced by the expanded bases (1) of Müller's fibers; this layer also contains the capillaries, here not shown.

The internal ear is composed of a bony labyrinth, whose complicated cavity is closely reproduced by a much narrower membranous sac, the membranous labyrinth; the intervening space between these two is occupied by a fluid, the *perilymph*, and bands of fibrous tissue holding the smaller tube in place. Within the membranous sac a second fluid, the endolymph, is contained, which fills and communicates with all parts of the complicated tube, including the cochlea, saccule, utricle, and semicircular canals. The spiral canal of the cochlea is nearly divided in two by a thin plate of bone, the lamina spiralis. From the edge of this lamina two membranes proceed to the walls of the cochlear canal, which is thus divided into three passages—the scala vestibuli, the central canal of the cochlea, and the scala tympani. The membrane which divides the scala vestibuli from the central canal of the cochlea is extremely delicate

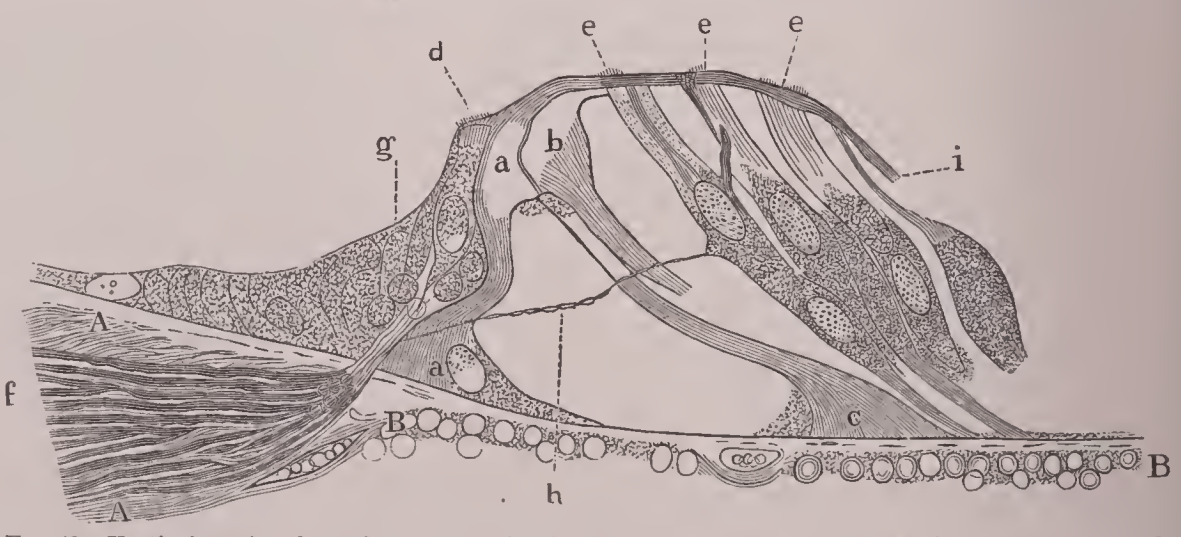



Fig. 46.—Vertical section through organ of Corti: A B, membrana basilaris; *a c*, inner and outer rods of Corti; *d*, hairs of inner hair-cell; *e e e*, outer hair-cells; *f*, bundle of nerves; *g*, epithelium of sulcus spiralis internus; *h*, nerve-fibril; *i*, lamina reticularis.

and is known as the *membrane of Reissner*. That which divides the central canal from the scala tympani below is known as the *basilar membrane*.

The central canal of the cochlea is lined by epithelium, which over the inner half of the basilar membrane is specialized into neuro-epithelium, and constitutes the remarkable *organ of Corti*. The epithelium is composed of two varieties of cells—the sustaining cells and the auditory or hair cells, so called from the hair-like appendages on their free inner ends. The sustaining cells are further modified at one point into the long conspicuous pillars of Corti, two highly specialized elements which lean toward each other and join at their inner ends, forming a series of arches, beneath which is a canal, the *tunnel of Corti*. On either side of this tunnel lie rows of the auditory cells, at the inner side only a single row, on the outer side a quadruple file. The hair-cells are separated by the sustaining elements, and reach only part way to the basilar membrane: the ends of the hair-cells are in close relation with the terminal filaments of the auditory nerve, which are conveyed along spiral canals with the bony crest projecting from the axis of the cochlea. The various groups of the sustaining cells on the outer side of the arch of Corti have received special names, as the cells of Deiters, Hensen, and Claudius, being in all cases, however, but the modified epithelium of the canal. Within the outer portions of the membranous labyrinth, in the saccule, utricle, and semicircular canals, certain portions of the wall are distinguished by specializations of the epithelium for the reception of the filaments of the auditory nerve, forming the maculæ and cristæ acusticæ. For the details regarding the middle and external portions of the auditory apparatus, see EAR.

The foregoing outline, which is necessarily extremely meager, will, however, it is hoped, serve to give the reader accurate elementary ideas with regard to normal human histology. For an account of the tissue-changes accompanying disease, the reader is referred to INFLAMMATION, TUMORS, and other articles treating of abnormal or pathological processes. Revised by G. A. PIERSOL.

**Histology, Vegetable**: that branch of histology which treats of the tissues of plants. In the study of plant histology it is always necessary to use a compound microscope with magnifying powers ranging from 200 to 1,000 or more diameters. Moreover, it is generally necessary that the material for study should be carefully prepared by proper sectioning, staining, and mounting. The general method of treatment is as follows:

All of the ordinary soft parts of plants are first soaked for a time in a weak solution (1 per cent.) of chromic acid, or a saturated aqueous solution of picric acid, or a dilute solution of acetic acid (in order to "fix" the protoplasm), and then slowly dehydrated by soaking them successively in 20, 35, 50, 75, 90 per cent., and absolute alcohol. From the latter they are put into equal parts of turpentine and paraffin and warmed slowly, and finally into melted paraffin and kept for a number of hours at a temperature of 50° C. (122° F.). The paraffin after a while infiltrates into the cells and intercellular spaces, so that when cold it firmly adheres to the specimen. Thin sections of such a prepared specimen may now be made by slicing both the paraffin and the specimen by means of a microtome. The successive slices are laid in order upon an ordinary glass slip, and the paraffin removed by heat and turpentine. Staining fluids (as hæmatoxylin, fuchsin, saffranin, carmine, gentian violet, Bismarck brown, etc.) may now be applied. Alcoholic stains may be added at once, but for the aqueous stains the turpentine must first be removed by alcohol. When the staining is completed, the specimen is dehydrated by alcohol, washed with turpentine or clove oil, and finally mounted in Canada balsam.

There are many modifications of the processes, very briefly sketched above, but what is here given may serve as an illustration of histological methods.

All parts of all plants are composed of "cells," which originally were nucleated masses of protoplasm, usually covered with a cell-wall. As seen under the microscope, protoplasm is usually a colorless, granular, soft substance; occasionally it is hyaline (i. e. without granules), and by drying (as in seeds) it may become quite hard. It may be a homogeneous and compact mass (Fig. 1, A), as it usually is in young cells, or it may be more or less filled with water cavities (vacuoles), as in all older cells (Fig. 1, B, C).

The nucleus is a rounded body within the protoplasm, from which it differs in being more dense and more readily absorbing staining fluids. Its structure is quite complex; the mass of the nucleus is composed of a hyaline substance,

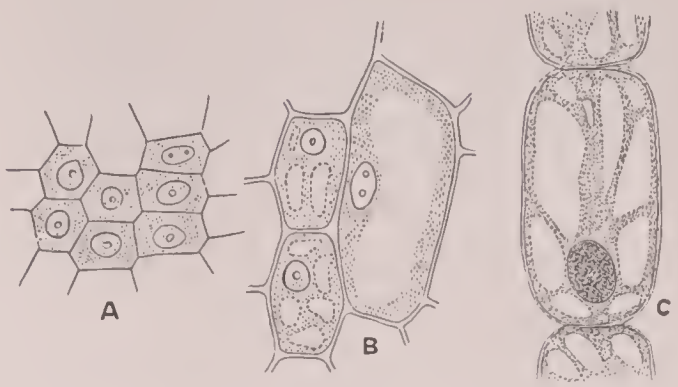



FIG. 1.—A, young cells with homogeneous protoplasm; B and C, older cells with vacuoles.

which takes stains less readily, and hence is called achromatin; this is permeated with a multitude of minute tangled threads which absorb stains with great readiness, hence the substance of which they are composed bears the name of chromatin (Fig. 2). This structure can be made out only by the most careful preparation and the application of staining fluids.

In the division of the nucleus (in the so-called "indirect" division of the cell) the chromatin threads undergo many interesting changes, some of which are shown from B to G in Fig. 2. After the threads have become more distinct (B) they arrange themselves in a stellate form, when each splits lengthwise into two "daughter threads," which then separate into two groups, one set of "daughter threads" going to one pole and the other to the opposite one (C, D, E). Here they gradually assume the form of tangled threads of chromatin for the new nuclei (F, G, H). These changes are referred to in histological papers as the "karyokinesis" of the nucleus, and the successive figures assumed by the chromatin threads as the "karyokinetic figures." These are seen best in the root-tips of the onion and English bean (*Vicia faba*), the cells of the stamen-hairs of spiderwort (*Tradescantia virginica*), the pollen mother-cells of some monocotyledons (*Fritillaria* and *Allium*), the development of the cells in the embryo sac of many plants (*Allium*, *Fritillaria*, *Pinus*, *Picea*, etc.), the division of epidermal cells in the formation of stomata in the Iris, etc.

Chloroplasts occur in the protoplasm of all green cells. (See CHLOROPHYLL.) Their deportment with stains (including chlorophyll itself) shows them to be at least some modification of protoplasm. They are usually minute, rounded granules, imbedded in the ordinary uncolored protoplasm, but in some of the common "pond scums" (*Spirogyra*) they are long ribbons which lie spirally within the cylindrical cell wall. (See Fig. 1 in the article CHLOROPHYLL.)

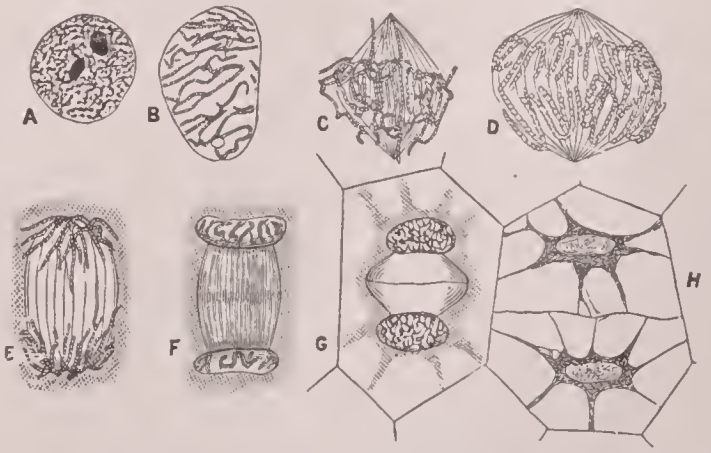



FIG. 2.—Cell nucleus in successive stages of division showing the chromatin threads.

Among the contents of plant-cells none are more common than starch granules ($C_6H_{10}O_5$). Their presence is immediately shown by the application of a solution of iodine, which turns them blue or purple. In this way starch is shown to be present in chloroplasts of leaves which have been exposed for some time to the sunlight. It occurs also in the cells of many seeds and stems. The various forms of the starch granules of different plants are shown in Fig. 3.

The cells of many seeds contain a nitrogenous substance, named aleurone, in the form of minute granules which are

quickly soluble in water, and on application of iodine take a yellowish-brown stain. It sometimes occupies the whole

FIG. 3.—Starch granules from various plants (highly magnified): A, wheat; B, rye; C, barley; D, oats; E, Indian corn; F, buckwheat; G, rice; H, millet; I, pea; J, bean; K, vetch; L, potato.

cell, as in the inner bran-cells of rye, wheat, etc. (Fig. 4, B), while in other cases it is associated with starch granules, as in the cells of the embryo in the seeds of the pea, bean,

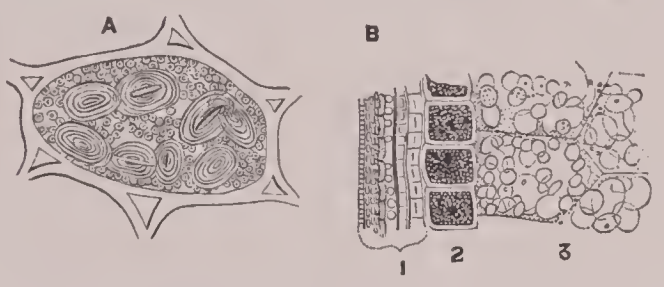



FIG. 4.—A, cell from seed of pea, containing starch and aleurone; B, a section from a rye grain—1, outer bran-cells; 2, aleurone-cells (inner bran); 3, starch-cells.

vetch, oak, chestnut, etc. In the study of aleurone the specimen must be mounted in a medium which will not dissolve it, as alcohol, glycerine, turpentine, oils, etc. Many cells in many species of plants contain crystals of calcium oxalate ($CaC_2O_4 + H_2O$), which present many modifications in size and form (Fig. 5). The slender needle-shaped crystals (Fig. 5, B, C) which occur in bundles nearly filling the cell are commonly distinguished as raphides. They are common in

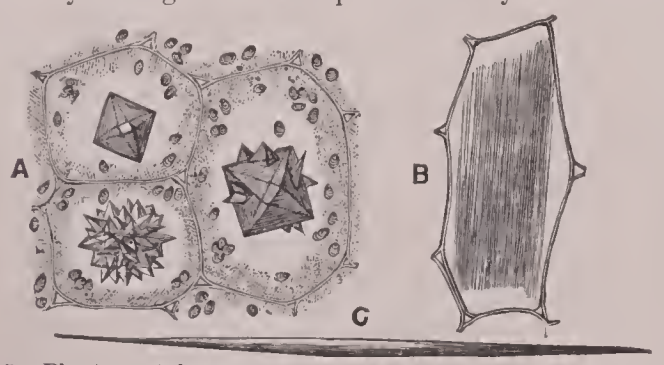



FIG. 5.—Plant crystals; A, in cells of begonia; B, in cells of *Lemna*; C, single crystal from *Lemna*.

the fuchsia, evening primrose, balsam, spiderwort, calla, etc. Ordinary crystals (Fig. 5, A) may be found in the begonia, onion, beet, pigweed (*Amarantus*), lamb's quarters (*Chenopodium*), elm, etc. Some crystals are composed of calcium carbonate ($CaCO_3$), and others of calcium sulphate ($CaSO_4$), but both are of comparatively rare occurrence. The latter may be observed in the "eddies" in the points of some desmids, e. g. *Closterium* and *Micrasterias*. In order to determine whether the crystals are composed of calcium oxalate, carbonate, or sulphate, they are treated with acetic acid which dissolves the carbonate with effervescence, while the oxalate and sulphate remain intact. Under treatment with hydrochloric acid the carbonate and oxalate dissolve, the former with effervescence, the latter without, while the sulphate remains intact.

The cell-walls of young cells are composed of cellulose ($C_6H_{10}O_5$); as they grow older they usually undergo greater or less changes in chemical composition, such as lignification (the woody modification), cuticularization or suberization (the corky modification), and the mucilaginous modification. Finally the substance of the cell-walls of the fungi has been found to differ considerably from true cellulose, hence it is separated under the name of "fungus-cellulose." These may be distinguished as follows:

| SUBSTANCE. | Cellulose. | Wood. | Cork. | Fungus-cellulose. |
|---|---|---|---|---|
| Water..... | Quickly permeable. | Slowly permeable. | Impermeable. | Quickly permeable. |
| Sulphuric acid..... | Soluble. | Soluble. | Insoluble. | Insoluble. |
| Cuprammonia..... | Soluble. | Insoluble. | Insoluble. | Insoluble. |
| Sulphuric acid and iodine. | Blue. | Yellow or brown. | Yellow or brown. | Yellow or brown. |
| Chloroiodide of zinc. | Violet. | Yellow or brown. | Yellow or brown. | Yellow or brown. |

Cellulose walls may be stained by hæmatoxylin, alum carmine, aniline blue, and methyl blue. Lignified cell-walls stain readily with aniline colors, an alcoholic preparation of fuchsin being especially useful. Cork-cells stain with difficulty, but may be successfully treated by immersing for some time in a solution of fuchsin or saffranin in equal parts of alcohol and water.

The thickening of the cell-wall is rarely uniform. It may consist of isolated thickened areas, or the thickening may be general, with isolated spots of unthickened wall. These modifications, together with changes in the forms and contents of the cell, enable us to separate masses of plant-cells into a number of pretty well-marked tissues, as follows:

*Soft tissue* (parenchyma); cells with thin colorless walls (normally of cellulose) usually of about equal diameters, and very commonly more or less separated by intercellular spaces (Fig. 6, A). Very abundant, inasmuch as it constitutes the active part of every organ in the plant.

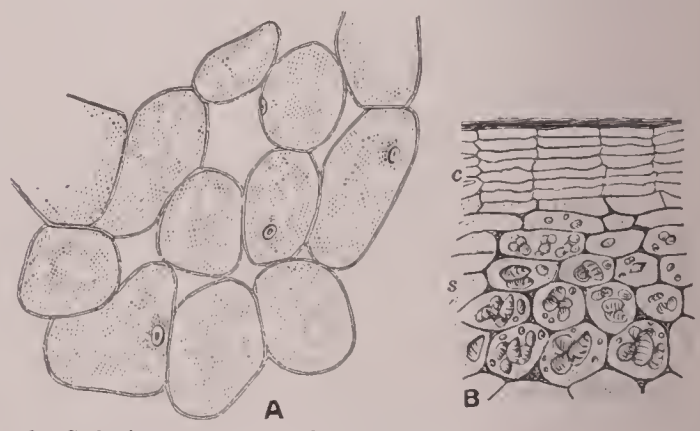



FIG. 6.—Soft tissue: A, from the flesh of an apple; B, from a potato tuber; *s*, ordinary soft tissue; *c*, cork-cells.

In the corky modification the cells are more nearly rectangular in shape, and intercellular spaces are wanting (Fig. 6, B, *c*). Cork-cells are produced by the formation of successive parallel divisions in a layer of cells known as the phellogen, the outermost cells soon becoming suberized and dying. Cork forms as a protective layer over living cells, and is especially abundant in the cortical (bark) parts of the stems of many plants.

*Thick-angled tissue* (collenchyma); cells with colorless walls of cellulose, with the longitudinal angles, only, thickened. The cells are elongated and prismatic, and occur in long bands immediately beneath the epidermis of herbaceous stems and leaves of higher plants (Fig. 7). Its cells commonly contain a few chlorophyll granules.

*Stony tissue* (sclerenchyma); cells with thickened, usually colored walls, which are more or less lignified, and much pitted and channeled (Fig. 8). The cells are usually short, and are commonly irregular in shape. They occur abun-

dantly in the hard coverings of many nuts and seeds, and also in the pith of many plants, where they often contain starch.

*Fibrous tissue*; cells with thickened, usually colored walls, which are strongly lignified and somewhat pitted (Fig. 9). The cells are always much elongated and are normally fusiform, their ends overlapping. Fibrous tissue occurs in the woody parts and the bark of the higher plants, to which it gives strength and toughness. Two varieties of fibrous cells are recognized, viz., bast-cells and wood-cells, occurring respectively in the bark and the wood of the higher flowering plants, or, speaking more precisely, in the phloem and the xylem portions of the fibro-vascular bundles of flowering plants.

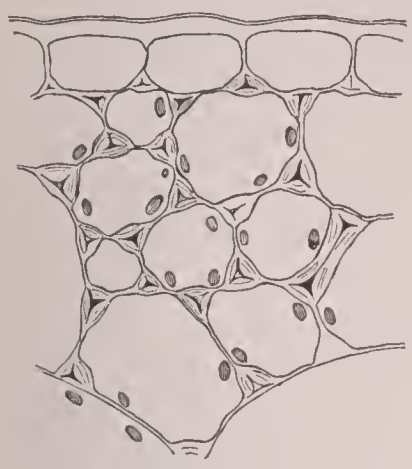


Fig. 7.—Thick-angled tissue, from a begonia-leaf.

*Milk tissue* (laticiferous tissue); distinguished at once by the milky contents of the cells or tubes, which in some cases appear to be transformed fibers, while in others they are modifications and fusions of parenchymatous cells (Fig. 10). The walls are soft and frequently thickened, but appear to be otherwise little if at all modified from true cellulose. The latex, as the milky fluid is called, is frequently white by reflected light, as in the poppy, spurge, milkweed, etc., but may be yellowish or red, as in bloodroot, celandine, argemone, etc. By transmitted light latex is commonly brownish. It commonly contains many granules, which in the spurges (*Euphorbia*) are composed of starch.

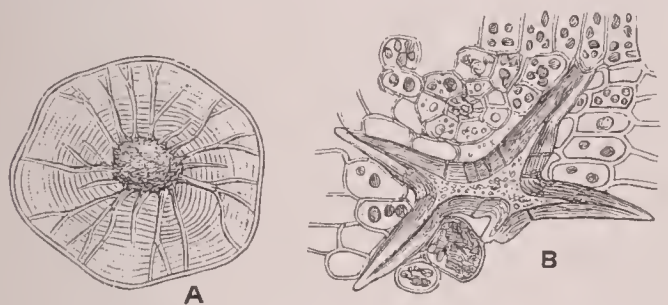



Fig. 8.—Stony tissue: A, stone-cell from walnut; B, stone-cell from leaf of camellia.

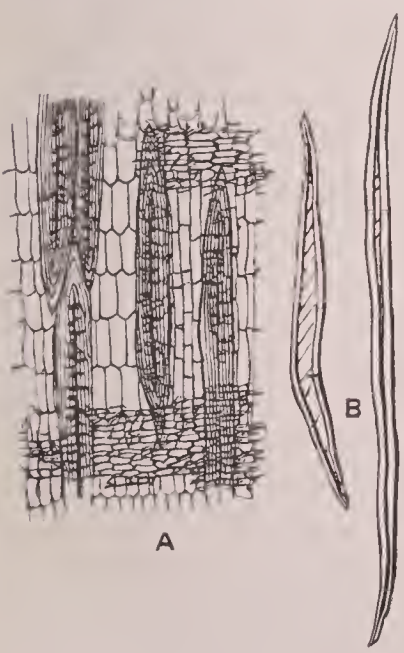



Fig. 9.—Fibrous tissue: A, bast-cells from bark of cinchona; B, wood-cells from beech.

*Sieve tissue*; composed of tubes of rather wide diameter, with colorless unlignified walls, which are pierced in many places by groups of large pores (Fig. 11). The transverse partitions, which are horizontal or oblique, are so fully perforated as to suggest the name *sieve* for the vessels in which they occur. The protoplasm is continuous through the sieve plates (Fig. 11, C).

Sieve tissue occurs in the phloem portions of the fibro-vascular bundles of the flowering plants and the fernworts, being, however, much better developed in the former than in the latter. In the dicotyledons, where it shows the highest development, it is one of the constituents of the bark, usually forming a column lying immediately external to the column of tracheary tissue, from which it is separated by the so-called "cambium zone." In a few families of plants, notably the *Cucurbitaceæ*, *Solanaceæ*, *Asclepiadaceæ*, etc., there is also a column of sieve tissue on the inner side of the fibro-vascular bundles, i. e. next to the pith.

*Tracheary tissue* occurs in the fibro-vascular bundles of the fernworts and flowering plants. It is composed of tubes of rather wide diameter, or of fusiform cells which have more or less communication with one another through their perforated extremities (Fig. 12). The lignified walls are always somewhat thickened, the special manner of thickening enabling us to distinguish a number of varieties. Thus we have *ringed* vessels where the thickening is almost confined to certain rings which occur at intervals (Fig. 12, A). In the *spiral* vessels the thickening occurs along one or more spiral lines separated by belts, in which the walls have thickened but little or not at all (Fig. 12, B). When the spiral thickening is close, the bands tend to anastomose, thus giving rise to the *reticulated* vessels (Fig. 12, C). From the latter the passage is an easy one to the so-called *scalariform* vessels, in which the anastomosing is quite regular (Fig. 12, D). In the *pitted* vessels the thickening proceeds a step further, much more of the wall being thickened, the unthickened spaces appearing as small spots or pits (Fig. 12, E, F). All these varieties grade insensibly into one another; it is a common thing to find a vessel with rings in one part and spirals in another; and so the spiral passes into the reticulated, etc.

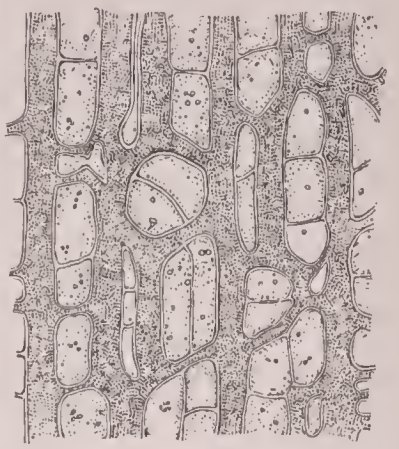


Fig. 10.—Milk tissue of lettuce.

Differing somewhat from the foregoing varieties of tracheary tissue are the *tracheids* (Fig. 12, G and H), which are more like wood fibers in size and shape, but with the wall structure of spiral or pitted vessels. Spiral tracheids occur in the wood of many dicotyledons, intermingled with the genuine wood fibers. Pitted tracheids constitute the bulk of the woody parts of the stems of the conifers, as the pines, spruces, firs, etc. Occasionally the pitted tracheids have spiral thickenings also, as in the Douglas spruce (*Pseudotsuga taxifolia*).

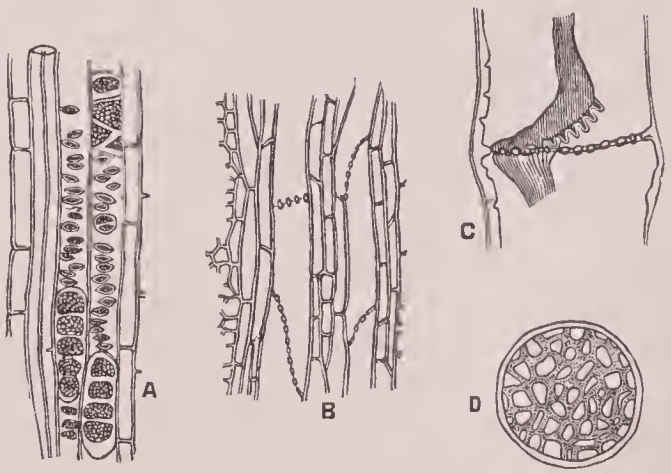



Fig. 11.—Sieve vessels: A, in linden; B, in grape; C, in gourd, showing contracted protoplasm; D, sieve plate of gourd seen in cross-section.

The foregoing tissues occupy definite positions in the plant-body in each species, and while their arrangement shows many differences, there is enough similarity to enable us to make some general statements. The tracheary, sieve, and fibrous tissues are almost invariably associated together so as to form strengthening columns, the *fibro-vascular bundles*, which extend through the parts of the plant-body. In the stems of flowering plants each bundle in the stem is composed of a column of sieve tissue, with more or less of bast fibers and soft cells (parenchyma) standing externally to a similar column of tracheary tissue, wood fibers, and soft cells (Fig. 13). Bundles of similar plan, more or less modified, extend into the leaves, floral organs, and fruits. From their position in the stems of dicotyledons the two columns constituting the bundles are called respectively the phloem and the xylem, the former including sieve, fibrous, soft, and other associated tissues, and the latter the tracheary, fibrous, soft, and associated tissues.

In the fernworts the tracheary tissue occupies the middle of the bundle and is encircled by the other tissues, while in young roots there are several columns of tracheary tissue

arranged radially about the axis, and alternating with an equal number of columns of sieve tissue. There are thus three principal modes of arrangement of the tissues in the bundles, viz., (1) in two parallel columns, called by de Bary

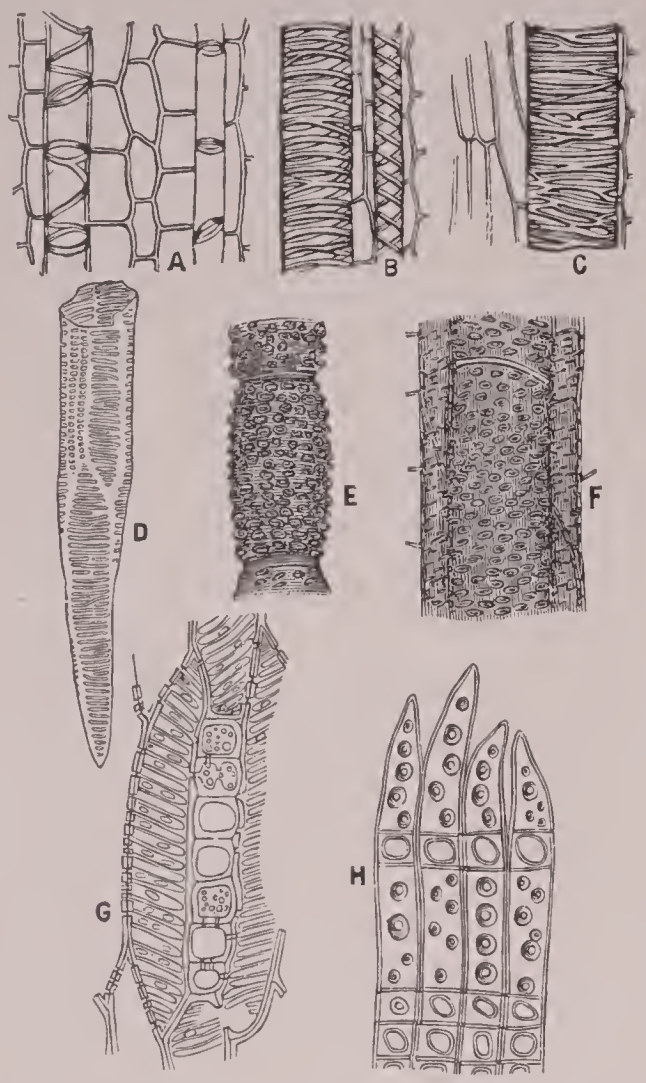



Fig. 12.—Tracheary vessels: A, ringed (one with rings and spirals); B, spiral; C, reticulated; D, scalariform; E and F, pitted; G, spiral tracheids; H, pitted tracheids.

the collateral type (Figs. 13 and 14, A); (2) the concentric type (Fig. 14, B); and (3) the radial type (Fig. 14, C).

The connection of the bundles with one another in the stem to make the framework or skeleton presents number-

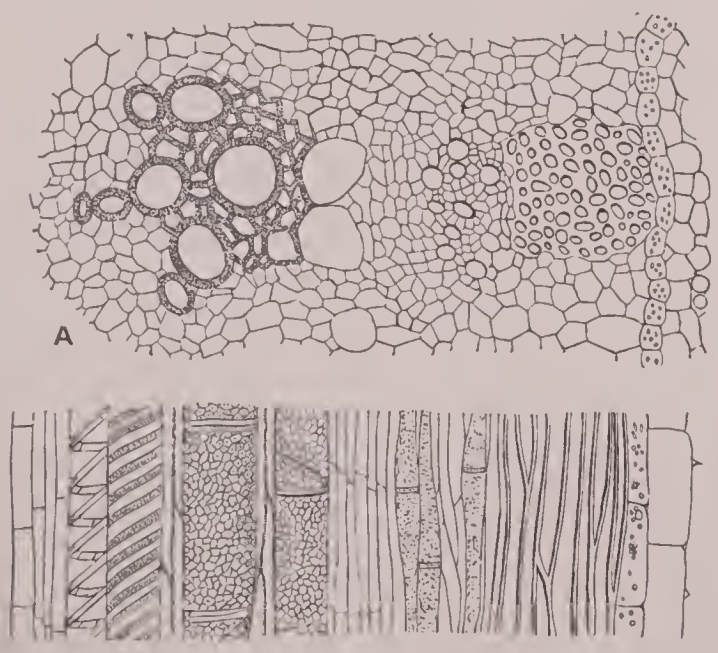



Fig. 13.—Fibro-vascular bundle of sunflower: A, cross-section; B, longitudinal section.

less variations, but some idea of how it is done may be obtained from the accompanying plans (Fig. 15).

The boundary layer of cells (rarely more than one) in all parts of the plant-body (the *epidermis*) is composed of somewhat modified soft tissue (*parenchyma*). The cell walls usually are thickened and stratified in the exposed portions of the cells, the other portions remaining thin. The protoplasm is generally hyaline, and chlorophyll is rarely present. The thickened external walls of the epidermis frequently develop a waxy or resinous matter which covers the

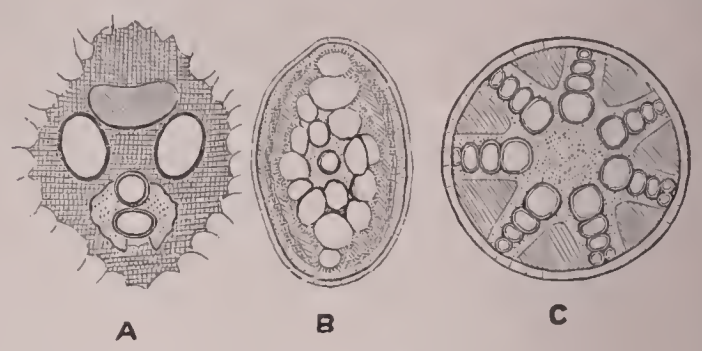



Fig. 14.—Diagrams of bundles in cross-section: A, collateral; B, concentric; C, radial.

surface with a whitish, granular, flour-like substance or a transparent, unctuous coating, to which the name of *bloom* has been somewhat inappropriately applied. It is common on cabbage-leaves, grapes, plums, etc.

The epidermis is pierced by many openings—the breathing pores or *stomates*—through which the interchange of gases takes place. See Stomates.

The epidermis commonly develops hairs upon its surface as extensions of some of its cells. See Hairs (of plants).

After considering the fibro-vascular bundles and the epidermal (boundary) portion of the plant-body, there is left a mass of tissues as yet poorly classified, which Sachs called the "fundamental" tissue-mass, or system of tissues. In many plants the belt of tissues lying immediately beneath the epidermis shows much similarity, and is called the *cortical zone*. In it the columns of thick-angled tissue lie next to the epidermis, while between and below these is a mass of chlorophyll-bearing parenchyma; beneath this again is often a belt of large-celled parenchyma, sometimes underlaid with a layer of elongated thick-walled cells (fibers). In dicotyledonous stems the mass of cells lying within the ring of fibro-vascular bundles (the pith) is mostly soft tissue, occa-

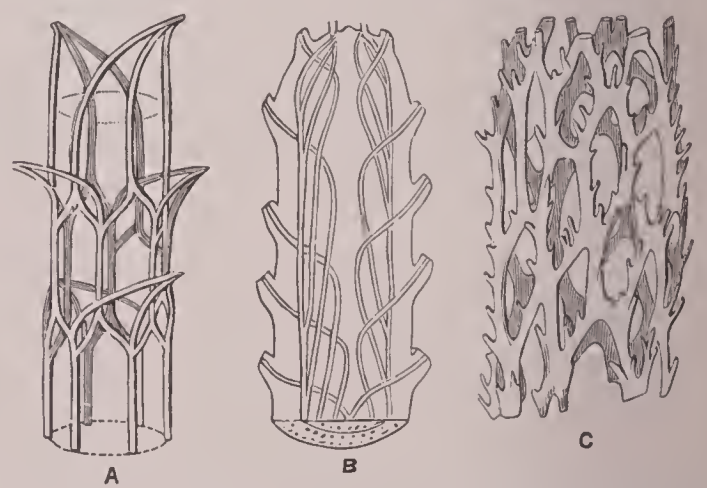



Fig. 15.—Fibro-vascular stem skeletons: A, of a dicotyledon (*Clematis*); B, of a monocotyledon (*Aspidistra*); C, of a fern (*Aspidium*).

sionally with intermingled stony cells. Between the pith and the cortical zone are radiating medullary plates ("medullary rays") of tissue originally of parenchymatous cells, but later, especially in woody plants, of thick-walled, stony cells, these constituting the "silver grain" of wood. In all parts of the fundamental system milk tissue may be present. Likewise cork may develop in any part, although in uninjured organs more commonly immediately beneath the epidermis.

Literature.—The following titles are selected from a multitude of works bearing upon plant histology: Arthur, Barnes, and Coulter's *Handbook of Plant Dissection* (1886); Behrens's *Guide for the Microscopical Investigation of Vegetable Substances* (translated by A. B. Hervey, 1885); Bower's *Course of Practical Instruction in Botany* (1888); de Bary's *Comparative Anatomy of the Vegetative Organs of the Phanerogams and Ferns* (English translation 1884); Poulson's *Botanical Microchemistry* (translated by William Trelease, 1884); Strasburger's *Das botanische Practicum* (1887); Zimmermann's *Botanische Mikrotechnik* (1892; translated by J. E. Humphrey, 1893).

Charles E. Bessey.

**Historical Theology**: See Church History.

**Historic Geology**: See GEOLOGY.

**History** [from Lat. *historia* = Gr. *ἱστορία*, a learning or knowing by inquiry, deriv. of *ἵστωρ*, learned, knowing, wise man (for **Ϝίδτωρ*), deriv. of *εἰδέναι*, know]: in its most ordinary sense, a narrative of transactions in the order of time, with or without critical and philosophical commentary.

In its origin, history, considered as a method of recording events, is indistinguishable from oral tradition, which seldom preserves the memory of any but the most remarkable occurrences beyond three or four generations. A considerable advance was made when traditions assumed the form of ballads, easily remembered and repeated, but no really authentic record could exist previous to the invention of writing. The first application of this art was to monumental purposes, and along with the invocation of deities, chronicles of the actions of kings began to figure upon Egyptian and Babylonian temples. The invention of papyrus as a writing material was a further step in advance, and from this period (possibly about 4000 B. C.) the Egyptians may be said to have possessed an historical literature. The practice of recording events in writing spread in due time to the Hebrews, the Phœnicians, the Chaldæans, and the Assyrians, but the pursuit of history as a branch of literary art, and the study of it as a department of intellectual culture, were reserved for the Greeks. About the middle of the fifth century B. C. Herodotus of Halicarnassus composed the first work answering to our present idea of history, presenting the results of his own inquiries into a series of previous transactions in a thoroughly artistic form. As mere narrative the work of Herodotus has never been surpassed to this day, and, notwithstanding his extraordinary credulity, his work still possesses unmistakable value. It is, however, to be regarded as literature, rather than as an authentic record of facts. A great step in advance was taken by the next great historian, Thucydides, who, not content with relating the actions of men, endeavors to penetrate into their motives, and to investigate not merely the accompanying incidents, but the determining causes of changes in human affairs. As Herodotus is the first great narrator, so is Thucydides the first great philosophical historian. In the opinion of Macaulay (see his remarkable essay on history), Thucydides has never been excelled, even if he has been equaled, as an historical writer. The next distinguished philosophical historian, Polybius, though living in the age when all other states were succumbing to the power of Rome, was enabled to investigate the causes of national greatness and decay on a much larger scale than his predecessor. Xenophon's *Anabasis* and Cæsar's *Commentaries* are remarkable examples of pure narrative unaccompanied by reflection. Of the two great Roman historians, Livy, like Herodotus, aims principally at narrative, but aims at another purpose alien to the simplicity of his model—the glorification of his own people, whose prose epic, in fact, he has written. He also follows the example of Thucydides in interspersing his own reflections, frequently in the form of speeches composed by himself, but placed in the mouths of historical personages; his work may be considered as the finest ancient example of the eclectic or composite style. Tacitus imitates Thucydides, but with the addition of an element distinctively his own—an intense moral purpose. Escaped from an era of tyranny, the subject of his history, he aims at painting it in the blackest colors to prevent any subsequent relapse into it. He has thus become the typical representative of an important department of history. He was essentially an advocate. Many valuable historians flourished during the decline of the Roman empire, but we meet with none of special mark before Eusebius (A. D. 330), the first great ecclesiastical historian, and Procopius (A. D. 550), neither philosophical nor eloquent, but the model of the dry, impartial, business-like historian.

During the Middle Ages history was entirely eclipsed, except among the Saracens. Ignorance, superstition, the slow circulation of intelligence, the barbarism of language, and the total loss of the critical spirit conspired to reduce historians for several centuries to mere annalists. The intellectual revival of the twelfth century produced a marked improvement, but History was not replaced upon her old footing until the resurrection of classical literature had brought good models to light, and the invention of printing rendered them generally accessible. Two great Italian historians, Macchiavelli and Guicciardini, kindred spirits to Thucydides and Tacitus, traced, the former the mediæval, the latter the contemporary, history of his country, with a mastery that fixed the standard of historical composition for the language. Their example, though not their style, was emulated by de Thou, the French, and Davila, the Italian, historian of the wars of religion in France; by Mariana, the historian of Spain, and Strada, the elegant but inaccurate narrator of the revolt of the Low Countries; Raleigh, the first Englishman to attempt a history of the world, and Clarendon, whose account of the Rebellion is perhaps the best example of a partisan history. These remain the only eminent English historians until Hume, the magic of whose style and the symmetry of whose narrative atone in some degree for his negligence and prejudice. Robertson gave the first example of a high-class English historian devoting himself to the transactions of foreign nations. His knowledge of the world ensured him a full measure of success as a political historian, though his *History of America* has been superseded by Prescott, and his *History of Charles V.* is limited and marred by his ignorance of German. A far greater name is that of his contemporary, Gibbon, whose *Decline and Fall of the Roman Empire* is perhaps the greatest historical work ever produced—a wonderful example of diligence in the accumulation of enormous materials and of mastery in their control. Gibbon's judgment is almost infallible, and his historical portraits are as accurate as they are brilliant. His principal defect is his insensibility to the spiritual side of man's nature.

Since the eighteenth century history has claimed more and more the attention of superior minds, and we must be content with a bare enumeration of some of the principal works. Early English history has been treated by Freeman, that of the Tudor dynasty by Froude, the Commonwealth by Guizot and Gardiner, the Revolution by the dazzling but too rhetorical Macaulay, Scottish history by Tytler and Burton. Green's *History of the English People* is a work of the first importance. France boasts a constellation of the brightest historical names, including Michelet, her general historian; Thierry, the investigator of her early history; Thiers, the least scrupulous, but the most genuinely national of all her writers; Guizot, Barante, Lamartine, Louis Blanc, Henri Martin, de Tocqueville, Taine, and Lanfrey. The subordinate historical branch of memoir-writing has also flourished more among the French than among any other nation. In virtue of its subject, Carlyle's *French Revolution* may be included among French histories. This extraordinary work, a poem rather than a narrative, is the only modern book that has added an entirely new type to history.

Some of the most valuable contributions to Italian history have been made by foreigners, Sismondi, Roscoe, Gregorovius, Voigt, Burchardt, Giesebrecht, and Symonds, but Italy also boasts her Botta, Cantù, and Colletta. Germany has produced a national historian in Johannes Müller, and the greatest of political historians in Ranke; her mediæval history is recounted by von Raumer, Giesebrecht, Dahn, and Droysen. Schlosser's general history of the eighteenth century and Heeren's *History of Commerce* are additional instances of first-class German histories; the number of the simply meritorious is legion. The American Motley has immortalized himself as the historian of the revolt of the Netherlands. The history of Bohemia has been classically written by Palacky, of Russia by Karamsin and Rambaud, of Sweden by Geijer, and of Portugal by Hercolano. The story of the Greek war of independence has been told by Tricoupi. Bancroft is still a standard historian of the U. S., though it is unlikely that he will remain so. As historians of limited periods in American history, or limited subjects, Parkman, Henry Adams, Fiske, Schouler, Holst, MacMaster, and Rhodes are important. The best histories of the Spanish conquest of South America are by Prescott and Arthur Helps. Very great ability has been displayed in technical military histories, of which we can only mention that of the Peninsular war by Gen. W. F. P. Napier and that of the Crimean war by Kinglake.

The reconstruction of philology and archæology has directed attention to classical history, which, with the exception of the era comprehended in Gibbon's work, may be said to have been completely rewritten during the present century. Niebuhr, though sometimes unduly skeptical, effectually disentangled the legendary from the authentic portions of early Roman history. The work thus begun has been carried on with even greater success by Schwegler and Mommsen. The history of the republic has been written on a grand scale by Mommsen, and the interval between him and Gibbon has been ably bridged by Dean

Merivale. Grote has produced what will long remain the standard history of the Greek republics, although its animation is by no means equal to its erudition and sagacity. The *Histories of Greece* by Curtius and Duruy are also worthy of note. The history of the Christian Church has been admirably told by Milman, Stanley, Neander, and Schaff. Duncker's *History of the Aryan Race* gives a brilliant and comprehensive view of the early historical period of this section of mankind. The history (as yet so obscure) of Egypt is told by Brugsch, Marriette, and Rawlinson, and that of Assyria by Rawlinson and Lenormant. India has found eminent historians in Mill and Orme, and its ancient annals have been critically investigated by Lassen and his coadjutors. The rise of Mohammedanism has employed the pens of Muir, Sprenger, and others. Among the native Oriental historians may particularly be named Mirkhond, the historian of Persia.

Finally, an important class of history, much cultivated in modern times, may be described as collateral or auxiliary to history proper. Its office is to treat of the origin and progress of human pursuits or institutions, such as commerce or law, which involves a chronological arrangement, though the mention of persons or events is only subsidiary to the main design. The Germans and the French have excelled in this kind of history. Hallam's *Constitutional History* is a good example in English.

The spirit of modern times has modified the study of history in four principal ways: (1) By the resort, as a main source of information, to archives, including statutes, charters, public documents of all kinds, diplomatic and even private correspondence. (2) By the endeavor to reconstruct the private as well as the public life of nations, involving an intimate knowledge of the minutiæ of their daily existence. (3) By the application of the mythical theory to fabulous, sometimes even to extraordinary, narratives. (4) By the attempt to frame a philosophy of history—i. e. to discover the general laws on which particular events depend.

*Archives, Statutes, etc.*—It was long before it was recognized that the history of every civilized people was in some sort written in its public institutions, and that the essential principles underlying great struggles were displayed in such manifestoes as the Solemn League and Covenant or the Declaration of Independence. Such were comparatively rare in antiquity, during which period the value of documentary evidence as an aid to history was very imperfectly recognized. Nor was it sufficiently attended to among the moderns until the obscurity and imperfection of the annalists of the Middle Ages led historians to resort to the contemporary archives as a supplementary source of information. It was soon discovered that laws and charters not only filled up the outlines of historians, but corrected their errors; and it is now universally admitted that an authentic history of any period must be based upon documentary testimony where such is procurable. The principle is of course liable to exceptions from the occasional deliberate falsification of such testimony, the preambles of laws frequently stating considerations notoriously at variance with truth, and letters expressing the wishes and designs, rather than the convictions, of the writer. It is nevertheless certain that this self-delineation presents, on the whole, both a truer and livelier picture of an age than any formal narrative; and no history would now be considered adequate where every possible use had not been made of documentary materials. The researches of palæographical scholars and the disclosure of state archives long jealously secluded have immensely increased the resources of this nature at the disposal of historical scholars. The valuable histories of Ranke are based almost entirely upon the examination of confidential state papers. Much has been done in Great Britain, Germany, France, Italy, and Switzerland by the official publication of original documents and papers, and of abstracts of the correspondence preserved in the record offices.

*History in its Relation to Private Life.*—It was natural that in its infancy the attention of history should be principally fixed upon great public events and picturesque occurrences. "To rescue from oblivion the memory of former incidents, and to render a just tribute of renown to the many great and wonderful actions both of Greeks and barbarians, Herodotus of Halicarnassus produces this historical essay." The same principle actuated all ancient historians, and their references to the state of manners or the social condition of the people are in general merely incidental. The conviction that the intrigues of cabinets and the shocks of armies are only important in so far as they affect the general well-being originated with the humane philosophy of the eighteenth century. It has now thoroughly leavened every branch of historical research. External incidents, so far from being considered as the sole objects of historical inquiry, are now chiefly valued for the light they afford to the primal causes on which the march of history depends, and, unless in the case of professedly military or political histories, no historian is satisfied unless he can exhibit the moral and social condition of a nation at a given period with the same vividness as that with which he would detail a public occurrence or depict a political character. Macaulay's view of the social state of England at the Revolution and Mill's picture of the condition of India at the British conquest are famous examples. This expansion of the scope of history has necessarily introduced the most important modifications into historical composition, and greatly extended the range of accomplishments requisite for the historian. The Germans excel in that kind of historical composition which they term *Kulturgeschichte*.

*The Mythical Theory.*—In the earliest ages of historical authorship stories of the supernatural, even if referring to contemporaries, were accepted as intrinsically credible, and all the early history of nations was enveloped in a cloud of legend. The existence of a critical spirit, however, soon made itself manifest, but the legendary element was scrutinized on no satisfactory principle. According to the theory of Euhemerus, improbable stories were regarded as distortions of actual prosaic occurrences; thus when Hercules is said to have slain the Lernæan hydra, it is to be understood that he drained the Lernæan marsh. Another theory, prevalent in the Middle Ages, and of which Bryant is the most characteristic modern representative, regards all legendary fables as perversions of a really veracious archetype; thus Hercules is to be identified with Samson. Both these views are now exploded, and legends are regarded either as "the natural effusions of the unlettered, imaginative, and believing man" (*Grote*), or as anthropomorphic representations of natural phenomena, whose original signification has been forgotten. (*Cox, Max Müller*, etc.) Whether their origin be referred to nature or imagination, they are equally regarded as poetry, only available in small measure and with the utmost caution for the ascertainment of authentic history. The first application of this principle on a large scale was made by Niebuhr in his Roman history, and the result has been to clear our histories of innumerable popular legends, and to free ancient history in particular from formidable chronological difficulties, besides destroying one great source of error in the construction of theories to account for what never took place. The study of folk-lore has also discredited many occurrences not intrinsically incredible; the story of Tell and the apple, for instance, loses its claims to credence as soon as it is shown to be an ordinary incident in popular mythology. It can scarcely be disputed, on the other hand, that the interpretation of tradition has frequently afforded pretexts for the most extravagant theories, such as the resolution of the heroes of the *Iliad*, *Ramayana*, and other epics into mere celestial and atmospheric phenomena. It might be safe to admit, as a general principle, that where gods alone are introduced in a legend the deification of Nature may be suspected, but that there is room for the supposition of actual event where mortals are also concerned.

*Philosophy of History.*—The idea of a philosophy of history could not arise until after the conception of a universal history had been formed; and this was scarcely possible until after the realization of a universal empire. The Roman empire, however, was hardly established ere it began to decline, and the accompanying decadence of intellectual power prevented any attempt at a general philosophy of history until the days of St. Augustine, who was led to undertake it by the necessity of exonerating his religion, to whose prevalence the downfall of the empire was naturally attributed by its adversaries, from responsibility for the political disasters of the time. From this point of view his *De Civitate Dei* is a masterly performance, but its inadequacy to afford a theory of the course of historical development may be inferred from its regarding the whole course of occurrences merely in their relation to the Christian Church, and its consequent restriction to the records of the Old and New Testaments, and of the heathen nations affected by the promulgation of Christianity. Its limitations, however, were unnoticed by the incurious spirit of the Middle Ages; and no progress toward historical philosophy was discernible until (in 1567) Jean Bodin enunciated the proposition that the course of

events is controlled by definite laws admitting of investigation by the human intellect. The next great writer who took up the subject was Bossuet, but his *Discourse on Universal History*, often cited as the foundation of the science, is little more than an improved republication of Augustine. The true founder of historical philosophy was the Italian Vico, whose *New Science* (1725) first attempted that scientific explanation of the course of events whose possibility had been asserted by Bodin. The author, who had reflected profoundly on the phenomena attending revolutions in human history, deduces from them the principles which regulate the origin and development of society. The germ of his political speculations exists in a memorable passage in Plato's *Republic*, but what with Plato is mere assertion is with Vico corroborated by a command over the vast mass of experience which had accumulated since Plato's age. His great problem is to reconcile the existence of a divine plan of history with the freedom of human agency, in which he has perhaps been as successful as any of his successors. The idea of a deduction of all human events from first principles being once admitted, various attempts to ascertain these principles began to be made, leading to the establishment of rival historical schools. The great maxim, that the grand determining causes of history are general laws which even the most distinguished individuals obey while they seem to control, was placed in the clearest light by Montesquieu (1745). The chief merit of his contemporary, Voltaire, is not the application of any principle, but the fearless and independent spirit which cleared history of everything intrinsically insignificant or dependent upon mere traditional sanction. With all his brilliancy of detail, his general view of history is discouraging and ignoble. Condorcet (1793) arrived at the opposite conclusion, and first laid it down distinctly that the operation of the laws recognized by Vico leads definitely and inevitably to the elevation of humanity as a whole. This generalization would now hardly be disputed by any philosophical writer, but great differences still exist as to what tendencies should be allowed to rank as laws, and as to the best method of expressing and classifying them. The grandest attempt ever made to sum up all historical principles under a single formula is, so far, that of Hegel (1837). Hegel conceives the development of history to represent the progress of the principle of the universe itself from a condition of chaos to one of self-consciousness. Every important stage in history is identified with some ruling idea which it has been its mission to express and exhaust, that humanity may proceed to develop the next. Friedrich von Schlegel, on the contrary, explains history as the striving back of mankind to a lost condition of original blessedness. It is the great merit of Herder (1791) to have pointed out the vast influence of external nature on mankind, and of Saint-Simon (1813) to have shown the connection of history with the physical sciences. Saint-Simon, borrowing perhaps a hint from Turgot, also enunciated the principle of two necessary stages of human thought—the theological and the physical—subsequently expanded by Comte into his famous doctrine of the three stages—the theological, the metaphysical, and the positive. The significance of this pregnant suggestion is evinced by the debate which it has excited; but it certainly can not be allowed to rank as a demonstrated law so long as all three of these hypothetically successive stages continue to coexist in all civilized nations. Michelet and Pierre Leroux have contributed valuable principles to historical philosophy by insisting on the fundamental unity of all peoples in spite of national distinctions, and de Tocqueville by his recognition of the fact that real progress inevitably tends to democracy. Bonald, on the contrary, has revived the theocratic conception of Augustine. To Bunsen we are indebted for the proof of the degree to which history has inscribed itself upon language; to Buckle, for a demonstration of the paramount importance of intellectual progress as an instrument of national development. Lecky has exhibited in a most striking manner the sudden and, as it almost appears, spontaneous disappearance of accredited beliefs, whose hold upon men's minds has long been imperceptibly loosening. The principal danger of such speculations is their tendency to subordinate individual action altogether to general laws, and to overlook the diversities of human character as agencies in shaping the destinies of nations. The revolutions in North America and France were perhaps equally inevitable, but in the present state of our knowledge no satisfactory reason can be given why one might not as well as the other have brought forth a Washington. Russia owes her present position to Peter, Prussia to Frederick, but no rule can be deduced from historical science to show that either of these sovereigns must necessarily have been a man of genius. Carlyle, on the other hand, greatly exaggerates the hero's independence of circumstances.

*The Study of History.*—As there is no study more delightful than that of history, so is there none more vitally necessary to the citizen of a free state. The constitution of a democratic republic especially, assuming as an indispensable condition of its working that every citizen shall take an intelligent interest in public affairs, imposes the study of history as a duty incumbent upon all. It is impossible to form a correct judgment of present circumstances without the means of comparison with the past supplied by a knowledge of history. The student must bear in mind, however, that all such knowledge is not equally useful. The annals of great military monarchies supply comparatively little that the citizen of a free state can turn to account, and some of the most attractive chapters of human history—that of Egypt, for instance—are chiefly important to the cultivators of special studies. The citizen of the U. S. should especially familiarize himself with the history of free states, his own country before all others; then the great and free country from which it sprang, and from whose institutions its own are derived; then the prototypes of freedom in ancient Greece and Rome. If possible, he should also familiarize himself with the slow development of Roman institutions into the feudalism of the Middle Ages, and the continous transformation undergone by the latter. To state the conclusions which he might probably deduce from such an inquiry would involve trespass on the ground of contemporary politics; nor need we do more than allude to the splendid examples of excellence with which history abounds, and their obvious tendency to encourage a high standard of public and private virtue. The best method of study is that which commences with an outline or skeleton of the subject, serviceable even if the student proceeds no further, but capable of being filled up indefinitely. Commencing with simple and condensed narratives, such as the excellent series published under the editorship of Mr. Freeman, let the student proceed to comprehensive histories like Grote's or Gibbon's, filling up, as it were, the interstices of his knowledge by a resort to memoirs and detached narratives of particular transactions, and crowning his labors by the endeavor to comprehend and apply some system of the philosophy of history. Such general conspectuses of a subject as Voltaire's *Essai sur les Mœurs* will save him much toilsome research; but with these, even more than with regular historical narratives, he will need to be on his guard against the idiosyncrasies of his author, no matter of what school. In conclusion, it may be confidently affirmed that the more progress he is able to make toward recognizing all history as one great whole pervaded by an absolute unity of plan, the more reason will he have to congratulate himself on genuine progress in his historical studies.

See Hegel, *Philosophy of History* (1839); Adams, *Manual of Historical Literature* (3d ed. 1889); Droysen, *Principles of History* (1893). See also the article Church History.

Revised by C. K. Adams.

**Hit** (anc. *Is*): town of Asiatic Turkey; on the west bank of the Euphrates; 90 miles W. N. W. of Bagdad (see map of Turkey, ref. 7–J). The existence of the town has from the earliest times to this day depended on the immense pits of bitumen and naphtha found in the immediate vicinity. These materials were taken hence for the building of Babylon, and even as far as Egypt. The modern town, mean and dirty, has a population of about 2,000.

Edwin A. Grosvenor.

**Hita, Archpriest of**: See Ruiz, Juan, Archpriest of Hita.

**Hitchcock**, Charles Henry, A. M., Ph. D.: geologist; b. at Amherst, Mass., Aug. 23, 1836; son of Edward Hitchcock, geologist; graduated at Amherst College, Massachusetts; instructor in Geology in that institution and at Lafayette College; Professor of Geology at Dartmouth College, New Hampshire, since 1869; assistant geologist of Vermont 1857–61; State geologist of Maine 1861–62, and of New Hampshire 1868–72. He was vice-president of the American Association for the Advancement of Science in 1883. His most important writings are contained in the *Final Report on the Geology of New Hampshire*, vols. i.–iii., 1874–78: his minor contributions, which are numerous, treat more especially of New England geology, the crystalline schists, and local ore deposits. Revised by G. K. Gilbert.

**Hitchcock**, Edward, D. D., LL. D.: geologist; b. in Deerfield, Franklin co., Mass., May 24, 1793. Interrupted in his preparation for Harvard College by sickness and weakness of the eyes, he educated himself while following the plow. From 1815 to 1818 he was principal of Deerfield Academy. His first publication was *The Downfall of Bonaparte*, a dramatic poem of 500 lines; this appeared in 1815. From that date till 1818, while principal of the academy, he furnished the calculations for *The Farmer's Almanac* and frequent corrections to *The Nautical Almanac*. From 1821 to 1825 he was pastor of the Congregational church in Conway, and meanwhile made a geological survey of Western Massachusetts. From 1825 to 1844 he was Professor of Chemistry and Natural History in Amherst College. In 1830 he was appointed State geologist of Massachusetts, having suggested the survey which he was appointed to make. In 1836 he was commissioned to do the same work in the first district of New York, but resigned the office on account of ill health. From 1844 to 1854 he was president of Amherst College and Professor of Natural Theology and Geology. Under his administration the college greatly flourished. When he resigned the presidency, he retained the professorship, and devoted the remainder of his life to his favorite science of geology, but always in its connection with religion. His earliest publications in geology and natural history were *Geology of the Connecticut Valley* (1823) and *Catalogue of Plants within Twenty Miles of Amherst* (1829; new ed., revised by Prof. Tuckerman, 1874). In 1832 appeared *First Report on the Economic Geology of Massachusetts*, and in 1835 the full report on the geology, zoölogy, and botany of the State, which have given Massachusetts the honor of being the first in Europe or America to provide at public expense for the survey of an entire State. The final report on the geology of Massachusetts was made in 1841 in 2 vols. quarto of 831 pages, with 55 plates. *The Religion of Geology and its Connected Sciences* (1851) and *Religious Truths Illustrated from Science* (1857) were the works to which he gave the most thought and study. Among the most popular of his books have been *History of a Zoölogical Temperance Convention in Central Africa* (1850); *A Wreath for the Tomb* (1838); and *Religious Lectures on the Peculiar Phenomena of the Four Seasons* (1850).

President Hitchcock was one of the originators and founders of Mt. Holyoke Seminary and of the Massachusetts Agricultural College. In connection with these may be mentioned his *Memoir of Mary Lyon* and his *Report to the Massachusetts Legislature on the Agricultural Schools of Europe*, which he visited and examined by appointment of the Government in 1850. The last book which he published was the *Reminiscences of Amherst College* (1863). His most unique and enduring monument is the Hitchcock Ichnological Museum of Amherst College, created by his genius, science, and industry. The American Geological Society owes its existence to his suggestion, and he was its first president. He died in Amherst, Feb. 27, 1864.

Revised by George P. Fisher.

**Hitchcock**, Edward, A. M., M. D.: specialist in physical culture; b. at Amherst, Mass., May 23, 1828; graduated at Amherst College 1849; Harvard Medical School 1852; after teaching in the Williston Seminary, Easthampton, Mass., was appointed (1861) Professor of Hygiene and Physical Education in Amherst College, a position he still (1894) holds. The chair of physical culture at Amherst was the first of the kind established in the country. He has been for many years a member of the board of health, lunacy, and charity of Massachusetts, and is a director of Mt. Holyoke College and of Clark Institute for the Blind, and was for three years president of the American Association for the Advancement of Physical Culture. Author of *Anatomy and Physiology* (New York, 1852), and a long series of pamphlets on anthropometry and physical culture. C. H. T.

**Hitchcock**, Ethan Allen: soldier and author; grandson of Ethan Allen; b. at Vergennes, Vt., May 18, 1798; graduated from the U. S. Military Academy, and entered the army as third lieutenant of artillery July, 1817. Till 1829, except for three years as assistant instructor of infantry tactics at West Point, he served on garrison and recruiting duty, after which he became commandant of cadets at the Military Academy. He served in the Florida war as acting inspector-general in Gaines's campaign of 1836. Promoted major Eighth Infantry in 1838, he was placed on garrison duty from 1839 until called to Washington in 1841, and placed in charge of the Indian bureau. In the Mexican war he was inspector-general of Gen. Scott's army, and received the brevets of colonel and brigadier-general. From 1851 till 1854 he commanded the military division of the Pacific. In consequence of personal differences with the Secretary of War, he resigned Oct. 18, 1855, and made his home at St. Louis. In Feb., 1862, he was appointed major-general of volunteers, was placed on duty in the War Department, and in November was appointed commissioner for exchange of prisoners of war and commissary-general of prisoners. He remained in service till Oct., 1867. His writings include *Remarks upon Alchemy and the Alchemists* (1857); *Swedenborg a Hermetic Philosopher* (1858); *Christ the Spirit, being an Attempt to State the Primitive View of Christianity* (1861); *Remarks on the Sonnets of Shakspeare*, and *Colin Clout Explained* (1865); *Notes on the Vita Nuova of Dante* (1866). D. at Sparta, Ga., Aug. 5, 1870.

**Hitchcock**, Ethan Allen: See the Appendix.

**Hitchcock**, Ripley: See the Appendix.

**Hitchcock**, Roswell Dwight, D. D., LL.D.: educator; b. at East Machias, Me., Aug. 15, 1817; joined the sophomore class in Amherst College in 1833; graduated in 1836; was principal of an academy in Jaffrey, N. H., 1836–37; pursued biblical and other studies under private tuition 1837–38; entered Andover Theological Seminary in 1838; was assistant teacher in Phillips Academy, Andover, for one term; was tutor at Amherst 1839–42; and in 1869 was elected one of the trustees of the college. From 1842 to 1844 he was a resident licentiate at Andover; then preached for a year in Waterville, Me.; and was ordained and installed over the First Congregational church in Exeter, N. H., Nov. 19, 1845. One year (1847–48) was spent in Germany at the Universities of Halle and Berlin. In 1852 he resigned his pastorate to accept the Collins professorship of Natural and Revealed Religion in Bowdoin College; and in 1855 he was chosen Washburn Professor of Church History in Union Theological Seminary, New York city. In 1871 he was made president of the American Palestine Exploration Society. He received the degree of D. D. from Bowdoin College in 1855, and from Edinburgh University 1885, and of LL. D. from Williams College in 1873, and from Harvard University 1886. From 1863 to 1870 he was one of the assistant editors of *The American Theological Review*, for which, as previously for *The Presbyterian Quarterly*, he wrote many articles, mostly relating to Church history. Besides numerous essays, orations, addresses, and sermons, he published *The Life, Character, and Writings of Edward Robinson* (1863); *A Complete Analysis of the Bible* (1869); *Socialism* (1878); and edited (with Dr. Eddy and Dr. Schaff) *Hymns and Songs of Praise* (1874); alone, *Hymns and Songs for Social and Sabbath Worship* (1875); *Carmina Sanctorum* (1885). He was joint editor with Prof. Francis Brown of *The Teaching of the Twelve Apostles* (1884; 2d ed. 1885). After his death, *Eternal Atonement*, a collection of sermons from his pen, was published (1888). He was elected president of the Union Theological Seminary, New York city, in 1880. D. at Somerset, Mass., June 16, 1887.

Revised by George P. Fisher.

**Hitchin**: town of Hertfordshire, England, on the Ivel; 32 miles N. N. W. of London (see map of England, ref. 12-J). It has breweries, manufactures of straw-plaiting, and a trade in corn, malt, and flour. Pop. (1891) 8,860.

**Hit'tites** [Heb. *Chittī*, *Chittīm*, sons of *Chēt*, Heth]: a Canaanitish tribe, mentioned in Scripture first in connection with Abraham at Hebron (Gen. xv. 20, xxiii. 3–18); next as the people from whom Esau took his first two wives (Gen. xxvi. 34); later among the other tribes in the Promised Land (e. g. Ex. xxiii. 28; Josh. ix. 1, xi. 3). Uriah the Hittite was one of David's chief officers (2 Sam. xxiii. 39). Numbers of them remained with the Jews even as late as the time of Ezra and Nehemiah (Ezra ix. 1). They are mentioned upon the Egyptian and cuneiform inscriptions, but nothing like a full or accurate account can be given of them. They left numerous inscriptions, which are undecipherable. It is thought that they were a far greater people than the incidental biblical allusions would lead one to expect. Cf. A. H. Sayce, *The Hittites* (1888). See Hieroglyphics.

**Hittorf**, Johann Wilhelm: See the Appendix.

**Hit'torff**, Jacques Ignace: architect; b. at Cologne, Germany, Aug. 20, 1793; studied in Paris; traveled through England, Germany, and Italy; spent two years in archæological studies in Sicily; and in 1824 returned to Paris, where he was kept busy as the architect of important public works until his death. He was made a member of the

Institute of France in 1853. Died in Paris, Mar. 27, 1867. The most prominent of his works as a practical architect are the Cirque de l'Impératrice, Hôtel du Louvre, and different embellishments of the Place de la Concorde and Bois de Boulogne. The most remarkable of his writings are *Architecture antique de la Sicile* and *Architecture moderne de la Sicile*, but especially his *Architecture polychrome chez les Grecs*, which was one of the earliest and remains one of the most important works on the Greek custom of painting buildings and their sculptured decoration. Revised by RUSSELL STURGIS.

**Hitzig**, FERDINAND: biblical scholar; b. at Haningen, Baden, June 23, 1807; studied after 1824 at the Universities of Heidelberg, Halle, and Göttingen, and was in 1833 appointed professor at the University of Zurich, whence in 1861 he removed to that of Heidelberg. In Halle he heard Gesenius, and from that time he concentrated his studies principally on the exegesis of the Old Testament; and by his freedom from dogmatic prejudices, by his comprehensive learning and acuteness, he contributed much to the true understanding especially of the prophets and Psalms, on which he published large exegetical works. His best work is his *Commentary on Isaiah* (Heidelberg, 1833). He also wrote *Urgeschichte und Mythologie der Philistäer* (Leipzig, 1845), etc., and *Geschichte des Volkes Israel* (1869, only first part published). D. in Heidelberg, Jan. 22, 1875.
Revised by S. M. JACKSON.

**Hiuen-tsang** (also written *Hiouen Thsang*, *Hwen Tsang*, *Hsüen-chwang*, *Yuen Tswang*, etc.): a Chinese Buddhist monk who set out in the year 629 on a journey to India in search of Buddhist scriptures, and who returned in 644 after having visited 110 countries and places, with 657 different works in Sanskrit (requiring twenty-two pack-horses) and many Buddhist relics and images. The remainder of his life (nineteen years) was spent in translating, with the assistance of twelve other monks, into Chinese the works he had brought with him. By command of the emperor an account of his travels was prepared under the title *Ta T'ang Si-yu-ki*, or Record of Western Rambles in the Time of the T'ang Dynasty. See Julien's translation *Mémoires sur les Contrées Occidentales, par Hiouen Thsang* (2 vols., Paris, 1857–58), and Beal's *Si-yu-ki: Buddhistic Records of the Western World* (2 vols., London, 1884). See also Julien's *Histoire de la Vie de Hiouen Thsang* (Paris, 1853).
R. LILLEY.

**Hives**: See NETTLE-RASH.

**Hi'vites** [Heb. *Chivvī*, midlanders, villagers]: a Canaanitish race conquered by the Hebrews (Josh. ix. 7, xi. 19); part of them escaped total destruction by a successful fraud (Josh. ix. 26). The great mass of them, living in the region of Tyre (Judges iii. 3), seem to have been unconquered. Solomon exacted tribute of the Hivites living in his kingdom (1 Kings ix. 20, 21).
Revised by S. M. JACKSON.

**Hiwassee College**: an institution in Monroe co., Tenn.; organized in 1849 with the design to secure thorough instruction at minimum cost and under conditions most favorable to physical, mental, and moral development. A new edifice, the Edwin W. Marsh, Jr., building, was opened to public use in 1887, and the doors were opened to young ladies and girls Jan., 1894. The college is in a prosperous condition, and bids fair to continue its sphere of operations in the Southern States, from which it draws its patronage.
S. G. GILBREATH.

**Hoactzin**, hō-akt'zin, or **Hoatzin**: native name of a bird found in Northern South America; the only member of the order OPISTHOCOMI (*q. v.*). It is about 2 feet in length, with slender body and long tail. The rounded wings are ample in size, but owing to the peculiar structure of the breastbone the bird flies poorly. The head bears a long, flaring crest. The general color of the upper parts is brown, with, in places, a greenish gloss. The belly, rump, primaries, and part of secondaries are rusty red. The wings have narrow, whitish bars, and the crest is yellowish, with many feathers tipped with black. The hoactzin is partial to thickets near the water, nesting in low bushes. It feeds largely on the wild arum (*Caladium arborescens*), whose leaves impart an extremely disagreeable, musky flavor to the flesh. The young are peculiar for the great development of the thumb, and are said to scramble about, using their wings like legs. As the birds grow the thumb is gradually absorbed, and in the adult this part of the wing is even less prominent than in most birds. F. A. LUCAS.

**Hoadley**, BENJAMIN: prelate; b. at Westerham, Kent, England, Nov. 14, 1676; was educated at Catharine Hall, Cambridge, of which he became a fellow in 1697; took holy orders 1701; became rector of St. Peter-le-poor, London, 1704; rector of Streatham, Surrey, 1710; was distinguished by his advocacy of Low Church views in a famous controversy ("the convocation controversy") with Atterbury and others, Burnet and Wake being on Hoadley's side. In 1715 he was made Bishop of Bangor, and in 1717 a sermon preached before the king on the words, "My kingdom is not of this world," led to the famous Bangorian controversy, in which he was assailed by the non-jurors and the High Church party, headed by William Law, Archdeacon Warren, and Canon Snape, because he advocated the withdrawal of temporal jurisdiction from the clergy. This controversy led to the prorogation of the convocations and the almost complete extinction of their powers. In 1721 he was translated to the see of Hereford; to that of Salisbury 1723; and of Winchester 1734. D. at Chelsea, Apr. 17, 1761. Among his works are *Letters on Miracles* (London, 1702); *Reasonableness of Conformity* (1703); *Brief Defense of Episcopal Ordination* (1707); *A Preservation against the Principles of Non-jurors* (1716); *Nature and End of the Lord's Supper* (1735); and *Sermons* (1754–55).—His two sons, BENJAMIN and JOHN, also distinguished themselves. The former was born in London, Feb. 10, 1706; studied at Cambridge; took his degree as doctor of medicine in 1728; settled in London; was appointed physician to the royal household in 1742; and died at Chelsea, Aug. 10, 1757. He wrote in 1747 the comedy *The Suspicious Husband*; assisted Hogarth in his *Analysis of Beauty*; and published in 1756 *Observations on a Series of Electrical Experiments*. John was born in London, Oct. 8, 1711; studied law and then theology; took orders; became chaplain to the Prince of Wales 1735, and held various rectorates and vicarages. D. in Winchester, Mar. 16, 1776. He wrote comedies—*The Contrast* (1731) and *Love's Revenge* (1737)—oratorios and pastorales, and edited his father's works (1773, 3 vols.).

**Hoag**, CHARLES E.: See the Appendix.

**Hoang-Hai**: See YELLOW SEA.

**Hoang-Ho**: same as HWANG-HO.

**Hoar**, EBENEZER ROCKWOOD, LL. D.: jurist; b. at Concord, Mass., Feb. 21, 1816; a son of Samuel Hoar (1778–1856). He graduated at Harvard in 1835, and was admitted to the bar in 1840; was a judge in the court of common pleas 1849–55; a judge of the supreme judicial court 1859–69; U.S. Attorney-General 1869–70; joint high commissioner on the Washington treaty of 1871; M. C. from Massachusetts 1873–75. D. at Concord, Mass., Jan. 31, 1895.

**Hoar**, GEORGE FRISBIE, LL. D.: U. S. Senator; a son of Hon. Samuel Hoar; b. at Concord, Mass., Aug. 29, 1826; graduated at Harvard in 1846; admitted to the bar in 1849; settled at Worcester, Mass. He was elected to the 41st Congress, and re-elected to the 42d, 43d, and 44th. In 1877 he was elected to the U. S. Senate from Massachusetts; re-elected in 1883, and again in 1889 and 1895.

**Hobart**: formerly Hobart Town; capital of Tasmania, formerly Van Diemen's Land; on the navigable Derwent, which at its entrance into Storm Bay forms an excellent harbor for the largest vessels (see map of Australia, ref. 9-I). Hobart was founded in 1804. It is beautifully situated at the foot of Wellington Mountain, and well built with straight and broad streets and many handsome buildings, among which there are several Episcopalian, Roman Catholic, and Presbyterian churches and a Jewish synagogue. It has also a fine Government house, 4 banks, and 3 public libraries. It has good public schools, and gas and water works. It is connected with Launceston on the north side of the island by rail and with Melbourne by steamer, and carries on quite a lively trade. It has an Anglican and a Roman Catholic bishop. Pop. (1891) 24,905; (1896) with suburbs, 36,300. Revised by M. W. HARRINGTON.

**Hobart**, AUGUSTUS CHARLES (*Hobart Pasha*): naval officer, who served as admiral of the Turkish fleet; b. in England, Apr. 1, 1822; entered the British navy in 1836; served with distinction in the Crimean war, rising to the rank of captain; became the commander of a blockade-runner during the U. S. civil war, and in 1867 entered the service of the Ottoman Government, which gave him the title of pasha. He was placed in command of the fleet operating against Crete, and took energetic measures to prevent the Greeks bringing aid to the islanders. He was afterward raised to

the rank of grand admiral, with the command of the Turkish squadron in the Mediterranean. On the outbreak of the war between Russia and Turkey, the latter appointed him to the command of the Black Sea fleet. On Jan. 8, 1881, the sultan raised him to the rank of marshal of the empire. D. at Milan, June 19, 1886. F. M. Colby.

**Hobart**, Garret A.: Vice-President of the U. S.; b. at Long Branch, N. J., 1844; educated at Rutgers College; studied law at Paterson, N. J., with Socrates Tuttle, whose daughter he afterward married; admitted to the bar in 1866; became city counsel in 1871, and counsel to the board of chosen freeholders in the following year; was in the Legislature in 1873–74; was sent to the State Senate in 1877, and was its president in 1881–82; defeated for the U. S. Senate 1884; elected to the vice-presidency in 1896. D. in Paterson, N. J., Nov. 2, 1899.

**Hobart**, John Henry, S. T. D.: bishop and author; b. in Philadelphia, Pa., Sept. 14, 1775; graduated with honors at Princeton in 1793; was tutor there 1796–98; ordained deacon of the Protestant Episcopal Church in 1798, and priest in 1800. In 1799 he became rector of Christ church, New Brunswick, N. J.; in 1800 was for a short time rector of St. George's, Hempstead, L. I., and in the same year assistant minister of Trinity church, New York, of which in 1812 he became assistant rector, and in 1816 rector. He was made assistant Bishop of New York in 1811, and bishop in 1816. In 1821 he became Professor of Pastoral Theology and Pulpit Eloquence in the General Theological Seminary, New York, of which he was one of the founders. Among his published works are *Companion for the Altar* (1804); *Apology for Apostolic Order* (1807). See *Memoir* by William Berrian (1833); *The Early Years of Bishop Hobart* (1834); and *The Professional Years of Bishop Hobart*, by J. McVickar (1836). D. at Auburn, N. Y., Sept. 12, 1830. W. S. P.

**Hobart**, John Henry, D. D.: son of Bishop John Henry Hobart; b. in New York city, Oct. 1, 1817; graduated at Columbia College (1836) and at General Theological Seminary; ordered deacon 1841; some time rector of Grace church, Baltimore, and an assistant minister of Trinity, New York, 1848–63. For a number of years Dr. Hobart was registrar of the House of Bishops. Author of *Instruction and Encouragement for Lent* (New York, 1859); *Church Reform in Mexico* (1877); *Mediæval, Papal, and Ritual Principles Stated and Contrasted* (1877); sermons, etc. D. Aug. 31, 1889. William Stevens Perry.

**Hobart College**: a general Church institution of the Protestant Episcopal Church at Geneva, N. Y. All bishops of dioceses in the U. S. are regents *ex officio*; the bishop of the diocese in which the college may at any time stand is a member of the board of trustees *ex officio*, as is the president of the college. The bishops of the dioceses of the State of New York are visitors. The institution was projected 1812; founded for academic work 1822 by a provisional charter; chartered as Geneva College 1825; named Hobart Free College 1852; Hobart College 1860, being largely indebted to Bishop Hobart and to an early endowment from Trinity church, New York. There are three courses leading respectively to the degrees A. B., B. S., B. L. The equipment includes valuable scholarships and prizes, a chemical and a physical laboratory, a cabinet and museum, a gymnasium, and a library of 37,512 volumes in a fire-proof building. The college site is noted for its beauty and salubrity. Its alumni number over 1,400. Charles D. Vail.

**Hob'bema**, Meindert: painter; b. in Holland in 1638. Little is known of his life, for he seems to have been neglected by his contemporaries. He lived and died poor, and it was not till fifty years after his death that his pictures began to be considered. Hence they are not common in the older public galleries, and are little known in Europe. But they have always been sought by private buyers, and a great many were taken to Great Britain during the eighteenth century. The newly formed public galleries of London, Edinburgh, and Glasgow, and the large private collections of Great Britain are especially rich in Hobbemas. He is of not so poetical a nature as Ruysdael or Cuyp, but still he is ranked by many as dividing with them the supremacy of the great Dutch school of landscape. His execution is extremely firm, even and solid, his perception of natural forms exceptionally clear, his composition simple, so that his pictures look like close copies of natural scenes chosen for their gracefulness and quiet beauty. His most prominent fault is a mechanical way of painting foliage, tending to spotty and twinkling light. Hobbema died Dec. 7, 1709.

In the National Gallery in London are *The Avenue of Middelharnis*, *Showery Weather*, *Watermills and Bleacheries*, the *Ruins of Brederode Castle*, and several more; in the Bridgewater Gallery, a *Watermill* and two other valuable landscapes; in the Dulwich Gallery and in Buckingham Palace, several; and landscapes whose names are hardly important as being so similar are in the galleries of the Hermitage, near St. Petersburg, and at Munich, Vienna, Bordeaux, and especially Amsterdam and Rotterdam.

Russell Sturgis.

**Hobbes**, Thomas: one of the most distinguished thinkers of the period of English emancipation from scholasticism; b. Apr. 5, 1588, at Malmesbury, in Wiltshire. His father was a country clergyman. After a thorough preparation, he was sent to Oxford at about the age of fifteen, and there studied Aristotle and scholastic philosophy for five years, acquiring certain nominalistic principles which marked all his subsequent thinking, although he early assumed a hostile attitude toward scholasticism. He became tutor to the future Earl of Devonshire, and in 1610 traveled with his charge through France, Italy, and Savoy. On his return, and on subsequent visits to the Continent, he met the foremost thinkers of the time, and became more or less intimate with Lord Bacon, Ben Jonson, Lord Edward Herbert of Cherbury, Descartes, Gassendi, Galileo; later in life with Selden, Cowley, and Dr. Harvey. In 1628 he translated and published *Thucydides*, with the express purpose of showing his countrymen a warning example of the "fatal consequences of intestine troubles." Just at this time the foundations of civil order were shaken by the struggle between the House of Stuart and the supporters of individual liberty and the rights of conscience. Of an unusually timid disposition, Hobbes felt very keenly the lack of security which the state should afford, and this subject (the state) occupied his chief thoughts for the rest of his life. Retiring to Paris with the royalists in 1640, he published a small edition of his *Elementa Philosophica de Cive* in 1642, the work being reprinted, much enlarged, in 1647 at Amsterdam by the famous Elzevirs. In 1647 he became mathematical instructor to Charles, Prince of Wales, a relation which was broken the next year by the removal of the prince to Holland. His connection with the exiled royalist party was severed by the publication of his views on political, moral, and theological subjects in the treatises (1) *Treatise on Human Nature* in 1650, (2) *De Corpore Politico* (London, 1650), and (3) his collected views in the *Leviathan, or the Matter, Power, and Form of a Commonwealth, Ecclesiastical and Civil*, in 1651. He escaped persecution from exiled English royalists, as well as from French authorities, by fleeing secretly from Paris and taking refuge in England, where Cromwell's absolute power in 1653 furnished a government much in accordance with Hobbes's doctrines. He published a remarkable *Letter upon Liberty and Necessity* in 1654, and the first and second divisions of his great work, *Philosophical Rudiments*, in 1655–58; the first division treating of *Body*, the second division of *Human Nature*, the third of *The State*. His *Leviathan* and *De Cive* were censured in Parliament in 1666, and very many works were written to refute them, the most able of these being Cudworth's *Intellectual System*. After the Restoration, Hobbes received a pension of £100 from Charles II., his former pupil. In 1675 he published a translation of Homer's *Iliad* and *Odyssey*. He wrote his autobiography in Latin verse, and his *Behemoth*, a dialogue on the civil wars between 1640 and 1660, was written somewhere about 1670. He died Dec. 4, 1679, at the seat of the Earl of Devonshire, his constant friend and supporter.

The literary style of Hobbes is pronounced admirable, being always clear and never tedious. His system of philosophy was a materialistic scaffolding built for the purpose of supporting and complementing his philosophy of the state, which is his only valuable contribution to human thought, besides certain negative or skeptical principles afterward elaborated by Locke and Hume. He held sensation to be the basis of all knowledge; matter to be the only reality; philosophy to be the knowledge of effects in their causes and of causes in their effects; scientific method, consequently, to be twofold (*a*) inductive or analytical, and (*b*) deductive or synthetical. In his *Prima Philosophia* he defines the ideas of space, time, thing, cause, etc., somewhat after the manner of the schoolmen. But the subject of philosophy is the two kinds of bodies, natural and artificial, the latter including human organizations, of which the state is the

highest example. He held mind to be material; thought to be a process of adding and subtracting representations produced by physical impressions; language to be the most essential instrumentality to human life, rendering possible the existence of civil society and the state and the development of science and reason itself; ideas of good and evil to have their origin in the sensations of pleasure and pain; the human will to be under the control of circumstanees and necessity. The state of nature is not the ideal state of man, but a state of war on the part of each against all—*bellum omnium in omnes*—and its result a condition of complete misery. Self-interest impels man to combine with his fellows and institute government, a "leviathan power" which adjusts and subordinates individual selfishness and produces the maximum of happiness. Outside the state are found constant war, fear, poverty, filth, ignorance, and wretchedness; within the state dwell peace, security, riches, science, and happiness. Coercion is essential, and absolute monarchy is the most perfect form of government. Individual conviction should not be considered. The state is the Grand Man which makes possible the rational development of the individual man, like a mortal god subduing his caprice and passion, and compelling obedience to law, developing the ideas of justice, virtue, and religion, creating property and ownership, nurture and education. It is surprising that his tendencies toward nominalism in philosophy should have yielded to so realistic a doctrine in his science of politics, for he makes not the individual man (as Rousseau does a century later), but the state, the true reality. The social or political process is the real one, the individual is only a vanishing or transitory point in the social whole. Hobbes was so much impressed with the importance of the authority of the state that he could not appreciate the necessity of mediation by which the individual will shall be adjusted and reconciled to the universal will (of the state) through the principle of popular representation. Complete *Works*, edited by Molesworth, 16 vols. (5 vols. Lat., 11 vols. Eng.), London, 1839–45. W. T. Harris.

**Hobby** [M. Eng. *hobie*, from O. Fr. *hobe, hobier*, deriv. of *hober*, move, stir]: in Great Britain, either of certain small falcons, especially the *Falco subbuteo*, a bird about a foot in length and of very elegant shape. It was once much employed in hawking.

**Hobhouse**, John Cam (*Lord Broughton*): b. June 27, 1786; graduated at Cambridge in 1808; in 1820 was elected to Parliament by the Liberals of Westminster, and later represented both Nottingham and Warwick; entered the cabinet of Earl Grey as Secretary of War in 1831; was made Secretary of State for Ireland in 1833, and president of the board of control from 1835 to 1841 and from 1846 to 1852; was created a baron in 1851, and died June 3, 1869. His *Journey through Albania and other Provinces of Turkey with Lord Byron* (1813), *Illustrations of the Fourth Canto of Childe Harold* (1818), and *Italy* (1859), attracted much attention.

**Hoboken**: city (incorporated 1855); Hudson co., N. J. (for location see map of New Jersey, ref. 2–E); on the Hudson river, and the terminus of the Lackawanna Railroad; adjoining Jersey City on the S. and Weehawken on the N., and directly opposite New York eity, with which it is connected by several lines of steam-ferries. It has a large trade with the principal domestic and foreign ports, supplies New York city and its shipping with the greater part of their coal, has large dry docks, and is the terminus of the Netherlands-American, Hamburg-American, North German Lloyd, Wilson, Phenix, Savannah, and Thingvalla steamship lines. The new piers of the North German Lloyd, to replace those destroyed by fire June 30, 1900, are the finest in the world. It is widely known for its production of lead-pencils, caskets, leather, leather goods, wall paper, automobiles, artists' materials, straw hats, and foundry and machine-shop products. The city is connected with Jersey City and suburban towns by electric street railways, and has excellent water and sewerage systems and electric street lighting. The assessed valuation was: personal, $2,020,030; real, $25,770,900—total, $27,790,930, and the tax-rate $2.08 per $100. There were 22 churches, high school and 7 grammar schools, free public library, 2 convents, St. Mary's Hospital, 7 U. S. bonded and 7 free warehouses, Stevens Institute of Technology (founded by Edwin A. Stevens, and opened in 1871), and 1 daily, 4 weekly, 2 monthly, and 2 other periodicals. Pop. (1890) 43,648; (1900) 59,364. Revised by W. W. Baxter.

**Hobson**, Richmond P.: See the Appendix.

**Hobson's Choice**: a nominal choice with no real alternative; a familiar term which owes its origin to the practice of Tobias Hobson, university carrier at Cambridge, England, in Milton's time. He was the subject of two poems by Milton. It is related in *The Spectator* (509) that Hobson was the first person in England who kept a hackney-stable. He always politely asked his customers to take their choice of his forty horses; but no matter which horse was chosen, Hobson always managed to put off the traveler with the horse which stood nearest the door.

**Hoche**, ōsh, Lazare: general; b. at Montreuil, France, June 25, 1768; son of a poor workman, who could give him no education. In 1784 he enlisted in the army; in 1791 he fought as sergeant in the regiment of Gardes Françaises with the rabble before the door of Marie Antoinette; in 1792 he became lieutenant in the regiment of Rouergue; and in 1793 he distinguished himself in the siege of Thionville and in the battle of Neerwinden. Having been imprisoned on some suspicion, he sent a plan of a campaign to the committee of public safety, and he was immediately liberated, made a brigadier-general, and sent to serve in the army of Houchard. He soon received an independent command, and in 1793 he defeated the Austrians at Weissenburg, and compelled them to withdraw from Alsace. In 1795 he foiled the invasion of the royalists and the English, attempted from the peninsula of Quiberon. In 1796 he pacified the Vendée, while his expedition to Ireland failed, as stormy weather scattered his ships. In Apr., 1797, he again commanded against the Austrians, and defeated them in three battles; he was at Wetzlar when the armistice of Lisbon ended the war. In the fall of that year he was suddenly taken ill, and died Sept. 18; a post-mortem examination showed that he had been poisoned.

**Hochelaga**, hŏk-*e*-laa'ga: the county-seat of Hochelaga County, Quebec, Canada; a beautiful suburb of Montreal, with which it is connected by a street railway (see map of Quebec, ref. 5–B). Its convent of the Holy Name is the largest nunnery in the province. Pop. of village about 1,600.

**Hoch'kirch**: a village of Saxony; 7 miles S. E. of Bautzen (see map of German Empire, ref. 5–G). Here Frederick the Great was completely defeated by the Austrians under Daun Oct. 14, 1758. He had taken up a very unfavorable position, and had only 30,000 men. At five o'clock in the morning he was attacked by Marshal Daun with 50,000 men. The attack was half a surprise, a dense fog covering the whole landscape, and with great loss the king was compelled to retire to the heights of Drehsa. There he was again attacked, by the Duke of Aremberg, and the retreat became a rout.

**Höchst**, höchst: town in the province of Hesse-Nassau, Prussia; at the influx of the Nidda into the Main; 6 miles W. of Frankfort (see map of German Empire, ref. 5–D). It is noted for the battles fought here—June 20, 1622, in which Tilly defeated Duke Christian of Brunswick, and Oct. 11, 1795, in which the Austrians defeated the French under Jourdan. Pop. (1890) 8,455.

**Hoch'städt**: See Blenheim.

**Hocking**, or **Hockhocking**: a river of Ohio; rises in Fairfield County, flows S. E. through Hocking County, and joins the Ohio in Athens County, after a course of 80 miles. For nearly 70 miles it is navigable for boats.

**Hock-tide** [O. Eng. *hōcor*, scorn + *tīd*, time], or **Hoke Days**: the Monday and Tuesday occurring two weeks after Easter, a former English festival in memory of Ethelred's great victory over the Danes in 1002. Tolls were taken at the town-gates and money was collected throughout the parish for the priest. Traces of the old customs existed in some places in the eighteenth century.

**Hodell**, Frans Oscar Leonard: Swedish dramatist; b. in 1840; was in early youth apprenticed to a druggist; in 1860 he entered the stage; and from 1870 up to the time of his death was editor, and from 1881 proprietor, of *Söndags-Nisse* (The Sunday Puck), a comical paper. He was one of the most fertile of Swedish dramatic authors, and wrote or adapted for the comic stage more than 100 plays. The most popular of all of them is *Andersson, Petersson, and Lundström* (1866), acted more than 300 times in Stockholm. Among his other plays may be noticed *En Söndag i det gröna* (A Sunday à la champêtre, 1861); *Fabriksflickan* (The Factory Girl, 1868); *Herr Larssons Pariserfärd* (Mr. Larsson's Trip to Paris, 1868); *Syfröknarna* (The

Seamstresses, 1868); *Tre par skor* (Three Pairs of Shoes, 1881). He also proved himself to be an excellent author of songs and ballads by his *Visor och kupletter* (Songs and Stanzas, 1873). D. May 25, 1890. P. Groth.

**Hodge**, Archibald Alexander, D. D., LL. D.: son of Dr. Charles Hodge (1797–1878); b. in Princeton, N. J., July 18, 1823; graduated at the College of New Jersey in 1841; was tutor 1844–46; graduated at Princeton Theological Seminary in 1847; went the same year as a missionary to Allahabad, India; returned in 1850 on account of the impaired health of his wife; was settled as a pastor in Lower West Nottingham, Md., 1851–55; at Fredericksburg, Va., 1855–61; and at Wilkesbarre, Pa., 1861–64. In 1864 he was elected by the General Assembly of the Presbyterian Church to the chair of Didactic, Historical, and Polemic Theology in the Western Theological Seminary, Allegheny, Pa. In connection with the professorship, he became in 1866 pastor of the North Presbyterian church of the same city. He was chosen Associate Professor of Didactic and Polemic Theology at Princeton 1877, and succeeded his father in 1878. He published *Outlines of Theology* (New York, 1860; enlarged ed. 1878); *The Atonement* (1867); *Commentary on the Confession of Faith* (1869); *Life* of his father (1880); *Popular Lectures on Theological Themes* (1887). D. at Princeton, N. J., Nov. 11, 1886.

Revised by S. M. Jackson.

**Hodge**, Charles, D. D., LL. D.: of Scotch-Irish descent; b. in Philadelphia, Pa., Dec. 28, 1797. In 1812 he entered the sophomore class in the College of New Jersey, and graduated with the highest honors in 1815. From 1816 to 1819 he was a student in the Theological Seminary at Princeton. In 1820 he became assistant teacher of the original languages of Scripture in the seminary, and in 1822 was elected by the General Assembly Professor of Oriental and Biblical Literature. In 1828 he returned to his chair, after three years' study at the Universities of Paris, Halle, and Berlin. In 1840 he was transferred to the chair of Exegetical and Didactic Theology, to which, in 1852, Polemic Theology was added. He was moderator of the General Assembly (Old School) at Philadelphia in 1846, and 1858 one of a committee to revise the *Book of Discipline*. The celebration at Princeton, Apr. 24, 1872, of the semi-centennial anniversary of his professorship was the first of its kind in the U. S. His contributions to sacred literature were of the most scholarly and solid character. In 1825 he founded *The Biblical Repertory*, the scope of which was enlarged and *Princeton Review* added to its title in 1829. In 1872 it was united with *The Presbyterian Quarterly and American Theological Review*, the organ of the New School branch. Till then, for nearly forty years, he had been not only editor-in-chief of *The Princeton Review*, but also chief contributor, more than one-fifth of all that was written for it coming from his pen. He also published *A Commentary on the Epistle to the Romans* (Philadelphia, 1835; abridged 1836; rewritten and enlarged 1866); *Constitutional History of the Presbyterian Church in the United States* (2 vols., 1840–41); *The Way of Life* (1842); commentary on *Ephesians* (1856); *First Corinthians* (1857); *Second Corinthians* (1860); *What is Darwinism?* (1874). But the great work of his life was *Systematic Theology* (3 vols., 1871–72), which is regarded as one of the ablest expositions of Calvinism ever made. See *Semi-Centennial Commemoration of the Professorship of Charles Hodge, D. D., LL. D., Sept. 24, 1872* (1872), and his *Life* by A. A. Hodge (New York, 1880). D. in Princeton, N. J., June 19, 1878. Revised by S. M. Jackson.

**Hodge**, Frederick Webb: ethnologist; b. in Plymouth, England, Oct. 28, 1864; was taken to the U. S. when seven years of age; was educated in Washington, D. C.; appointed to the U. S. Geological Survey in Aug., 1884, devoting such of his time as was not occupied by official duties as a student in the Corcoran Scientific School until Dec., 1886, when he resigned from the Geological Survey and became secretary of the Hemenway Southwestern archæological expedition. During his connection with this expedition Mr. Hodge made detailed surveys and maps on a large scale of the ruins of Los Muertos, and their accompanying irrigation *acéquias* and reservoirs, descriptions of which have been embodied in papers on the *Architecture of the Prehistoric Pueblos of Southern Arizona* and *Methods of Irrigation of the Ancient Inhabitants of the Salado Valley*. At the close of the field-work of the Hemenway expedition in July, 1889, Mr. Hodge returned to Washington and was appointed to the bureau of ethnology, Smithsonian Institution, for duty in connection with the preparation of a *Synonymy of Indian Tribes*, under the direction of Mr. H. W. Henshaw. J. W. Powell.

**Hodge**, Hugh Lenox, M. D., LL. D.: b. in Philadelphia, June 27, 1796; brother of Prof. Charles Hodge; graduated at Princeton with honors 1814; took the medical degree in 1817 at the University of Pennsylvania; was Professor of Obstetrics in that institution 1835–63, when he became emeritus professor. Author of a *System of Obstetrics* (1864) and a work on *Diseases Peculiar to Women* (Philadelphia, 1859), standard treatises of the first authority; wrote much and ably for the professional journals, and had a wide fame as a practitioner and instructor. D. at Philadelphia, Feb. 23, 1873.

**Hodge**, Hugh Lenox, M. A., M. D.: surgeon; b. in Philadelphia, Pa., July 30, 1836; studied at the University of Pennsylvania, and received the degrees of B. A. 1855, M. A. 1858, and M. D. 1858; was resident physician in the Pennsylvania Hospital 1858–60; in 1861 was appointed demonstrator of surgery and chief of the surgical dispensary of the University of Pennsylvania, and in 1870 demonstrator of anatomy. During the civil war he was one of the surgeons attached to the U. S. Satterlee Hospital, belonged to the Pennsylvania reserve corps of surgeons, and was pension examining surgeon to the U. S. sanitary commission; has been attending surgeon to the Children's Hospital since 1864, and attending surgeon to the Presbyterian Hospital since its opening in 1872. He has written and published a number of articles in medical journals.

**Hodge**, John Aspinwall, D. D.: minister; b. in Philadelphia, Pa., Aug. 12, 1831; graduated at the University of Pennsylvania 1851, and at Princeton Theological Seminary 1856; was pastor of the First Presbyterian church at Mauch Chunk, Pa., 1857–65, and of the Presbyterian church in Hartford, Conn., 1866–92. He published *What is Presbyterian Law?* (Philadelphia, 1882; 6th ed. 1892); *Theology of the Shorter Catechism*, second part, the first part being by the Rev. A. A. Hodge, D. D. (New York, 1888); *Recognition after Death* (New York, 1889); and the tracts *Why I am a Presbyterian* and *Form for Organizing a Church*. He resides at Lincoln University, Pennsylvania.

**Hodges**, Edward, Mus. Doc.: organist and composer; b. at Bristol, England, July 20, 1796, and educated there; organist successively of several Bristol churches, and early a composer of sacred music of the old English cathedral school of the severest kind; received his doctor's degree from Cambridge in 1825; in 1838 settled in New York and became successively organist of St. John's chapel and (1846) of Trinity church; returned to England in 1863, and died at Clifton, Sept. 1, 1867. D. E. Hervey.

**Hodges**, John S. B.: See the Appendix.

**Hodgins**, John George, LL. D., F. R. G. S.: Canadian educator; b. in Dublin, Ireland, Aug. 12, 1821; removed to Canada in 1833, and graduated at Victoria College in 1856. He was deputy minister of education of Ontario 1876–89, when he became librarian and historiographer of the Educational Department for Ontario. From 1855 till 1879 he edited *The Journal of Education*, and is author of *School History of Canada* (1862); *Sketches and Anecdotes of the Queen* (1870); *The School-house and its Architecture* (1872); *School Manual* (1870); *Lectures on School Law* (1870).

**Hodgson**, Brian Houghton: See the Appendix.

**Hodgson**, Shadworth Hollway, M. A. (Oxford), LL. D. (Hon. Edinburgh): b. at Boston, Lincolnshire, England, Dec. 25, 1832. He was educated at Rugby and Oxford; honorary fellow of Corpus Christi College, Oxford; president of the Aristotelian Society for the Systematic Study of Philosophy, London, since 1880. His principal works are *Time and Space: a Metaphysical Essay* (London, 1865); *Principles of Reform in the Suffrage* (London, 1866); *The Theory of Practice* (2 vols., London, 1870); *The Philosophy of Reflection* (2 vols., London, 1878); *Outcast Essays and Verse Translations* (London, 1881). He has also contributed articles to *Mind* (London), the *Proceedings of the Aristotelian Society*, etc. J. Mark Baldwin.

**Hodgson**, Telfair, D. D., LL. D.: clergyman; b. at Columbia, Va., Mar. 14, 1840; educated in Philadelphia and at Princeton, where he graduated in 1859. He was one of the few clergymen ordained in the Church of the Confederate States of America, and was a chaplain in the Confederate army. In 1872 he became Professor of Philosophy in the University of Alabama; later was appointed vice-chancellor

of the University of the South at Sewanee, Tenn., and dean of its theological department. He published some sermons and pamphlets. D. at Sewanee, Sept. 11, 1893.

WILLIAM STEVENS PERRY.

**Hod-Mezö-Vasarhely**: See VASARHELY.

**Hod'ograph** [Gr. *ὁδός*, way, path + *γράφειν*, write, describe]: the locus of the extremities of lines drawn from a fixed point to represent in magnitude and direction the velocity of a moving point. The invention of this construction is due to Sir W. R. Hamilton, and the most beautiful of the many remarkable theorems to which it leads is this: *The hodograph for the motion of a planet or comet is always a circle, whatever be the form and dimensions of the orbit.* Since the radius-vector of the hodograph represents the velocity at each instant, it is evident that an elementary arc represents the acceleration or change of velocity in the direction of any co-ordinate, and thus a finite arc represents the whole acceleration of the moving point during the corresponding time; and it is evident also that the tangent to the hodograph is parallel to the direction of the acceleration of the moving point in the corresponding position of its orbit. The intensity of heat and light emanating from a point, or from a uniformly radiating spherical surface, diminishes with increasing distance according to the same law as gravitation. Hence the amount of heat and light which a planet receives from the sun during any interval is proportional to the whole acceleration during that interval—i. e. to the corresponding arc of the hodograph.

Revised by S. NEWCOMB.

**Hodom'eter** [from Gr. *ὁδός*, road, way + *μέτρον*, measure]: a more correct form of ODOMETER (*q. v.*).

**Hoe** [M. Eng. *howe*, from O. Fr. *hoe* > Fr. *houe*, from O. H. Germ. *houwa* (> Mod. Germ. *haue*, hoe), deriv. of *houwan*, cut, hew: Eng. *hew*]: an instrument of farm-husbandry of various forms. The best known is a plate of steel attached to a handle at somewhat less than a right angle, and is used for cutting and drawing the earth. The shuffle-hoe is drawn and thrust backward and forward for the purpose of cutting off weeds. Various forms of horse-hoe are used for cultivating those crops which are planted in rows and drills.

**Hoe**, RICHARD MARCH: inventor; b. in New York, Sept. 12, 1812; the son of Robert Hoe (1784–1833), an ingenious English mechanician who became a manufacturer of printing-presses in New York. Richard Hoe became after his father's death a partner in the business, to which was added the manufacture of saws, in which Mr. Hoe made important improvements. In 1841 Richard Hoe, with his brothers, Robert Hoe and Peter Smith Hoe, assumed the whole business, the former partners retiring. In 1846 he brought out "Hoe's lightning press," extensively employed for newspaper-work. It has been much improved. He also made many less celebrated inventions. D. in Florence, Italy, June 7, 1886.

**Hoefer**, hö'fer, JOHANN CHRISTIAN FERDINAND: scientist and author; b. at Döschnitz, in the principality of Schwarzburg-Rudolstadt, Apr. 21, 1811; educated at gymnasium of Rudolstadt. In 1830 he went from Bremen to Lille, where he enlisted in the foreign legion as a soldier, and from Lille to Marseilles, whence he was sent to Navarino, the station of his regiment; returned in 1831 to France and taught foreign languages at the Colleges of Lyons, St.-Étienne, and Roanne; co-operated with Cousin in translating Kant's *Kritik der reinen Vernunft* in 1834, and removed to Paris, where he began to study natural science and medicine, while he made his living by writing and translating for different periodicals. In 1840 he received the degree of doctor, and in 1848 he was naturalized as a French citizen. The most prominent of his writings are *Histoire de la Chimie* (1842), the first complete history of the science of chemistry; *Dictionnaire de Physique et de Chimie* (1846); *de Médecine pratique* (1847); *de Botanique* (1850); *d'Agriculture et d'Horticulture* (1855); *Histoires du Café, du Chocolat, de la Pomme de Terre, du Lotus, du Poivrier, etc.* (1850–51); *Histoire du Maroc* (1848); besides a great number of articles in the *Biographie Générale*, of which he was editor-in-chief. D. at Brunoy in May, 1878.

**Hof**: town; in Upper Franconia, Bavaria; on the Saale; 103 miles by rail S. S. W. of Leipzig (see map of German Empire, ref. 5–F). It has a fine church, built in 1299 and thoroughly restored in 1884, and extensive manufactures of cotton, woolen, linen, leather, and colors. Pop. (1895) 27,558.

**Hofdijk**, WILLEM JACOBSZOON: poet and writer; b. in Alkmaar, Holland, June 27, 1816. He was early powerfully influenced by the Romantic movement, and in 1839 had already completed a romantic poem, *Rosamunde*. This attracted some attention from literary people, especially from van Lennep, who subsequently befriended the young poet. In 1841 he obtained a clerk's position under the city government at Alkmaar, which he held till 1851, when, through van Lennep's offices, he was made instructor in Dutch History and Literature in the gymnasium at Amsterdam. Throughout his life he was a prolific writer both in verse and prose. Of longer poems we have from him *De Bruidsdans* (1842); *De Jonker van Brederode* (1849); *Een Kunstenaars-idylle* (1849); *Aeddon* (1852); *Helene* (1854); *Zuid en Noord* (1861); *In't harte van Java* (1881); *In het gebergte Di-Eng* (1884); *Dajang Soembi* (1886). Collections of shorter pieces and ballads are *Kennemerland. Balladen* (1850–52); *Verspreide Gedichten* (1860); *Romantische Poëzy* (1867); *Malven en asters* (1880). With less success Hofdijk essayed dramas, or dramatic poems: *Griffo de Salier* (1852); *Theda* (1854); *De bloem der waereld* (1854); *Vondel gekroond* (1858); *Een bouze eed* (1868); and others. The more important among Hofdijk's prose-works are *Geschiedenis der Nederlandsche Letterkunde* (1856); *Historische Landschappen* (1856); *De Kloosterorden in Nederland* (1862); *Geschiedenis des Nederlandschen Volks* (3 vols., 1865–72); *Voor 300 jaren* (1865–71); *Willem Frederik Hendrik, Prins der Nederlanden* (1880). D. at Arnhem, Aug., 1888.

A. R. MARSH.

**Ho'fer**, ANDREAS: soldier and patriot: b. at St. Leonard, in the Tyrol, Nov. 22, 1767; became a vintner and horse-merchant; took command of a party of riflemen serving against the French 1796; took a prominent part (1803–09) in the public affairs of the Tyrol: led in the uprising of the people against the French and Bavarians 1809; gained the important battles of Sterzing and Innspruck; defeated Lefebvre and drove him out of the province, and was declared ruler of the Tyrol. Soon after, Austria having been reduced to submission by Napoleon, Hofer, who having renewed hostilities was excluded from the amnesty, was betrayed for money by one of his most trusted followers, and was taken prisoner and shot by order of Napoleon at Mantua, Feb. 20, 1810.

Revised by F. M. COLBY.

**Höfer**, EDMUND: novelist; b. in Greifswald, Germany, Oct. 15, 1819; studied philology and history in Greifswald, Berlin, and Heidelberg; in 1842 returned home and devoted himself to writing; ten years later he published a collection of stories under the title *Aus dem Volk*. In 1854 he removed to Stuttgart and founded the *Hausblätter* in company with Hackländer. His observation was keen and his perception fine, and his best work is of a high order of artistic realism; but he wrote too much to write always well, and only a few of his works have permanent value. Among them are *Gedichte* (1853; 2d ed. 1856); *Schwanwiek* (1856); *Bewegtes Leben* (1856); *Wie das Volk spricht* (8th ed. 1876); *Norien, Erinnerungen einer alten Frau* (1858); *Die Honoratiorentochter* (1861); *Altermann Ryke* (1865); *Ein Findling* (1868); *Der Demagoge* (1872); *Zur linken Hand* (1874); *Der Junker* (1878); *In der letzten Stunde* (1881). See *Ausgewählte Schriften* (14 vols., 1882). D. at Cannstatt, May 23, 1882.

**Höffding**, HARALD, Ph. D.: b. in Copenhagen, Denmark, Mar. 11, 1843; educated in college and university at Copenhagen; has been in turn school-teacher, privat docent, public docent, and, since 1883, Professor of Philosophy in the University of Copenhagen. In 1881 he was made a member of the Royal Danish Society for Science. He has published, in Danish, *The Conception of Will in the Greek Philosophy* (1870); *Philosophy in Germany since Hegel* (1872); *Contemporary English Philosophy* (1877; German trans. 1889); *Life and Philosophy of Spinoza* (1877); *Outlines of Psychology* (1882; German trans. 1887, and 2d ed. 1892; English trans., London and New York, 1891, from the German of 3d ed.); *Psychological Researches* (1889; German trans. as articles in the *Vierteljahrschrift für wissenschaftliche Philosophie*, vols. xiii. and xiv.); *Human Ethics* (German trans.) and *Ethical Researches* (1891; partly translated as articles in *The International Journal of Ethics* and *The Monist*). Prof. Höffding describes himself as a "critical Positivist," influenced much by the English psychologists. He emphasizes the principle of association as the law of an inner synthesis or activity of mind. In ethics he is a Utilitarian as far as the ethical criterion is concerned, but does

not follow the English in making personal welfare the ethical motive or end. J. Mark Baldwin.

**Hoffman**, Charles Fenno, M. A.: author; b. in New York in 1806. He was educated at Columbia College. In 1827 he was admitted to the bar, and was afterward (1833–47) editorially connected with the New York *American*, *The Knickerbocker Magazine*, the New York *Mirror*, etc. He published *A Winter in the West* (1835); *Wild Scenes in the Forest and Prairie* (1837); *Greyslaer*, a novel (1840); *The Vigil of Faith and other Poems* (1842); *The Echo*, poems (1844); *Love's Calendar* (1848); and an edition of his poetical works, edited by E. F. Hoffman, appeared in 1874. He was in 1846–47 editor of *The Literary World*, and soon after was attacked by a mental disease, in consequence of which he lived in retirement. He was a half-brother of Murray Hoffman. D. in Harrisburg, Pa., June 7, 1884.

**Hoffman**, David, LL. D. (Oxon.), J. U. D. (Göttingen): lawyer and author; b. in Baltimore, Dec. 25, 1784; Professor of Law in the University of Maryland 1817–36; traveled in Europe for two years, after which he practiced law in Philadelphia till 1847; then went to Europe to gather materials for a history of the world, two volumes of which (completing the history to the year 573), entitled *Chronicles Selected from the Originals of Cartaphilus, the Wandering Jew*, were published in London in 1853. In 1853 he returned to the U. S. He published also *A Course of Legal Study* (1836; 2d ed.); *Legal Outlines* (1836); *Miscellaneous Thoughts*, etc., by Anthony Grumbler (1837); *Viator, or a Peep into my Note-book* (1841); *Legal Hints* (1846), etc. D. in New York city, Nov. 11, 1854.
Revised by F. Sturges Allen.

**Hoffman**, Eugene Augustus, D. D., D. C. L., LL. D.: clergyman; b. in New York city, Mar. 21, 1829; educated at Harvard College (graduated 1848) and at the General Theological Seminary (graduated 1851); rector of Grace church, Elizabeth, N. J., 1853–63; of St. Mary's church, Burlington, N. J., 1863–64; of Grace church, Brooklyn Heights, N. Y., 1864–69; of St. Mark's church, Philadelphia, Pa., 1869–79; appointed dean of the General Theological Seminary, New York, in 1879. He has published numerous pamphlets, tracts, sermons, and historical papers. Dean Hoffman and members of his family have munificently endowed the institution of which he is the head.
Revised by W. S. Perry.

**Hoffman**, Murray: jurist; b. in New York, Sept. 29, 1791; graduated in 1809 at Columbia College; was admitted to the bar, and was assistant vice-chancellor (1839–43) and judge of the superior court of New York (1853–61). He published *Office and Duties of Masters in Chancery and Practice in the Master's Office* (1824); *A Treatise on the Practice in the Court of Chancery* (1834–40, 3 vols.); *Treatise upon the Estate and Rights of the Corporation of New York as Proprietors* (1853); *Reports of Cases, Court of Chancery* (1839–40; 3d ed. 1874); *On the Law of the Protestant Episcopal Church in the United States* (1850); *Ecclesiastical Law in the State of New York*; *The Ritual Law of the Church* (1872); *Law and Practice as to References, and the Powers and Duties of Referees* (1875), etc. D. in Flushing, L. I., May 7, 1878. Revised by F. Sturges Allen.

**Hoffman**, Richard: pianist; b. in Manchester, England, May 24, 1831; removed to the U. S. in 1847, where he has since resided. He made an early appearance as a pianist, and for many years maintained a reputation as one of the best resident pianists in New York. He was associated with Julius Benedict in the tour with Jenny Lind in 1850, and frequently played with Benedict, Gottschalk, and others in concert tours. He has all his life been engaged in teaching in New York city, and his compositions, with few exceptions, are for the piano. D. E. Hervey.

**Hoffman**, Walter James, M. D.: ethnologist; b. at Weidasville, Pa., May 30, 1846. He graduated from Jefferson Medical College, Philadelphia, Pa., in 1866, and practiced his profession in Reading, Pa., until the outbreak of the Franco-German war, when he was commissioned as surgeon in the Prussian army. Upon returning home he was appointed acting assistant surgeon, U. S. army, and was attached as naturalist to the expedition for the exploration of Nevada and Arizona, Lieut. Wheeler, U. S. Engineer Corps, commanding; was ordered to the military post at Grand River agency, North Dakota, in 1872, and detailed as surgeon to the expedition commanded by Gen. Stanley for the selection along the Yellowstone river of a route for the Northern Pacific Railroad. He was detailed in charge of the ethnological and mineralogical material of the U. S. Geological Survey, under Dr. Hayden, in 1877, and at the organization of the bureau of ethnology, in 1879, was appointed assistant ethnologist. Dr. Hoffman is author of numerous contributions relating to ethnology, biology, and folk-lore. For services in medicine and science he has been ten times decorated by foreign powers. J. W. Powell.

**Hoffmann**, Ernst Theodor Wilhelm: writer; b. at Königsberg, Prussia, Jan. 24, 1776. He studied law, and held various judicial offices in Posen and Warsaw for some years. In 1816 he was appointed councilor of the court of judicature in Berlin, where he died July 24, 1822. His life was full of troubles and very unhappy. In his early manhood he was thrown out of his position by Napoleon's invasion, and for several years he was compelled to earn an uncertain livelihood by giving lessons in music and drawing, two arts of which he was a perfect master. He composed several operas. When he was once more reinstated in his judicial office he evinced an irritability of mind and had contracted habits which made him unfit for society. He retired from the drawing-room to the tavern, where his sparkling wit and brilliant imagination soon gathered a circle of revelers around him, and where the last of his fine gifts were as rapidly destroyed. His first book, *Phantasiestücke in Callots Manier* (1814), is a collection of essays or papers chiefly on music, and in spite of a somewhat willful singularity, both in style and ideas, they are worthy of being read. His next great work, *Elexire des Teufels* (1816), is also brilliant and powerful, though it is still more wild, weird, and eccentric. His last effort was *Lebensansichten des Katers Murr* (1821–22); but although this book is considered his chief work by many, it is really only the ruin of his mind. Among his minor novels there are many which may be considered as very good, such as *Meister Martin und seine Gesellen*, *Das Fraülein von Scudery*, *Doge und Dogaresse*, etc. Greatly overestimated at his time, he is a typical representative of the vagaries and eccentricities of the earlier Romantic school, and it is quite significant that he should have been imitated by the same school in France. See Hitzig, *Hoffmanns Leben und Nachlass*; Z. Funk, *Aus dem Leben zweier Dichter* (1836). Revised by Julius Goebel.

**Hoffmann**, Hans: poet and novelist; b. in Stettin, Germany, July 27, 1848; studied philology and history at Bonn, Berlin, and Halle; traveled in Italy and Greece, and became a teacher in Stettin, his native city. Since 1879 he has devoted all of his time to literature, and has produced a number of stories and novels which, by their humor and their refined artistic form, rank among the very best of contemporary German fiction. His collection of poems, *Am Wege gepflückt* (1893), also contains many gems of lyric verse. Among his novels may be mentioned *Unterm blauen Himmel*, *Von Frühling zu Frühling*, *Iman der Schreckliche und sein Hund*, *Der eiserne Rittmeister*, *Ruhm*, *Landsturm*.
Julius Goebel.

**Hoffmann**, Friedrich, M. D., F. R. S.: b. at Halle, Germany, Feb. 19, 1660; graduated M. D. at Jena 1681; practiced medicine with great renown at Minden and Halberstadt; became physician to the King of Prussia 1708; was Professor of Medicine at Halle 1693–1742. Hoffmann is memorable as one of the first to introduce the modern or scientific spirit into the Galenic or regular medical system of his time. His special medical theories, however, were of only temporary value, and have been long forgotten. His greatest work was *Systema Medicinæ Rationalis* (9 vols., 1718–40). Others were *Medicina Consultatoria* (12 vols., 1721–39) and other works, including five volumes of posthumous *Opuscula*. His name is perpetuated by Hoffmann's Anodyne (*q. v.*). D. at Halle, Nov. 12, 1742.

**Hoffmann von Fallersleben**, -fŏn-faal-ers-lā'ben, August Heinrich: poet and scholar; b. at Fallersleben, in Hanover, Apr. 2, 1798; studied at Göttingen and Bonn; became librarian in 1823, and Professor of German Language and Literature in 1830 at the University of Breslau, but was dismissed in 1842 on account of his *Unpolitische Lieder* (1840–41, 2 vols.) and banished from Prussia. For several years he led a wandering life, but settled in 1845 in Mecklenburg; was rehabilitated in Prussia in 1848 and received a pension; edited 1854–57 the *Weimarisches Jahrbuch*, and became in 1860 librarian at the Castle of Corvey. The most prominent of his linguistic and historical writings are *Horæ Belgicæ* (1830–62); *Fundgruben für Geschichte deutscher Sprache*

*und Literatur* (2 vols., 1830–37); *Geschichte des deutschen Kirchenliedes bis auf Luther* (1832; 2d ed. 1854); *Altdeutsche Blätter* (1835–40); *Spenden zur deutschen Literaturgeschichte* (1844); *Die deutschen Gesellschaftslieder des 16. und 17. Jahrhunderts* (2d edit. 1860); autobiography, *Mein Leben* (1868); of his poems, besides above mentioned, *Unpolitische Lieder* (1841); *Allemannische Lieder* (1843); *Soldatenlieder* (1851); *Kinderlieder* (1845); *Ausgewählte Gedichte* (8th ed. 1875). D. at the Castle of Corvey, Jan. 19, 1874. Revised by BENJ. IDE WHEELER.

**Hoffmann's Anodyne** (*Spiritus ætheris compositus*): a valuable anodyne mixture of common ether, ethylic alcohol, and the heavy oil of wine. It overcomes spasm, pain, and nausea, and is useful to expel flatus and stop hiccough. It was named from its inventor, Friedrich Hoffmann (1660–1742).

**Hö'fler**, KARL ADOLPH KONSTANTIN RITTER, von: historian; b. Mar. 26, 1811, at Memmingen, Bavaria; studied at Munich and Göttingen; visited Italy; became Professor of History at Munich in 1840, but was removed in 1847 on account of his *Concordat und Constitutionseid der Katholiken in Bayern*, and accepted in 1851 a chair of History at Prague. He has been a champion of the Germans as opposed to the Czechs. The most prominent of his writings are *Die deutschen Päpste* (1839); *Fränkische Studien* (1853); *Die Geschichtsschreiber der hussitischen Bewegung* (1856–65); *Papst Adrian VI.* (1880); *Abhandlungen aus dem Gebiet der slawischen Geschichte* (5 vols., 1879–83).

**Hofmann**, AUGUST WILHELM: chemist; b. at Giessen, Germany, Apr. 8, 1818; studied law, and afterward chemistry under Liebig. In 1845 he became a teacher of chemistry in the University of Bonn. From Bonn he went to England to take charge of the new Royal College of Chemistry, an institution modeled after the laboratory of Liebig in Giessen. In 1853 he became Professor of Chemistry in the Royal School of Mines, still remaining at the head of the College of Chemistry; in 1864 was invited to Bonn to build a university laboratory, and became its director. In 1865 he was called to Berlin, where he remained until his death, May 5, 1892. His researches on aniline and similar bases were extraordinarily fruitful from the point of view both of pure science and of chemical industry. They led to the present conception of the constitution of aniline, so far as its relation to ammonia is concerned, and formed an important part of the foundation of what is called "modern chemistry." In 1858 he obtained fuchsine by treating aniline with carbon tetrachloride. Founded the *Deutsche chemische Gesellschaft.* Author of *Einleitung in die moderne Chemie.*

**Hofmann**, HEINRICH K. J.: See the Appendix.

**Hofmann**, JOSEPH: See the Appendix.

**Hofmann-Peerlkamp**, PETER: See PEERLKAMP.

**Hofwyl**: See FELLENBERG.

**Hog**: See SWINE.

**Hogarth**, GEORGE: journalist and music critic; b. in England, 1783. He was educated for the legal profession; studied music as an amateur; in 1834 settled in London; became sub-editor and music critic of *The Morning Chronicle*, and in 1846 took a similar position on *The Daily News.* In 1850 he became secretary to the Philharmonic Society, and in 1862 published a history of that society from its foundation in 1813. He wrote a *History of the Opera* in two volumes (1838), and also a volume of *Musical History, Biography and Criticism* (1835). His eldest daughter, Catherine, was married to Charles Dickens, Apr. 2, 1836. Hogarth died Feb. 12, 1870. His history of the opera is entertainingly written, but not entirely to be depended upon.

D. E. HERVEY.

**Hogarth**, WILLIAM: painter and engraver; b. in London, Nov. 10, 1697, and at first apprentice to Ellis Gamble, a silver-plate engraver. While still an apprentice he engraved his first plate for printing, a business card for his master; and he was hardly out of his time and a free man before his own business card, "W. Hogarth Engraver," in a very well-designed frame in the taste of the time, and dated "Aprill ye 23, 1720," showed that he intended at first to follow the trade he had learned, and engrave ornamental designs on silver vessels and the like. But he had a chance to engrave illustrations for one or two books, and then in 1724 appeared the first of his many satirical prints, *Masquerades and Operas.* In this are shown crowds at the gate of the opera-house, of the pantomime, of a juggler, and another crowd helped by the devil in person into the building where a masquerade is to be held, while a wheelbarrow full of books, lettered with the names of the great English dramatists, is being trundled away for sale to the shops as waste-paper. Beyond is the gate of Burlington House, lettered "Accademy of Arts," and upon its summit is a statue entitled "W. Kent," the name of a not wholly despicable painter, gardener, architect, and general utility man in high favor just then, while seated statues of Raphael and Michelangelo serve as pendants. It is an awkward design, but Hogarth had already learned to draw men and women in movement, and to compose a crowd, which not every painter can do. About 1726 he began to paint seriously in oil, giving the reason for this in his remarks about the stealing of his designs by publishers, who copied his prints with but slight changes, and sold these copies instead of his own works. His early paintings were nearly all groups and scenes of several persons in each. Before 1731 he had completed the six important pictures of *The Harlot's Progress*, and in that year he exhibited them, issued his engraved ticket to subscribers for the prints, received nearly 1,200 names, and began the engraving, which he did entirely with his own hand, as it appears. The invasion of his rights as designer was in great part remedied by a bill which passed Parliament in 1735, and which was in a great measure obtained by Hogarth's efforts. Meantime the eight pictures of *The Rake's Progress* had been painted, exhibited, and engraved; his subscription ticket this time was the well-known *Laughing Audience*; there were many subscribers, and the prints were ready in the summer of 1735. About the same time his father-in-law, Sir James Thornhill, having died, the art school of that painter came into Hogarth's hands; out of it there grew a society for art study with classes for study of the living model, and this flourished and was useful until made unnecessary in 1762 by the newly established schools of the Royal Academy.

Hogarth painted some religious pictures and some portraits about this time; in 1740 the admirable portrait of Capt. Coram, chief organizer of the London Foundling Hospital, in which institution that fine head, with the immortal *March to Finchley*, and two large paintings of biblical subjects are still to be seen. The set of *Morning*, *Night*, *Noon*, and *Evening*, with admirable studies of out-of-door life in London, the *Strolling Actresses Dressing in a Barn*, the *Enraged Musician*, and the *Distressed Poet* belong to this time, and then followed what is often called his masterpiece, the set of the *Marriage à la Mode.* All the original pictures are preserved, except the *Actresses*, which was burned many years ago; the six pictures of the *Marriage* are in the National Gallery in London, together with a portrait of Hogarth by himself, with a dog beside him, a portrait of Simon Fraser, Lord Lovat, and one of Mary Hogarth—all these being works of this his best time. All these pictures were engraved, and the prints sold readily. He was fifty years old, and in comfort as a worthy citizen of London, but his diligence and vigor never flagged, and he produced in rapid succession *Calais Gate* (1749); the *March to Finchley*, in which he made admirable fun of the confusion attending the breaking up of a camp, as he had seen it when the Guards began their march toward Scotland at the coming of the Young Pretender in 1745; and *The Election*, four pictures of the abuses and oddities of a parliamentary election contest. All these were engraved, and some large satirical prints were issued of which no paintings are known; moreover, a great number of small studies, subscription tickets, book-plates, and the like were published.

There are two points of view from which Hogarth should be especially studied—(1) as an original engraver (see ENGRAVING), a *peintre-graveur*, if there ever was one; and (2) as one of the first of those men who have been at once artists in the technical sense, careful of and successful in the use of color, and historians or chroniclers, great at the telling of a tale. His methods as a painter were excellent, his work has endured the test of time, and is generally well preserved; and it is most worthy, sound, and meritorious. His power of story-telling, his handling of a busy and moving crowd, his gift at telling and appropriate detail, his satiric and humorous insight are all unsurpassed. The prints are of endless interest from their subject, and those of them which are from his own engravings show a strong and capable touch as an engraver; but to study his work in the original paintings is to gain a lesson in the combination of fine art with description, narrative, and satire hardly to be matched elsewhere.

Hogarth died Oct. 25, 1764. His most important works

have been named above. Small engraved copies of the greater number of his compositions have been made, and have been republished frequently. Nichols & Stevens's *The Genuine Works of William Hogarth* (3 vols., 1808–17) contains 210 of these octavo-size prints. Mr. Austin Dobson, who wrote the article *Hogarth* in the *Encyclopædia Britannica* and that in the *Dictionary of National Biography*, has expanded the latter article into a volume, *William Hogarth* (1891), containing eleven photogravures and about forty other illustrations. RUSSELL STURGIS.

**Hoge**, hōg, MOSES DRURY, D. D., LL. D.: a minister of the Presbyterian Church South; b. in Hampden-Sidney, Va., Sept. 17, 1819; educated in the College and Union Theological Seminary of Hampden-Sidney; was assistant pastor of the First Presbyterian church of Richmond 1843–45, and has since, from its organization, been the pastor of the Second Presbyterian church of the same city. In 1864 he ran the blockade from Charleston, and procured from the British Bible Society a grant of some 300,000 copies of the Scriptures for the Confederate soldiers. He was moderator of the General Assembly (South) at St. Louis in 1875; a delegate to the international meetings of the Evangelical Alliance in New York (1873) and Copenhagen (1884); to the national meeting in Boston (1889); and to the councils of the Reformed Churches (Pan-Presbyterian) in Edinburgh (1877) and in London (1888). In 1890 services were held commemorating his forty-five years of service, and a commemorative volume published.
CHARLES KIMBALL HOYT.

**Hogg**, JAMES: "the Ettrick Shepherd"; poet; b. in Ettrick parish, Selkirkshire, Scotland, Jan. 25, 1772; followed his ancestral occupation of shepherd, and several times attempted, with poor success, to gain a living as a farmer on his own account. His school education was very slight, but he was a great reader, and when twenty-four years old began to compose songs, some of which attracted much attention and gave him a local fame. In 1801 he published *Scottish Pastorals, Poems and Songs*, followed by *The Mountain Bard* (1803); became in 1810 editor of *The Spy*, a journal in Edinburgh. Here he was the associate of Scott, Wilson, and the other Tory men of letters, and a frequent contributor to *Blackwood*. His figure in the *Noctes Ambrosianæ* did not please him, but it added to his fame. In 1817 the Duke of Buccleugh settled him upon the farm of Altrive, where his unlucky business ventures brought him many troubles; but here he lived for the greater part of his remaining years, engaged mainly in literary work, varied by field-sports, of which he was very fond; and here he died Nov. 21, 1835. His best work, *The Queen's Wake* (1813), was followed by a large number of volumes of prose and verse of very unequal merit. Revised by H. A. BEERS.

**Hogg**, QUINTIN: English philanthropist; son of Sir James Weir Hogg, Bart.; b. Feb., 1845; educated at Eton. On leaving school he became interested in homeless boys in London, and began with humble apartments in the Strand, which he shared with six or eight lads. He greatly increased his work, and built up the Youths' Christian Institute, which, on the purchase of the old Polytechnic in Regent Street, 1880, became known as the Polytechnic, and had in 1891 a membership of 12,000. Mr. Hogg has expended over $500,000 in his work. C. H. T.

**Hogg**, WILSON THOMAS: a minister and officer of the Free Methodist Church; b. at Lyndon, Cattaraugus co., N. Y., Mar. 6, 1852; educated at Franklinville, N. Y., and Ten Broeck Free Academy; joined the Genesee conference 1873, and served several pastorates in Buffalo and other leading churches of Western New York till 1893; elected president Greenville College, Greenville, Ill., 1893. Was elected general superintendent Apr. 4, 1893. Has published *Handbook of Homiletics and Pastoral Theology* (1887) and *Revivals and Revival Work* (1890). ALBERT OSBORN.

**Hog-gum**, or **Gum Hog**: a variety of Bassora gum, used in preparing paper for the marbling process. The hog-gum of the West Indies, used in medicine and for paying boats, is furnished by various trees of the genera *Clusia* and *Moronobea*, and perhaps by *Rhus metopium* and *Heiwigia balsamifera*.

**Hog-plum**: the fruit of *Spondias lutea, tuberosa, purpurea*, and *Mombia* of Brazil and the West Indies, so called because hogs are fed upon the abundant and rather agreeable fruits. The fruit of *S. birrea* of Senegal and Abyssinia yields an intoxicating drink. That of *S. dulcis* or *Poupartia*, which grows in the Society islands, is very delicious. Several of the above and other species have medicinal qualities. They belong to the family *Anacardiaceæ*.

**Hogshead** [M. Eng. *hoggeshed*, orig. meaning, however, *ox-head*; cf. Low Germ. *okshoofd*, Swed. *oxhufvud*]: in wine-measure half a pipe, or 63 wine-gallons. In beer-measure a hogshead contains 54 beer-gallons. The first kind contains 52½ imperial gal., nearly; the second about 55 imperial gal. Any large cask is in popular language called a hogshead. In the U. S. a hogshead of tobacco weighs from 750 to 1,200 lb., varying in the different States.

**Hohenlohe**, hō′en-lō-*e* [Germ., cf. M. H. Germ. *hôch*, high + *lôh*, thicket, brush]: name of a princely family of Germany, sprung from Franconia, where the Castle of Holloch was the family seat; since the twelfth century the possessors of this castle have called themselves lords of Holloch. They acquired much landed property, became counts, and branched off into various lines. In 1776 the Counts of Hohenlohe were created princes of the empire. The family comprises two principal lines — Hohenlohe-Neuenstein and Hohenlohe-Waldenburg, of which the former is subdivided into the lines of Hohenlohe-Langenburg and Hohenlohe-Oehringen, the latter into those of Hohenlohe-Bartenstein and Hohenlohe-Schillingsfürst; these lines consist furthermore of many branches. The following members of the family are known to history: (1) FRIEDRICH LUDWIG, Prince of Hohenlohe-Ingelfingen, Prussian general, b. 1746; d. 1818. He is famous for the capitulation at Preuzlau, Oct. 28, 1806, where, having received the command of the Prussian army after the Duke of Brunswick, who was wounded in the battle of Jena, he made 17,000 men lay down their arms. (2) LUDWIG ALOYSIUS, Prince of Hohenlohe-Waldenburg-Bartenstein, b. 1765; d. 1829. He distinguished himself in the French, Dutch, and Austrian services as an able officer, fighting on the side of the allies against the revolutionary government of France and Napoleon, but after the restoration entered the service of Louis XVIII. and became marshal and peer of France. (3) ALEXANDER LEOPOLD FRANZ EMMERICH, Prince of Hohenlohe-Waldenburg-Schillingsfürst, b. 1794; d. 1849. He was educated by the Jesuits, became a priest, wrote mystical books, attracted swarms of believing patients, and had great fame as a healer of the sick by miraculous power. At the time of his death he was Bishop of Sardica *in partibus*. (4) CHLODWIG KARL VICTOR, Prince of Hohenlohe-Waldenburg-Schillingsfürst, ambassador of the German emperor to France; b. Mar. 31, 1819. He entered the Bavarian service, pursued a national policy, worked with success for a good understanding between Prussia and Bavaria, and became president of the Bavarian ministry in 1866. He did much for the unity of Germany, especially as vice-president of the German Zoll-Parliament of 1868 and 1869. But the anti-union party in Bavaria became so hostile that he resigned his office a short time before the Franco-German war broke out. After the war he voted for the incorporation of Bavaria in the empire, and in general was a supporter of Bismarck's policy. In 1874 the German emperor appointed him ambassador to the French Government. In 1883 he was appointed governor of Alsace, where he exerted himself to hasten the Germanization of the country.
Revised by F. M. COLBY.

**Hohenstaufen**, hō′*en*-stow-*fen* [Germ., cf. M. H. Germ. *hôch*, high + *stouf*, cliff, rock; cf. Eng. *steep*]: the name of a princely family in Germany which arose in the middle of the eleventh century, bore the imperial crown from 1138 to 1254, and died out in the latter part of the thirteenth century. The founder of the family was Friedrich von Büren, who in the middle of the eleventh century moved his residence from Büren, a place in the valley, on the bank of the Danube, in the present kingdom of Würtemberg, to the Castle of Hohenstaufen, situated on the brow of the hill. With the change of residence changed also the name of the family. Friedrich von Büren's son, FRIEDRICH VON STAUFEN or HOHENSTAUFEN, followed Henry IV. as his true knight, and distinguished himself so much by valor and military talents, especially in the battle of Merseburg (1080), that the king made him Duke of Suabia, gave him his daughter Agnes in marriage, and appointed him regent in Germany during his absence in Italy. By this rapid rise the family of Hohenstaufen (also called by the Italians *Ghibellines*, from another of their possessions, the Castle of Weiblingen) could not help coming into collision with the powerful family of the Welfs or Guelphs, which in Germany held the dukedom of Bavaria besides large possessions in Italy. On the death of Frederick

in 1105 he left two sons, of whom the elder, Frederick II., was confirmed as Duke of Suabia by Henry V., and the younger created Duke of Franconia in 1112. Both the brothers adhered with great fidelity to the emperor, and when, in 1125, the Franconian dynasty died out with Henry V., the family of Hohenstaufen inherited a large part of the emperor's private fortune, which greatly increased its wealth and power. Frederick II. even attempted to obtain the imperial dignity, but failed. Lothair the Saxon, an enemy to him and his family, was chosen emperor, and at one time the Hohenstaufens were pressed so hard that they had to sue for peace at the diet of Mühlhausen in 1135. Nevertheless, on the death of Lothair in 1138, Frederick II.'s brother, Conrad, Duke of Franconia, succeeded in being elected emperor, and the family held the dignity for more than a century in the persons of Conrad III., 1138–52; Frederick I. Barbarossa, 1152–90; Henry VI., 1190–97; Philip, 1197–1203; Frederick II., 1212–50; Conrad IV., 1250–52. The characters of these men, whose biographies are in this cyclopædia, were conspicuous for vigor and energy, tending toward despotism, but generally allied with magnanimity and many brilliant qualities. The most prominent feature of their reign was their perpetual contest with the Guelphs and the popes, during which, however, the poetry and art of German chivalry reached their highest perfection. See Raumer, *Geschichte der Hohenstaufen* (5th ed. 1878).

Revised by C. K. Adams.

**Hohenzollern**, hō′en-tsōl-ern: a small territory of Germany, entirely inclosed by Würtemberg and Baden, but belonging to Prussia. Its area is 453 sq. miles; it is mountainous, but fertile, drained by the Neckar and the Danube. Until 1849 it formed two independent principalities, Hechingen and Sigmaringen, which represent the elder line of the house of Hohenzollern, while the younger line is represented by the reigning dynasty of Prussia. In 1849 the King of Prussia bought the sovereignty of the country by paying the two princes an annual pension. Pop. (1895) 65,752.

Revised by C. K. Adams.

**Hohenzollern**: name of a princely family of Germany, from which the present imperial dynasty is descended. It traces its origin back to one Thassilo of Burchardinger, who is thought to have built the Castle of Zollern near Hechingen about the beginning of the ninth century. The early history of the line is obscure, but in the latter part of the twelfth century Count Frederick III. brought the family into notice by the prominent part that he took in the councils of the court. By marrying the heiress of the Burgrave of Nuremberg he secured the inheritance to the burgravate. His sons, Conrad III. and Frederick IV., succeeded to the joint possession of his titles and estates, and founded respectively the Franconian and the Suabian lines. The Suabian line separated in 1576 into two branches—Hohenzollern-Hechingen and Hohenzollern-Sigmaringen. The former was raised to the princely rank in 1623 by the Emperor Ferdinand II. In 1695 a covenant of inheritance was concluded between the two branches of the Suabian line and the younger or Frankish line, which had assumed the name of Brandenburg. Hermann Friedrich Otto, sovereign Prince of Hohenzollern-Hechingen, joined in 1806 the Rhenish confederation. Prince Frederick William Constantine, on failing to suppress the political disturbances of 1848–49, concluded a treaty with Prussia by which he transferred his sovereignty to the Prussian crown. On his death in 1869 the male line of Hohenzollern-Hechingen became extinct. The branch of Hohenzollern-Sigmaringen obtained the princely dignity in 1638, joined the Rhenish confederation in 1806, became allied to the imperial house of Napoleon by the marriage of Prince Carl with the daughter of Murat, King of Naples, and ceded its sovereignty to Prussia in consequence of the revolution of 1849. The princes of this branch, however, have since been prominent in European politics. Leopold, through his claim on the Spanish throne, became the occasion of the Franco-German war. His brother Karl was chosen King of Roumania in 1881. The younger line, the Franconian, generally named after its chief possession, the burgravate of Nuremberg, obtained the princely dignity in 1273 from the Emperor Rudolf. Frederick VI., Burgrave of Nuremberg, bought the margravate of Brandenburg from the Emperor Sigismund in 1415, and was created Elector of Brandenburg. In 1511 Albert of Brandenburg was chosen grand master of the Teutonic Knights, and in 1525 was acknowledged Duke of Prussia. Frederick William, the Great Elector (1640–88), gave the country political influence, acquired new provinces, and left at his death a state with 1,500,000 inhabitants. His son, Frederick III., attained the royal dignity, and was crowned Jan. 18, 1701, in Königsberg as Frederick I., King of Prussia. He was followed by the thrifty Frederick William I.; then Frederick II., the Great, who left his state with 6,000,000 inhabitants; then Frederick William II.; then Frederick William III., who was defeated by Napoleon, but regained his country; then his son, Frederick William IV.; then his younger son, William, who became William I., Emperor of Germany, Jan. 18, 1871. He was succeeded by his son (Frederick III.) Mar. 9, 1888, and the latter by his son (William II.) June 15, 1888.

F. M. Colby.

**Hoihow** (the Cantonese pronunciation of Chinese *Hai-K'ow*, seaport): the principal port of Hainan (*q. v.*), situated in the northeast part of the island at the head of a shallow bay which extends inland about 3 miles. It is the port of K'iung-chow-foo, the capital of Hainan, opened to foreign trade in 1876. The trade is chiefly with Hongkong and the southern ports of China. The exports amounted in 1892 to 1,002,304 taels, or about $1,052,104 U. S. gold, and the imports (cotton and woolen goods, opium, metals, medicines, etc.), mostly from Hongkong, to 861,773 taels, or about $904,861 U. S. gold. Indian yarn constitutes nearly 39 per cent. of the total value of imports.

R. L.

**Ho'jo**: name of the most powerful family in Japan during the century 1490–1590. Succeeding to the power of the Ashikaga dynasty, which had ruled at Kamakura, the Hojo family established themselves at Odawara, 24 miles to the W. The capture of this castle by Hideyoshi in 1590 overthrew their power, and Yedo (Tokio) became the new military capital.

J. M. D.

**Hok-chiu**: See Fuh-chow.

**Hok'usai**, Katsushika (1760–1849): a famous Japanese painter and draughtsman, held in particularly high esteem by foreign artists.

J. M. D.

**Hol'bach**, Paul Henri Thiry, Baron d': b. at Heidelsheim, in the Palatinate, in 1723. He went at an early age to Paris, where he married and spent his whole life. D. Jan. 21, 1789. His father had left him a large fortune, and in his rich and elegant house he gathered, with the greatest hospitality, a large circle of literary men, chiefly of the group of Diderot and the Encyclopædists. The baron himself was a man both of knowledge and talent, and a very prolific author. His first original works (he had already translated into French several German scientific books and written many scientific articles for the *Encyclopédie* of Diderot), *Le Christianisme dévoilé* (Amsterdam, 1767), *Esprit du Clergé* (London, 1767), and *De l'imposture sacerdotale* (Amsterdam, 1767), made an attack on Christianity more open, direct, and vehement, and also more skillful, than any to which it hitherto had been exposed. In a second series of writings, *Le système de la nature* (London, 1770), *Le bon sens, ou idées naturelles opposées aux idées surnaturelles* (Amsterdam, 1772), and *Le système social* (Amsterdam, 1773), he gives the positive, systematic development of those materialistic and atheistic views which in the first series are given under the form of criticism only. His style is dry or sentimental, affected or trivial. But his influence was great. He reached layers of society to which philosophy never before had penetrated, and his cynical ideas are often recognizable during the first years of the Revolution. He wrote his books under different pseudonyms, and for a long time even his most intimate friends knew nothing of his authorship. See Avezac-Lavigne, *Diderot et la société du Baron Holbach* (Paris, 1875).

Revised by A. R. Marsh.

**Holbein**, hōl'bīn, Hans, called The Younger: painter; b. at Augsburg, Bavaria, in 1497, or perhaps even a few years earlier; received his first instruction from his father, a painter of some note. The days of his youth were spent in Basel, and as early as 1512 his brilliant talent had attracted great attention, and he received large orders both for private houses and public buildings. Erasmus admired his work, and with a letter of introduction from him to Sir Thomas More he went to England in 1526. After living three years in More's house, he was introduced to the king, and Henry VIII. was so charmed by his pictures that he made him court painter and heaped both honors and money on him. D. in London, Nov., 1543, of the plague. In accuracy of drawing, in truth and richness of coloring, Holbein surpassed all contemporary painters in Germany, and stands, indeed, among the greatest painters of the world.

His portraits especially are excellent, and he produced a great number, which are scattered among all the larger European galleries. He painted a portrait of Erasmus which the latter preferred to the one engraved by Dürer. One of his finest pictures is the portrait of his friend and patron, Boniface Amerbach, who made the collection of Holbein's drawings and paintings now at Basel. While in England, Holbein painted or drew not only the king, but his queens, Jane Seymour and Anne of Cleves, Prince Edward, and nearly every distinguished nobleman and noblewoman of his court, besides distinguished commoners. These pictures and drawings are a splendid possession alike for art and for history; a collection of about ninety drawings is in Windsor Castle. Holbein worked for the engravers, but to what extent is not precisely known. Two important series of wood-cuts—*The Dance of Death* (see DANCE OF DEATH) and *Pictures from the Old Testament*—are ascribed to Holbein. One of the most famous pictures by Holbein is the *Madonna of the Meyer Family*, in the gallery of Dresden. This is, however, believed to be a copy, probably by Holbein's own hand, of the original in the palace of the Dukes of Darmstadt. Many of Holbein's best pictures have been engraved, and nearly all his finest drawings photographed, the last chiefly by Braun. See *Hans Holbein der jüngere*, by Ulrich Hegner (Berlin, 1827), a well-executed, useful work, which only needs revision to take its place among the standard books on the subject; *Holbein und seine Zeit*, by Alfred Woltmann (Leipzig, 1867, 2 vols. and appendix; 2d ed. 1 vol., 1874), a book absolutely necessary to the student for its facts, but ill-arranged, and, critically, little to be depended on—the second edition is full of contradictions of the first; a translation of Woltman's book by Cundall (London, 1879); *Life and Works of Holbein*, by R. N. Wornam (1 vol., London, 1867), almost useless from its want of arrangement, its slipshod style, and its want of the critical spirit.

Revised by RUSSELL STURGIS.

**Holberg**, LUDVIG: dramatist; b. in Bergen, Norway, Dec. 3, 1684; studied at the University of Copenhagen, traveled extensively in Holland, France, Germany, Italy, and stayed for nearly two years in England, most of the time studying at the University of Oxford; was in 1717 appointed professor at the University of Copenhagen; accumulated considerable wealth, which he bequeathed to an educational institution, the Academy of Sorö; was created a baron in 1747. His sound, practical ideas, and clear, solid reasoning, sustained by learning and seasoned by humor, made his works on history, *Danmarks Riges Historie* (History of Denmark, i.–iii., 1732–35); *Almindelig Kirkehistorie* (Ecclesiastical History, 1738); *Store Heltes og berömmelige Mœnds sammenlignede Historier* (Lives of Great Men and Heroes Compared, 1739); *Heltinders og navnkundige Damers sammenlignede Historier* (Lives of Great and Famous Women Compared, 1745); *Jödefolkets Historie* (The History of the Jewish People, 1742); and on philosophy, *Epistler* (Epistles) and *Moralske Tanker* (Moral Meditations, 1744), a most influential agent in Danish civilization. The greatest influence, however, on Danish literature was exerted by his comic writings. In 1719 his *Peder Paars*, a comic epopee, celebrating the adventures of Peder Paars, the shopkeeper, on his voyage from Kallundborg to Aars, appeared. With cutting satire Holberg in this poem, in stately alexandrines, derided the snobbishness and ignoble ambitions that ruled supreme almost everywhere in Denmark in those days. The poem caused a great sensation, and made him a great many enemies in influential quarters. It is still read, and is considered a classical work in Danish literature. The first of Holberg's comedies, *Den politiske Kandestöber* (The Political Pewterer), appeared in 1722, shortly after the opening of the Danish theater in Copenhagen. That very year he produced four new comedies, the following year ten more, and before the end of 1725 he had written some twenty odd plays. Among these comedies may be mentioned, as having more than the others retained their popularity up to the present time, *Jeppe paa Bjerget*, *Erasmus Montanus*, *Jakob v. Thyboe* (compare Miles Gloriosus), *Den Stundeslöse* (The Busy Trifler), *Barselstuen* (The Lying-in Room). Holberg's comedies are the chief products of his genius, and have had an influence on Danish and Norwegian civilization as hardly any other man's writings. He made use of many characters and subjects borrowed from Molière, Plautus, Terence, and Aristophanes, but he nationalized them all, so the Danish public in his characters found themselves as in a mirror, with all their more or less amiable follies. Holberg's comedies are still regularly acted on the Danish and the Norwegian stage. The satire has lost its sting, but the humor acts with still undiminished force on the mind of young and old. An intermediate position between Holberg's comical productions and his moralizing writings is held by his "moral novel," *Nicolai Klimii iter subterraneum* (1741), written in Latin, describing the adventures of a young student from Holberg's native city, Bergen, on a trip through the interior of the earth. Holberg in this book discusses, with thoroughness and good sense, a great many questions of social, religious, and ethical interest. D. Jan. 28, 1754.

P. GROTH.

**Holcombe**, JAMES PHILEMON: lawyer and author; b. in Lynchburg, Va., in 1820; was educated at Yale College and the University of Virginia; Professor of Law in University of Virginia 1852–60; was member of the Confederate Congress 1861–63; was principal of a high school from 1868–73. Besides many magazine articles, he was the author of *Introduction to Equity Jurisprudence* (1846); *Leading Cases upon Commercial Law* (1847); *Digest of Decisions of the United States Supreme Court* (1848); *Merchants' Book of Reference* (1848); *Law of Debtor and Creditor in the United States and Canada* (1848); *Literature and Letters* (1868). D. in Capon Springs, Va., Aug. 26, 1873.

Revised by F. STURGES ALLEN.

**Holcroft**, hŏl'krŏft, THOMAS: dramatist; b. in London, Dec. 10, 1745; a shoemaker's son; served for a time as a stable-groom at Newmarket; became an actor, and then an author; was arrested for high treason in 1794, being a member of the Society for Constitutional Information, but was released without trial. Author of thirty plays, besides novels, poems, translations, etc., some of which are of an irreligious tendency. His noteworthy works are *The Road to Ruin*, a comedy (1792), still popular; *The Life of Trenck* (1788), from the German; *Hermann and Dorothea* (1801), translated from the German of Goethe; *Memoirs* by himself, finished by Hazlitt (3 vols., 1816). D. Mar. 23, 1809.

**Hold**: a musical character, 𝄐, placed over a note, signifying a pause, or the holding of the note longer than its proper time. The hold may also be placed over a rest or a double bar, or as an indication of the end of a canon or other piece.

**Holden**, hōl'den: city; Johnson co., Mo. (for location of county, see map of Missouri, ref. 4–E); on the Mo. Pac. Railway; 40 miles W. of Sedalia, 50 miles S. E. of Kansas City. It is in an agricultural and stock-raising region, and contains 10 churches, 2 public schools, water-works, 2 hotels, 2 elevators, a flour and 2 grist mills, fair-grounds of 40 acres with race-track, St. Cecilia's Seminary, several manufactures, and a weekly newspaper. Pop. (1880) 2,014; (1890) 2,520; (1900) 2,126.

**Holden**, ALBERT J.: See the Appendix.

**Holden**, EDWARD SINGLETON, B. S., A. M., LL. D.: astronomer; b. in St. Louis, Mo., Nov. 5, 1846; educated at Washington University, St. Louis, where he was a pupil of Prof. Chauvinet (graduated 1866), and at West Point, where he graduated in 1870. He was appointed lieutenant in the Corps of Engineers. In 1873 he was appointed Professor of Mathematics in the navy, and assigned to duty at the naval observatory as assistant to Prof. Newcomb with the 26-inch telescope, which had just been mounted. In 1878 he had charge of the U. S. eclipse expeditions to Colorado. In 1881 he resigned his naval position to become director of the Washburn observatory, and Professor of Astronomy in the University of Wisconsin. In 1883 he had charge of the U. S. eclipse expedition to the South Pacific Ocean. In 1886 he was appointed president of the University of California, and was director of the Lick observatory 1888–97. In 1877 he took an active part in interpreting the famous cipher dispatches in the presidential campaign of the preceding year. He has published *Astronomy for Students*, with Prof. Simon Newcomb (New York, 1880); *Sir William Herschel; his Life and Works* (New York and London, 1881); *Handbook of Lick Observatory*; publications of the Washburn observatory (5 vols.); of the Lick observatory (1 vol.); and numerous memoirs on astronomical subjects.

S. NEWCOMB.

**Holden**, HUBERT ASHTON, M. A., LL. D.: clergyman and classical commentator; b. in Staffordshire, England, in 1822; educated at King Edward's School, Birmingham, and at Trinity College, Cambridge; tutor from 1848–53; head master of Ipswich School from 1858–83; fellow of the University of London, in which he had been classical examiner, 1869–

74 and 1886–90. He is especially noted as the editor of excellent exegetical commentaries to Cicero's *de officiis*; *Pro Plancio*; *Pro Sestio*; Xenophon's *Cyropædia* and *Œconomicus*; *Octavius* of Minucius Felix, and to a number of Plutarch's *Lives*—viz., the *Gracchi*, *Sulla*, *Timoleon*, *Themistocles* (2d ed. 1884), *Nicias*, and *Demosthenes* (1893).

**Holder**, Charles Frederick: See the Appendix.

**Hölderlin**, Johann Christian Friedrich: poet; b. at Lauffen on the Neckar, Germany, Mar. 20, 1770; studied at Nürtingen, where he became intimate with Schelling: continued his studies at Denkendorf and Maulbroun; was sent to the University of Tübingen in 1788 to study theology, but devoted himself to philosophy and poetry, and made the acquaintance of Schiller, who found him congenial and published some of his poems in *Thalia*. In 1796 he obtained a position as tutor in the family of a banker in Frankfort, and in the course of two years wrote two volumes of *Hyperion, oder der Eremit in Griechenland* (1797–99), in which he extolled the beautiful and accomplished wife of his employer in the heroine "Diotima." Resigning his tutorship he lived for a while with his devoted friend Sinclair, and wrote the fragments *Agis* and *Empedocles*. Meanwhile the burden of life grew too heavy for the sensitive poet to bear and he became insane. See Kelchner, *Friedrich Hölderlin und seine Beziehungen zu Homburg v. d. Höhe* (1883). D. in Tübingen, June 7, 1843.

**Holding-note**: in musical compositions of two or more parts, a note sustained or prolonged in one of the parts while the others are in motion. In fugues, and in adagio, andante, and legato movements, holding-notes are of constant occurrence, and give unity, compactness, and a binding effect to the general texture of the harmony.

**Holdredge**: city (founded in 1883); capital of Phelps co., Neb. (for location of county, see map of Nebraska, ref. 11–E); on the Burl. and Mo. River Railroad; 150 miles W. of Lincoln, 300 miles E. of Denver. It contains 7 churches, 2 public schools, water-works, electric lights, 3 national banks, 5 hotels, board of trade, shops of the Burl. and Mo. River Railroad, and 1 semi-weekly and 3 weekly newspapers. Pop. (1890) 2,601; (1900) 3,007.

Editor of "Nebraska Nugget."

**Holguin**: a city in the eastern part of Cuba; about 62 miles N. N. W. of Santiago, and 20 miles S. S. W. of the port of Jibaro (see map of West Indies, ref. 4–E). It is built on a fertile plain by a small river, and is the center of a rich agricultural district, exporting tobacco, maize, cattle, and timber. Holguin was settled in 1720, and received a city charter in 1751. Pop. (1899) 6,045. H. H. S.

**Holiday**: literally, a holy day; that is, a day set apart to holy or religious uses and observances (see Feasts), and hence any day set apart for relaxation or exemption from the ordinary cares and toil of life, either in commemoration of some event or for pleasure and rejoicing; and hence, in law, any day on which one or more legal obligations, as attendance upon court, service of notices, protesting of notes, etc., are remitted. Holidays being designated in old calendars by red letters are often called red-letter days. For the sake of distinction these days are often called *legal holidays* or *public holidays*.

*Legal Holidays.*—In the wide sense of the term Sunday is a legal holiday, but the law with regard to contracts and the performance of judicial and ministerial duties upon Sunday is so different from that of other legal holidays as to necessitate a separate treatment.

*Sunday.*—One or two laws forbidding secular pursuits on Sunday were passed in England before it became Protestant, but the principal statute regulating the matter in England is that of 29 Charles II., c. 7, in which it was enacted that "no tradesmen, artificers, workmen, laborers, or other person whatsoever shall do or exercise any worldly labor, business, or work of their ordinary callings upon the Lord's day or any part thereof (works of necessity and charity only excepted)."

At the common law, no judicial act performed on Sunday was valid, but all contracts and all other acts not of a judicial nature were of the same effect as if performed on any other day. The statute above mentioned makes all acts performed contrary to it by the persons mentioned in it illegal, but the courts of England have held that the words "any other person whatsoever" were not intended to extend its application to any others than those mentioned, and that any contract made by a person *out* of his ordinary calling is valid. What is a work of necessity or charity (mercy) must be decided according to the circumstances of each case. Most of the U. S. have Sunday laws which forbid the doing of any but works of "necessity and mercy" upon Sunday, and under them *all* acts are void which are not works of necessity or mercy. When a note falls due upon Sunday, it is payable upon the following Monday, and this rule applies to all analogous cases of contract both in the U. S. and in Great Britain.

*Other Holidays.*—Holidays other than Sunday are entirely statutory, and all acts are valid, whether judicial or otherwise, unless expressly or by necessary implication declared invalid in the creating statute. The purpose for which they are usually created are to give exemption from the obligation to perform certain acts, such as the protesting and giving notice of dishonor of notes (*bank holidays*), attendance upon court (*court holidays*), etc. In the case of these holidays a note falling due upon them is payable upon the day previous unless otherwise provided in the statute, either expressly or by necessary implication.

Persons can not be compelled to attend to legal business upon a legal holiday, as, for example, at court, at a sheriff's sale, etc. An employee who is hired by the week, month, or year who works on a general legal holiday at his employer's request can recover extra remuneration; but a day declared a legal holiday for banking purposes, or the like, is not thereby made a general legal holiday. The legal holidays besides Sundays in the U. S. are the Fourth of July (observed in all the States), and generally Christmas, Thanksgiving Day (appointed by the President and the Governors), New Year's Day, Washington's birthday, Decoration Day, Labor Day, and the general election days. Besides these special days or parts of days may be made holidays; thus in New York Saturday is a bank half-holiday.

In England the office holidays of the Supreme Court are Good Friday, Monday and Tuesday in Easter week, Whit-Monday, Christmas Day and the next following working day, and days appointed by proclamation for fasting, thanksgiving, and humiliation. The *bank holidays* are in England and Ireland Easter Monday, the Monday in Whitsun-week, the first Monday in August, and Dec. 26 (or, if this be a Sunday, the day following); in Scotland, New Year's Day, Christmas Day (or, if either be a Sunday, the day following), Good Friday, the first Monday of May, and the first Monday of August. F. Sturges Allen.

**Hol'inshed**, Raphael, or Ralph, M. A.: an English chronicler who died between 1580 and 1584. Almost nothing is known of his life, but his fame is perpetuated by the *Chronicles of England, Scotland, and Ireland* (2 vols. fol., 1577). Of this he was not the sole author, for Harrison, Stow, Fleming, and others prepared large portions.

**Hol'kar**: the name of a family of Mahratta chieftains who have played a conspicuous part in the history of India during the last two centuries, and often proved themselves formidable enemies of the British empire in Hindustan. Mulhar Rao Holkar was the founder of the family. He was born in 1693; received in 1736 the western part of Malwah, with Indor for its capital; and died 1765. But the most remarkable member of the family was Jeswunt Rao Holkar, a natural son of Tokhagi Holkar, who reigned from 1801–11. Although he was defeated at Indor (Oct. 14, 1801) by Dowlat Rao Sindia, his reputation for valor and energy was so great that a part of the victorious army went over to his side, and next year (Oct. 25, 1802) he entirely routed Sindia at Poona. Sindia took refuge with the British, and now a war began between Holkar and the British which was carried on with various success to Dec. 24, 1805, when peace was concluded and Holkar compelled to give up some maritime districts, and bind himself to take no Europeans into his service. He died insane, and was succeeded by his son, Mulhar Rao Holkar, who reigned from 1811 to 1833. He began war against the British in 1817, but was defeated, and under the peace of Jan. 6, 1818, a British residency was established at Indor. The present ruler of Indor (*q. v.*), Mulkerji Rao Holkar, who came into power in 1852 and remained true to the British in 1857, is not of the Holkar family, though he bears the name; with Kumdi Rao Holkar the family died out in 1852.

**Holl**, Frank: portrait and genre painter; b. in London, July 4, 1845; pupil of his father, F. Holl, engraver, and of the Royal Academy; won a gold medal there in 1869 for his *Sacrifice of Abraham*, and a traveling scholarship in 1871 for his picture called *The Lord Giveth and the Lord hath*

*Taken Away*; Royal Academician 1883. He was an excellent portrait-painter, and was the most successful man in England in this branch of art at the time of his death, with the single exception of Sir John Millais. D. in London, July 31, 1888. WILLIAM A. COFFIN.

**Holland** [: Germ., Dan. *Holland*, from Dutch *Holland*, for older *Holtland*, liter., *woodland*; *holt*, wood, woods + *land*, land], **North** and **South**: two provinces forming the northwestern part of the Netherlands, adjacent and similar in natural and social relations. The ground is very low, and must be protected against inundations of the North Sea and the Zuyder Zee by artificial dams and dikes. It is everywhere intersected by rivers, the Rhine, Yssel, Lek, Maas, and Mervede, and canals. But the soil is very fertile, and marvelously well cultivated. The rearing of cattle and the production of butter and cheese are the main pursuits of the inhabitants, but many other kinds of industry are carried on with success. North Holland has an area of 1,070 sq. miles, with (1896) 933,692 inhabitants; the area of South Holland is 1,166 sq. miles, with 1,082,678 inhabitants. The principal towns of North Holland are Amsterdam, Haarlem, and Alkmaar; of South Holland, The Hague, Leyden, Rotterdam, and Gouda. See NORTH HOLLAND CANAL and NORTH SEA CANAL OF HOLLAND. For the nation, see NETHERLANDS.

**Holland**: city; Ottawa co., Mich. (for location of county, see map of Michigan, ref. 7–H); on the Black river, and the Chi. and W. Mich. Railway; 4 miles E. of Lake Michigan, 25 miles S. W. of Grand Rapids. It is in an agricultural, lumber, and fruit region; is a popular summer resort; has a monthly and six weekly periodicals, and is principally engaged in tanning, iron-ore smelting, and milling. It is the seat of Hope College (Reformed Church, opened in 1862), which in 1890 had 13 professors and instructors, 293 students, of whom 128 were women, 5,000 volumes in its library, $45,000 invested in grounds and buildings, and $128,000 in productive funds. Pop. (1880) 2,620; (1890) 3,945; (1900) 7,790.

**Holland**, Sir HENRY, Bart., M. D., D. C. L., F. R. S.: physician and author; b. at Knutsford, Cheshire, England, Oct. 27, 1788; graduated M. D. at Edinburgh 1811; was for many years a physician in ordinary to Queen Victoria, and one of the most popular men, professionally and socially, in London. He several times visited the U. S., and traveled extensively in Europe and Asia. His second wife, a writer of ability, and a daughter of Sydney Smith, died Nov. 2, 1866. Sir Henry was the author of several books on various subjects; the most important are *Medical Notes and Reflections* (1839) and *Recollections of Past Life* (1871). D. in London, Oct. 27, 1873.

**Holland**, HENRY RICHARD VASSALL-HOLLAND, Lord: b. in Wiltshire, Nov. 21, 1773; succeeded in 1774 to the peerage as the third Lord Holland of the Fox family. His patronymic was changed from Fox to Vassall in 1797, the latter being the family name of his wife, the divorced Lady Webster, by whom he had had a son, Charles R. Fox, born before the divorce. Holland was a man of fine manners and most amiable character. His uncle, Charles James Fox, trained him up to liberal political principles, and he was educated at Eton and Christ Church, Oxford; he was (1806) made a commissioner and plenipotentiary for settling disputes with the U. S.; was Lord Privy Seal 1806–07; Chancellor of the Duchy of Lancaster 1830–40. Lord Holland was a most brilliant debater and parliamentary tactician, the steady friend of every political reform, and had a large personal following of strongly attached social and political friends. He did much to develop a taste for Spanish literature. Author of *Life and Writings of Lope de Vega Carpio* (1806); *Foreign Reminiscences* (1850); *Memoirs of the Whig Party* (1852); and other works. D. Oct. 22, 1840.

**Holland**, HENRY S.: See the Appendix.

**Holland**, JOSIAH GILBERT, M. D.: author and journalist; b. at Belchertown, Mass., July 24, 1819; graduated at Berkshire Medical College, Pittsfield, and practiced medicine three years. He became a contributor to *The Knickerbocker Magazine*, and was for one year superintendent of schools at Vicksburg, Miss. From 1849 to 1866 he was one of the editors of the Springfield (Mass.) *Republican*, which became under his management one of the most influential and widely circulated newspapers in New England. In 1866 he sold his interest in the *Republican*, and traveled for some time in Europe. In 1870, in connection with Roswell Smith and Messrs. Scribner, Armstrong & Co., he established *Scribner's Magazine*, of which, and of its successor, *The Century Magazine*, he remained editor until his death. He was very popular as a lyceum lecturer, was president of the New York city board of education, and chairman of the trustees of the College of New York. His works, some of them published under the name of *Timothy Titcomb*, are a *History of Western Massachusetts* (1855); *The Bay Path*, a novel (1857); *Letters to the Young* (1858); *Bitter Sweet*, a poem (1858); *Gold Foil* (1859); *Miss Gilbert's Career*, a novel (1860); *Lessons in Life* (1861); *Letters to the Joneses* (1863); *Plain Talk on Familiar Subjects* (1865); *Life of Lincoln* (1868); *Kathrina*, a poem (1867); *The Marble Prophecy* (1872); *Arthur Bonnicastle* (1873); *Garnered Sheaves*, poems (1873); *The Mistress of the Manse* (1874); *The Story of Seven Oaks* (1875); *Nicholas Minturn* (1876). D. in New York, Oct. 12, 1881. His poems and novels were widely popular and distinctly moral in purpose. His poetry is pure and sweet in feeling, and his fiction appealed to a large class of readers by its earnestness and good sense. Revised by H. A. BEERS.

**Holland**, ROBERT AFTON, A. B., S. T. D.: clergyman and author; b. at Nashville, Tenn., June 1, 1844; educated at Louisville College; at the age of seventeen became a Methodist preacher; at the age of eighteen became chaplain of a cavalry brigade in the Confederate army; after the war ended became pastor of Trinity Methodist church, Baltimore, and editor of *The Christian Advocate*, published in that city. In 1872 he took orders in the Protestant Episcopal Church, and from 1872 till 1880 was rector of St. George's church, St. Louis, Mo. From 1880 till 1884 he was rector of Trinity church, Chicago; then went to New Orleans, and after a brief rectorship in that city returned to St. George's, St. Louis. For eight years he was one of the faculty of the Concord Summer School of Philosophy. For many years he has been a vice-president of the American Social Science Association, and is also a vice-president of the American branch of the Christian Social Union. He has published *The Philosophy of the Real Presence*; *The Relations of Philosophy to Agnosticism and to Religion*; *The Proof of Immortality*; *Midsummer Night's Dream—an Interpretation*; *Democracy in the Church*; *What's the Use of Going to Church?*; *Annunciation Lilies* (a sermon).

**Holland**, THOMAS ERSKINE: See the Appendix.

**Hollar**, WENCESLAUS: engraver; b. at Prague, in Bohemia, July 13, 1607. It is said that he was taught by Matthew Merian. He went to Cologne and Antwerp, and his print of the city of Prague pleased Thomas Howard, Earl of Arundel, English ambassador to the emperor, who took Hollar to England with him in 1635 or soon after. He was made drawing-master to Prince Charles, afterward Charles II. During the civil war he served in the royal army, but fell into great poverty during the Commonwealth, and resided much on the Continent. Even after the Restoration he was poor and little appreciated. The great merit of his engraved work has received abundant recognition in later times. Nearly all of it is engraved from his own designs, and he is one of the greatest of the painter-engravers. D. in London, Mar. 28, 1677. Of his 2,700 prints the following may be named: Large topographical views of Strassburg, Lucerne, Oxford, and many other places; delicate architectural drawings of *Antwerp Cathedral*, *St. George's Chapel at Windsor*, *The Royal Exchange*, *London*, *Portraits of Charles I.*, *Charles II.*, *Rubens*, *Bishop Malder*, *Oliver Cromwell*; studies of costume and detail, as the four prints of the *Dress of English Women in the Four Seasons of the Year*, *Muffs and Masks*, *Shells*, the *Hanging Hare*.

RUSSELL STURGIS.

**Holley**: village; Orleans co., N. Y. (for location of county, see map of New York, ref. 4–D); on the N. Y. Cent. and Hudson Riv. Railroad and the Erie Canal; 22 miles W. of Rochester. It is in an agricultural and fruit-growing region, has extensive Medina sandstone quarries, and contains five churches, union school, academy, water-works, electric light, weekly newspaper, and a cider, vinegar, and evaporated apple manufactury, said to be the largest in the U. S. Pop. (1880) 1,018; (1890) 1,381; (1900) 1,380.

EDITOR OF "STANDARD."

**Holley**, ALEXANDER LYMAN, LL. D.: engineer; son of Alexander H. Holley, Governor of Connecticut 1857–58; b. at Lakeville, Conn., July 20, 1832; graduated at Brown University 1853; was technically educated at the Corliss Steam-engine Works. Between 1856 and 1863 he contrib-

HOLLAND & BELGIUM
English Miles
10 20 30 40 50 60
Railroads
Canals
Longitude East 82° from Washington
80°
81°
83°
84°
53°
52°
A B C D E F G H I J
1 2 3 4 5 6 7
NORTH SEA
ZUYDER ZEE
Wadden
GRONINGEN
DRENTHE
OVERYSSEL
GELDERLAND
UTRECHT
NORTH HOLLAND
SOUTH HOLLAND
Borkum
Rottum
Schiermonnikoog
Ameland
Ter Schelling
Vlieland
Texel
Vlie Stream
Griend
E. Ems R.
W. Ems R.
Juist
Emden
The Dollart
Delfzijl
Lauwer Zee
Dokkum
LEEUWARDEN
Franeker
Harlingen
Bolsward
Sneek
Ylst
Heerenveen
Dragten
GRONINGEN
Sappemeer
Winschoten
Nieuwe Schans
Boertange
ASSEN
Smilde
Meppel
Hoogeveen
Coevorden
Gramsbergen
Hardenberg
Ommen
Steenwijk
Kuinder
Blokzyl
Vollenhoven
Lemmer
Stavoren
Hindelopen
Wieringen
Mars Diep
Helder
Nieuwe Diep
Medemblik
Enkhuizen
Urk
Schokland
Kamperduin (Camperdown)
Alkmaar
Egmond aan Zee
Beverwijk
N. Sea Ship Canal
Zaandam
Marken
Edam
HAARLEM
AMSTERDAM
Muiden
Naarden
Amstel
Katwijk
LEYDEN
THE HAGUE ('S Gravenhage)
Delft
Old Rhine
Woerden
UTRECHT
Soest
Amersfoort
Nijkerk
Harderwijk
Elburg
Hattem
Kampen
Hasselt
ZWOLLE
R. Vecht
Raalte
Almelo
Rijssen
Deventer
Het Loo
Zutphen
Lochem
Goor
Delden
Hengelo
Enschede
Oldenzaal
Ootmarsum
Bentheim
R. Ems
Diepenheim
Groenlo
Vreden
Winterswijk
Bocholt
Wesel
Doesburg
ARNHEM
Huissen
Nijmegen
R. Waal
Rhenen
Wijk
Kuilenburg
Buren
Tiel
Bommel
Ravenstein
Grave
Heusden
Gorkum
Leerdam
Schoonhoven
Gouda
Oudewater
Nieuwpoort
ROTTERDAM
Schiedam
Vlaardingen
Maassluis
R. Maas
Briel
Voorne
Putten
Ysselmonde
Dordrecht
Beyerland
Strijen
Goeree
Haringvliet
Over Flakkee
Hellevoetsluis
Goedereede
Grevelingen
Brouwershaven
Schouwen
Zierikzee
Krammer
East Scheldt
Willemstad
Geertruidenberg
Oosterhout
Breda
BOIS LE DUC ('s Hertogenbosch)
Cleves
Old Yssel R.

FLANDERS
WEST FLANDERS
EAST FLANDERS
ANTWERP
LIMBURG
BRABANT
LIÉGE
HAINAULT
NAMUR
LUXEMBURG
G.D. DUCHY OF LUXEMBURG
BELGIUM
FRANCE
Ostend
Blankenberg
BRUGES
Dunkirk
Nieupoort
Ypres
Courtray
GHENT
ANTWERP
MECHLIN
BRUSSELS
Louvain
Tirlemont
Hasselt
MAESTRICHT
Tongres
LIEGE
Verviers
Spa
NAMUR
Charleroi
MONS
Tournay
Lille
VALENCIENNES
Douai
Arras
Cambrai
Le Quesnoy
Landrecies
Dinant
Givet
Philippeville
Mariembourg
Chimay
Rocroy
Mézières
Sedan
Bouillon
Arlon
Longwy
LUXEMBURG
Treves
Merzig
Echternach
Diekirch
Bastogne
Malmedy
AIX LA CHAPELLE
Düren
COLOGNE
Deutz
Bonn
Düsseldorf
Duisberg
Crefeld
Neuss
Gladbach
Venlo
Roermonde
Eindhoven
Turnhout
Bergen op Zoom
MIDDELBURG
Flushing
W. Scheldt
St. Quentin
Guise
Origny
Vervins
Crécy
Laon
R. Rhine
R. Meuse
R. Sambre
R. Moselle
R. Lieser
R. Our
R. Sure
R. Oise
Longitude East 5° from Greenwich
3°
4°
6°
7°
51°
50°
A
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14

uted to and edited various engineering periodicals, and published (in connection with Zerah Colburn) his *Railway Economy, a Report on European Railways* (New York, 1858). In 1879 he was appointed lecturer on Iron and Steel Metallurgy in the Columbia College School of Mines. Of no less importance were his practical services. In 1865 he introduced the Bessemer process of steel-making into the U. S., built steel-works and rolling-mills at Harrisburg, Troy, Chicago, Joliet, and Pittsburg, and a number of mechanical improvements in the process are due to him. In the same year he published *A Treatise on Ordnance and Armor* (New York and London). He was consulting engineer to many iron and steel works, president of the American Institute of Mining Engineers in 1875, vice-president of the American Society of Civil Engineers in 1876, one of the founders of the American Society of Mechanical Engineers, and achieved the rare distinction of being a leading authority and the advocate of fundamental improvements in three separate lines: railways, ordnance, and steel manufacture. D. in Brooklyn, N. Y., Jan. 29, 1882. In 1883 the American Institute of Mining Engineers published a memorial volume prepared by a special committee in honor of Holley, and in 1890 a bronze bust of him by J. Q. A. Ward was placed by American and foreign engineers in Washington Square, New York.

**Hollidaysburg**: borough. See the Appendix.

**Hollis**: town. See the Appendix.

**Hollister**: town. See the Appendix.

**Holliston**: town. See the Appendix.

**Holloway**, Laura Carter: See the Appendix.

**Holly** [O. Eng. *holen, holegn* : O. H. Germ. *huls* > Mod. Germ. *hulst*; borrowed into Fr. *houx*]: species of various shrubs and small trees, chiefly of the genus *Ilex* and family *Ilicineæ*. They are mostly evergreens, with rich green leaves and red berries. The typical species is *I. aquifolium*, the European holly, whose leaves are so highly prized for Christmas decorations. Its bark yields bird-lime, and has medicinal powers. The finest American species is the *I. opaca*, a small tree, used also in Christmas decorations, but its appearance is far inferior to that of the former species. The wood of both the above species is very hard and white, and is used by turners, inlayers, and carvers. *I. cassine* and other species yield the "yaupon tea" of the Carolinas and the "black drink" of the Creek Indians. Paraguay tea (see Maté) is produced by certain South American hollies. The U. S. have fourteen species of *Ilex*, mostly unimportant shrubs, some with deciduous leaves, besides one, the mountain holly, *Nemopanthes canadensis*, of another genus closely allied. The sea-holly or sea-holm of Europe is the *Eryngium maritimum*, a very different plant of the Umbellifer family. Revised by Charles E. Bessey.

**Holly**: village; Oakland co., Mich. (for location of county, see map of Michigan, ref. 7–K); on the Shiawassee river, and the Det., Gr. Hav. and Mil., and the Flint and Père Marq. Railways; 47 miles N. W. of Detroit. It is in one of the most fertile and attractive regions in the State; has flour and planing mills, furniture and box factories, foundry, and pickle and vinegar works, and contains a high-school building (cost $50,000), hotel (cost $20.000), and a weekly newspaper. Pop. (1880) 1,443; (1890) 1,266; (1900) 1,419. Editor of "Oakland County Advertiser."

**Holly Family**: the *Ilicineæ*, a family of trees and shrubs with simple, mostly alternate leaves, and small, axillary, 4–8-merous choripetalous flowers. Ovary free, compound, four to eight celled, forming a berry-like drupe, containing four to eight seeds. There are about 180 species, which are included in four genera, viz., *Ilex* (world-wide), *Byronia* and *Sphenostemon* (Australian and Pacific), and *Nemopanthes* (North American). Charles E. Bessey.

**Hollyhocks** [M. Eng. *holihoc*, liter., holy hock or mallow, so called because said to have been imported from the Holy Land]: certain biennial plants of the genus *Althæa* (*A. rosea, ficifolia, chinensis*), tall Old World herbs, much cultivated in gardens for their flowers, of which there are many varieties, single and double. The culture of these plants for forage purposes has been proposed. The stalks abound in a fiber which may be utilized as paper-stock.

**Holly Springs**: city. See the Appendix.

**Holman**, William S.: See the Appendix.

**Holm'boe**, Christopher Andreas: Orientalist; b. in Vang, Norway, Mar. 19, 1796; studied Oriental languages in Christiania and Paris, and became in 1822 lector and in 1825 Professor of Oriental Languages at the University of Christiania. The most prominent of his writings are *De prisca re monetaria Norvegia* (1841); *Sanskrit og Oldnorsk* (1846); *Det Oldnorske Verbum* (1848); *Det Oldnorske Sprogs väsentligste Ordforraad, sammenlignet med Sanskrit* (1852); *Norsk og Keltisk* (1854). As a member of various commissions he exercised a great and beneficial influence on educational affairs in Norway. He resigned his position in 1876, and died Apr. 2, 1882.

Revised by R. B. Anderson.

**Holmes**, Abiel. D. D., LL. D.: b. in Woodstock, Conn., Dec. 24, 1763; graduated at Yale in 1783, and was a tutor there 1783–85; held Congregational pastorates in Midway, Ga., 1785–91, and in Cambridge, Mass., 1792–1832. He married in 1790 a daughter of President Stiles (d. 1795); in 1800 he married a daughter of Hon. Oliver Wendell. He published *Annals of America*, a work of permanent value (2 vols., Cambridge, Mass., 1805; enlarged ed. bringing it down to 1826, 1829); *Life of President Stiles* (Boston, 1798); papers on Stephen Pannenius; on the Mohegan Indians; biography of John Lothrop, and many others. He received the degree of D. D. from Edinburgh University. D. in Cambridge, Mass., June 4, 1837. See his biography by W. Jenks.

**Holmes**, Augusta Mary Anne: composer; b. in Paris, France, Dec. 16, 1847, of Irish parents; received her entire education, musical and otherwise, in Paris. Her compositions are generally in the large forms. They include an opera, *Hero and Leander*; a psalm, *In Exitu Israel*; a symphony, *Orlando Furioso*; a symphony, *Lutece*, which gained a prize at a municipal competition; a symphony, *Les Argonauts*, performed by Pasdeloup, Apr. 24, 1881; a symphonic poem, *Irlande*; another, *Pologne*; and a symphonic ode with choruses, *Ludus pro Patria*, performed Mar. 4, 1888. She writes the text of her vocal compositions. D. E. Hervey.

**Holmes**, George Frederick: educator; b. in British Guiana in 1820; educated in England at Durham University. When eighteen years old he settled in the U. S.; was a teacher in Virginia, Georgia, and South Carolina, and in 1842 was admitted to the bar of South Carolina by the Legislature, although not naturalized. He was for a time assistant editor of *The Southern Quarterly Review*, and in 1845 accepted a professorship in Richmond College, Virginia. In 1846 he was chosen professor in the University of Mississippi, in 1847 Professor of History, Political Economy, and International Law in William and Mary College, and in 1857 Professor of History and Literature in the University of Virginia. Author of school-books especially designed for the Southern States. D. Nov. 4, 1897.

**Holmes**, Mary Jane (*Hawes*): novelist; b. in Brookfield, Mass. She was married to Daniel Holmes, a lawyer of Richmond, Ontario co., N. Y., and has since then resided in Versailles, Ky., and Brockport, N. Y. She has written a large number of very popular novels, including *Lena Rivers* and *Tempest and Sunshine*, mostly of an unambitious or domestic character, and of excellent moral tendency.

**Holmes**, Nathaniel: jurist and Shakspeare scholar; b. in Peterborough, N. H., in 1815; graduated at Harvard in 1837; was admitted to the bar in Boston 1839; was judge of the Supreme Court of Missouri from 1865 to 1868; and Professor of Law in Harvard University from 1868 to 1872. Judge Holmes was an ardent believer in the so-called "Baconian" theory of the authorship of Shakspeare's plays, and published in 1866 *The Authorship of Shakspeare* in support of his belief. Henry A. Beers.

**Holmes**, Oliver Wendell: author and physician; a son of Dr. Abiel Holmes; b. in Cambridge, Mass., Aug. 29, 1809; graduated at Harvard in 1829; studied law, and afterward medicine, receiving his doctor's degree in 1836, after several years' attendance in the European hospitals. In 1838 he became Professor of Anatomy and Physiology in Dartmouth, and in 1847 was called to the same chair in the Massachusetts Medical School, Boston, from which he retired in 1882. He was distinguished as an accurate anatomist, a skillful microscopist and auscultator, and an amateur photographer, but his widest fame is as a poet, wit, and man of letters. The first collected edition of his poems appeared in 1836. His Phi Beta Kappa poems, *Poetry* (1836), *Terpsichore* (1843), *Urania* (1846), and *Astræa* (1850), gave him fresh laurels; and his *Autocrat of the Breakfast Table,*

*Professor at the Breakfast Table*, and *Poet at the Breakfast Table*, all originally published in *The Atlantic Monthly*, were a series of brilliant prose papers, with occasional poems, nearly all in his happiest vein of mingled humor, pathos, healthy sentiment, and practical wisdom. His after-dinner poems and other short lyrics are among the best of their kind in the language. He wrote also various medical addresses, papers, and pamphlets, and *Currents and Counter-currents in Medical Science* (1861); *Elsie Venner*, a romance (1861); *Borderlands in some Provinces of Medical Science* (1862); *Songs in Many Keys* (1864); *Soundings from the Atlantic* (1864); *Humorous Poems* (1865); *The Guardian Angel* (1868); *Mechanism in Thought and Morals* (1870); *Songs of Many Seasons* (1874); *John L. Motley, a Memoir* (1878); *The Iron Gate, and other Poems* (1880); *Ralph Waldo Emerson* (1885); *A Mortal Antipathy* (1885); *Our Hundred Days in Europe* (1887); *Before the Curfew* (1888); *Over the Teacups* (1890). He visited England again in 1886, and received many honors. D. in Boston, Mass., Oct. 7, 1894. See his *Life and Letters*, by John T. Morse, Jr. (1896). HENRY A. BEERS.

**Holmes**, WILLIAM HENRY: archæologist; b. near Cadiz, O., Dec. 1, 1846. After completing a scientific course in the McNeely Normal College in 1870, he was appointed to the professorship of Physical Geography and Natural History in that institution. In 1871 he removed to Washington, D. C., and became attached as a draughtsman to the Smithsonian Institution. In 1872 he was appointed artist to the Hayden exploring expedition, and in 1874 was transferred to the geologic corps and placed in charge of the survey of the San Juan country, including Southwest Colorado and parts of the adjoining territories. He held this position until the reorganization of the survey in 1879. The atlas of Colorado and several of the later volumes issued by the Hayden survey were edited by Mr. Holmes, and the work of that survey was brought to a close under his superintendence. In 1881 he was appointed geologist under Director J. W. Powell of the reorganized survey; in 1882 was made honorary curator of aboriginal pottery in the National Museum, and in 1889 was placed in charge of the archæological explorations of the bureau of ethnology. In Sept., 1892, he was elected Professor of Archæologic Geology in the University of Chicago. His publications in archæology include reports on the cliff ruins of the San Juan country, papers on aboriginal art, and on the evolution of ornament. J. W. POWELL.

**Holm-oak** [liter., holly-oak, evergreen oak; *holm*, holly < M. Eng. *holme* < O. Eng. *holen*]: popular name of *Quercus ilex* (the *ilex* of Roman authors), a beautiful evergreen oak of Southern Europe and Northern Africa, prized for its beauty, as well as for the great excellence and durability of its timber.

**Holoceph'ali** [Gr. ὅλος, whole + κεφαλή, head]: one of the great divisions of cartilaginous fishes containing but two genera, CHIMÆRA (*q. v.*) from the northern hemisphere and *Callorhynchus* from Antarctic waters. These forms differ from all other shark-like forms in several structural features, which make them of extreme interest to naturalists. Among these may be mentioned the firm union of the upper jaw with the skull (as in higher vertebrates), whence the name of the group, and four internal gills communicating with the exterior by a single opening on each side of the neck (as in the ordinary fishes). There is no spiracular opening, and the jaws are covered with horny plates, four above, two below. The eggs of *Chimæra* are unknown; those of *Callorhynchus* are inclosed in a broad and curiously fringed horny shell. J. S. KINGSLEY.

**Holofernes**: See JUDITH.

**Holos'tomi** [Mod. Lat., from Gr. ὅλος, whole + στόμα, mouth]: a group and probably an order of eels, thus distinguished by Prof. Cope: "Epiclavicle suspended to fourth vertebra, post-temporal wanting. Parietals in contact. Mouth bounded by the premaxillaries, which are in contact medially, and bounded behind by maxillary. Symplectic present; vertebræ unaltered; no pectoral fin. Third superior pharyngeal not smaller than fourth." In addition to these characters, the pectoral fins are absent, and the vertical fins quite rudimentary and reduced to mere folds of the integument; the anus is situated very far backward; the gill-openings are confluent in a single outlet under or near the throat: and the ovaries have oviducts. This group has been formed for the reception of two families of eel-like fishes confined to the tropical regions—viz., (1) *Symbranchidæ*, represented in both the East Indies and America, and (2) *Amphipnoidæ*, confined to Bengal. THEODORE GILL.

**Holothurians**, or **Holothuroidea**: a group of ECHINODERMS (*q. v.*) commonly known as "sea-cucumbers," in allusion to the cucumber-shaped body. They form the class Holothuroidea and are characterized by having the body drawn out in a worm-like manner, the mouth and vent being at opposite ends. In most forms the skin is leathery, and the calcareous plates, so characteristic of other Echinoderms, are entirely concealed in the integument. Only in a few cases (e. g. *Psolus*) do they form conspicuous plates on the outside.

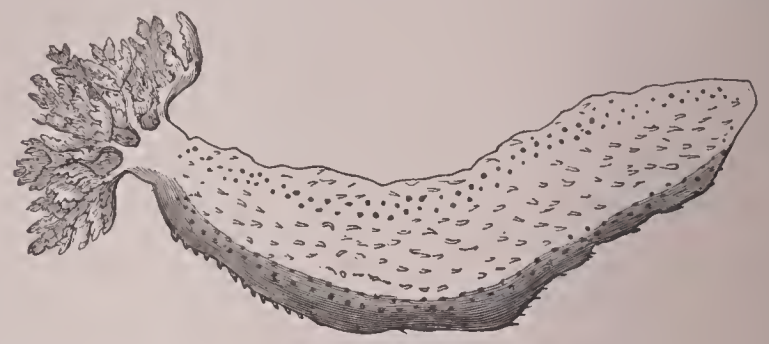

FIG. 1.—The common sea-cucumber.

In many these plates are microscopic, and sometimes they are strangely regular and beautiful, forming favorite objects for microscopists. Thus in *Myriotrochus* they take the shape of wheels; in *Synapta* of anchors and plates. The Holothurians are without teeth, and the mud or coral sand on which they feed is forced into the mouth by means of the tentacles which surround that opening. The intestine is either straight or curiously looped within the body, in some cases measuring forty times the length of the animal. In the circulatory, "water vascular," and nervous systems the radial arrangement of parts so characteristic of all Echinoderms is easily traced, but in most forms the "madreporic body" is internal. In most forms the sexes are separate; the development in a few is "direct," but in most there is a distinct metamorphosis, though the changes of form are less marked than in other Echinoderms. Few species have any economic importance. In the Eastern seas certain species are taken in large quantities, dried in the sun, and sent to China, where, under the name trepang, they are used for soup. Three orders of Holothurians are recognized: (1) *Pedata*, in which the tube feet are developed, the madreporic body is internal, and there is an enormous branching development of the hinder end of the digestive tract of unknown functions, but known as the "respiratory tree." Here belong the majority of the species. (2) *Elasipoda*, in which the body is bilaterally symmetrical, the tube feet being restricted to the lower surface, the upper surface being ornamented with strange outgrowths, and the stone canal opening direct to the exterior, there being no madreporic body. The respiratory tree also is lacking. These forms are all inhabitants of the deep seas. (3) *Apoda*, without tube feet, usually without respiratory tree, madreporic body internal, and the body-wall frequently transparent. Near these forms should be placed the curious *Rhopalodina* from Africa, in which the pear-shaped body is so folded as to bring mouth and vent in close proximity. Most important in the literature is Semper's *Monograph of the Holothurians* (Leipzig, 1868). Reference should also be made to the papers of Ludwig, Teuscher, and Semon. J. S. KINGSLEY.

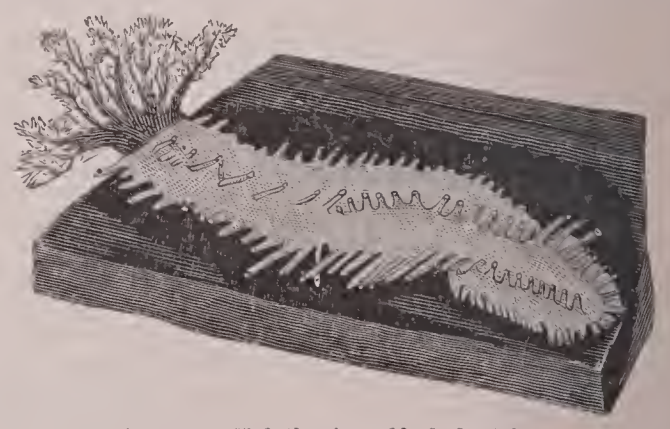

FIG. 2.—A Holothurian, *Cladodactylus*.

**Holothuridæ**: a family of HOLOTHURIANS (*q. v.*) of which the trepang (*Holothuria*) is the typical member.

# APPENDIX.

**Gallico**, Paolo: pianist; b. in Italy in 1868; studied in Trieste, and made his first public appearance there at the age of fifteen years. Next he went to Vienna for further study, and traveled in Europe on concert tours 1888–92. In 1892 he settled in New York, where he has since remained, teaching and playing in concerts. D. E. H.

**Galton**, Sir Douglas, K. C. B., D. C. L., LL. D., F. R. S.: b. at Hadzor House, Worcestershire, England, 1822; was educated at Rugby and at the Royal Military Academy at Woolwich, where he passed the highest examination on record, taking the first prize in every subject; was commissioned in the Royal Engineers in 1849, and became inspector of railroads and secretary of the railroad department of the Board of Trade, officially visiting the U. S. in 1856; was appointed assistant inspector of fortifications in 1860, and was Under-Secretary of State for War 1862–70, later becoming director of public works and buildings; retired 1875; was general secretary of the British Association 1870–95, and president of that body 1895–96; constructed the Herbert Hospital at Woolwich. Oxford conferred on him the degree of D. C. L., and Durham that of LL. D. His chief publications are *Healthy Dwellings* and *Healthy Hospitals*. D. Mar. 11, 1899.

**Ganancial System**, or **Spanish Community**: the system by which, under the laws of Spain, husband and wife hold in common that property (called in Sp. *bienes comunes*) which either or both of them acquire during the marriage by their labor, industry, or purchase. This system is the basis on which is founded the American system of community property as it exists, with some variations, in Louisiana, Texas, California, Nevada, Arizona, Washington, Idaho, and New Mexico, and in Spanish-American countries. (See Community Property.) The property subject to the rules of this system (ganancial property) does not include dotal property (Sp. *bienes dotales*), extradotal property or paraphernalia (Sp. *bienes paraphernales*), the property contributed by the husband to sustain the expenses of the matrimony (Sp. *arras*), nor the property of either consort acquired by succession, testament, or lucrative title (Sp. *bienes propios*). The right to the holding of the ganancial property, as such, is founded upon the implied contract of the marriage that the gains resulting from the joint labors of husband and wife, or from the use of the property brought by each into the marriage relation, but not itself a part of the ganancial property, shall be held in common by them. Separate property does not become ganancial property by being sold and the proceeds reinvested in other property; but *prima facie* all property is presumed to be ganancial which is not proved to be the separate property of either husband or wife, and the husband has the exclusive management of the community property. Upon the dissolution of the marriage by death or legal separation the ganancial property is equally divided; but the wife may expressly renounce her right to her share in it, and by so doing becomes discharged from debts contracted or losses sustained by her husband. She forfeits her right to it by abandonment or adultery. See Ballinger's *Property Rights of Husband and Wife under the Community or Ganancial System* (1895).

F. Sturges Allen.

**Garcia**, Calixto: soldier; b. in Holguin, Cuba, Oct. 14, 1836; became a lawyer, but left his practice to participate in the struggle for freedom in Cuba; assisted in planning the attempted revolution known as the Ten Years' war, and on Oct. 10, 1868, began operations with a force of 150 men; captured a number of towns, and became brigadier-general, and afterward commander-in-chief of the Cuban forces; was victorious at Jiguani, Holguin, Baquano, Cupcijal, Zarsal, and Santa Maria, but at San Antonio del Bahar he was attacked by a superior force of Spaniards on Sept. 3, 1873, and tried to kill himself by shooting, but did not succeed; was deported to Spain, but was freed in 1878 and returned to Cuba; was again captured and sent to Spain, and lived seventeen years in Madrid under police surveillance. In Sept., 1895, he escaped across the French frontier, went to New York, organized a filibustering expedition, and, having been arrested by the U. S. Government, forfeited his bail and met his vessel, the Bermuda, off Cape Henlopen, and landed in Cuba with 62 men, 6 field-guns, and a quantity of dynamite. After a number of small victories, on Sept. 5, 1897, he captured Victoria de las Yunas, the loss of which place occasioned the recall of Gen. Weyler. Garcia held the interior of the province of Santiago de Cuba until the U. S. forces arrived there in 1898, when he co-operated with them. He left the Cuban army July 17, 1898, but rejoined it Sept. 23, and in November he was sent to the U. S. as a member of a commission to present to President McKinley the views of the Cuban leaders. D. in Washington, D. C., Dec. 28, 1898.

**Gardner**, Elizabeth Jane: artist; b. in Exeter, N. H., 1842. Most of her professional life has been spent in Paris, where she studied under Bouguereau, Merle, and Lefebre. Among her more important paintings are *Cornelia and her Jewels*; *Cinderella*; *Corinne*; *Moses in the Bulrushes*; and *Maud Muller*.

**Garland**, Hamlin: author; b. in West Salem, Mass., Sept. 14, 1860. Removing to the West with his parents, he was educated in the common schools of Mitchell co., Iowa, and at Cedar Valley Seminary, where he graduated in 1881. His principal publications are *Main Traveled Roads* (1880); *A Little Norsk* (1891); *Jason Edwards* (1891); *A Member of the Third House* (1892); *A Spoil of Office* (1892); *Prairie Folks* (1893); *Prairie Songs* (1893); *Crumbling Idols* (1894); *Rose of Dutcher's Coolly* (1895); *Wayside Courtships* (1897); and *The Eagle's Heart* (1901).

**Gay**, Edward: artist; b. in Ireland in 1837. He studied art in Albany, N. Y., afterward going to Germany, where he studied under Schirmer and Lessing; returned to the U. S. in 1867, and opened a studio in New York city; was elected a National Academician in 1870, and has been a regular contributor to the exhibitions at the Academy and to those of the Water-color Society. Noteworthy among his oil-paintings are *A Mountain Stream*; *Ready for the Reapers*; *The Slopes of the Mohawk*; *The Last Load, Harvest-time*; *Gathering the Leaves*; *On the Sogne Fjord, Norway*; and *Golden Grain*. His water-colors include *Foggy Morning by the Lake*; *A Spring Morning*; *Waving Grain*; *Haymaking*; *Rye Fields in Early June*; and *Salt Marshes*.

**Gebhardt**, Oscar Leopold, von, D. D.: German Protestant theologian; b. in Wesenberg, Esthonia, Russia, June 22, 1844; studied at Dorpat, Tübingen, Erlangen, Göttingen, and Leipzig; after service as assistant librarian at Leipzig, Halle, and Göttingen, became a librarian of the Royal Library in Berlin in 1884; chief librarian and ordinary honorary Professor of Bibliography in Leipzig University in 1893. He is eminent as a New Testament patristic scholar; was first editor of the Greek codex of the New Testament, known as the *Codex Rossanensis* (Leipzig, 1880); edited an edition of the New Testament in Greek and German (1881; 3d ed. 1890); and edits, with A. Harnack, the *Texte und Untersuchungen zur Geschichte der altchristlichen Literatur* (1882 *sqq*). S. M. J.

**Gedike**, Friedrich: German educator; b. in 1755. He achieved great success as rector of the Friedrich-Werdersche Schule, in Berlin, and later was appointed traveling inspector of schools in the province under Von Zedlitz. He was a very ardent advocate of classical study, and did much to give to the classical gymnasium its pre-eminent posi-

tion in the German educational system. "The classical literature is and will continue to be the source of all our culture. It must remain, therefore, not only indispensable, but by far the most important study in our higher schools." These words of Gedike have been the guiding principle of the gymnasium to the present time. He was the first Chief School Councilor (Oberschulrat) of Prussia, appointed in 1787. In the same year he established a teachers' seminary for instruction of teachers in the classical schools. See Russell, *German Higher Schools*. D. in 1803.

C. H. THURBER.

**Geffcken**, FRIEDRICH HEINRICH: German jurist and publicist; b. in Hamburg, Dec. 9, 1830; studied law at the Universities of Bonn, Göttingen, and Berlin; entered the diplomatic service of Hanseatic villages, and was appointed secretary of the legation at Paris in 1854; *chargé d'affaires* for Hamburg at Berlin in 1856, and minister resident in 1859; minister resident in London in 1866; in 1869 was elected member of the Senate of Hamburg; in 1872 accepted the chair of Public Law at the University of Strassburg; retired because of ill health in 1882, taking up his residence in Hamburg, and afterward in Munich, and devoted his entire time to his historical works. Among his important works are *Das Staatstreich von 1851 und seine Rückwirkung auf Europa* (Leipzig, 1870); *Die Verfassung des deutschen Bundesstaats* (1870); *Staat und Kirche in ihrem Verhältniss geschichtlich entwickelt* (Berlin, 2d ed. 1877); *Zur Geschichte des orientalischen Krieges, 1854–1856* (Berlin, 1881); *Das Recht der Interventione* (Berlin, 1887).

F. STURGES ALLEN.

**Gengler**, HEINRICH GOTTFRIED PHILIPP. German jurist; b. in Bamberg, Bavaria, July 25, 1817; studied law at the gymnasium of Bamberg, and afterward at the Universities of Würzburg and Heidelberg, and was made doctor of laws in 1842; in 1847 was made professor extraordinary at the University of Erlangen, and in 1851 full professor. He has made a special study of private and commercial law and of the civil law of Bavaria. His published works include *Lehrbuch des deutsche Privatrechts* (Erlangen, 1854–62, 2 vols.); *Codex juris municipalis Germaniæ medii ævi* (1863–67); *Das deutsche privatrecht in seinen Grundzügen dargestellt* (3d ed. 1876); *Rechts alterthümer im Nibelungenliede* (1861); *Germanische Rechtsdenkmäler* (1875); *Deutsche Stadrechts alterthümer* (1882). F. STURGES ALLEN.

**Georgetown College**: an institution of learning in Georgetown, Ky. It is under the control of the Baptist denomination, and was opened in 1829. It possesses grounds and buildings valued at $194,000, and an endowment valued at $225,000, with a total income of $23,400. Its library contains 10,000 volumes and 1,500 pamphlets, and, with the scientific apparatus, is valued at $20,000. Ten scholarships are offered. The faculty numbers 5 in the preparatory department and 16 in the collegiate department.

**Gerber**, KARL FRIEDRICH WILHELM, von: German jurist and politician; b. in Ebeleben, in the principality of Schwarzburg-Sondershausen, Apr. 11, 1823; was educated at the gymnasium of his native place, and afterward studied law at Leipzig and Heidelberg; received his doctor's degree in 1843. He practiced his profession, and continued his law studies at the Universities of Jena, Erlangen, and Tübingen; was sent as a delegate in 1857 to the conference of Nuremberg; in 1867 to that at Hamburg for the codification of the German commercial and maritime law, and took an important part in the transactions of that body; refused the position of Minister of Education at Würtemberg, and accepted the chair of Law at Jena in 1862, where he was made counselor of the court of appeals; afterward he went to Leipzig as Professor of Ecclesiastical and Public Law, and was one of the rectors of the University of Leipzig 1865–67; was a member of the Reichstag for North Germany in 1867; president of the first provisional synod of Saxe in 1871; and has held various other offices of high public trust. His prineipal works are *Das wissenschaftliche Prinzip des gemeinen deutschen Privatrechts* (Jena, 1846); *System des deutschen Privatrechts* (1848; 15th ed. 1886); *Gesammelte juristiche Abhandlungen* (Jena, 1872). F. S. A.

**Gerhardt**, KARL: sculptor; b. in Boston, Mass., Jan. 7, 1853. After working as a machinist in Chicopee, Mass., he became a designer of machinery in Hartford, Conn. Early in life he manifested such strong artistic talent that he was sent to Paris for study, the sculpture that attracted attention to him being a bust of his wife and *A Startled Bather*. During his second year in Paris he contributed to the Salon, and later exhibited *Echo*, a statuette, and *Eve's Lullaby*, a life-size group. He made a bust of Gen. Grant as he appeared in his last days, and busts of Samuel L. Clemens and Henry Ward Beecher; a statue of Nathan Hale; an equestrian statue of Gen. Putnam; and a statue of Gen. Gouverneur K. Warren.

**Gericke**, WILLIAM: conductor; b. in Gratz, Styria, Apr. 18, 1845; entered the Vienna Conservatory in 1862, and studied composition for three years; in Oct., 1865, was appointed conductor at the theater in Linz, and in 1874 at the Hofoper, in Vienna, with Hans Richter; in 1884 was chosen by Mr. H. L. Higginson as conductor of the Boston Symphony Orchestra, to succeed George Henschel, where he remained for five years, being succeeded by Arthur Nikisch and Emil Paur. In 1898 he was again chosen conductor of this same orchestra on the retirement of Paur. His compositions remain mostly in manuscript. They include important works for orchestra and concerted instruments, an operetta, and some vocal works. Some of his songs, part songs, and piano pieces have been published. D. E. H.

**German**, EDWARD: composer; b. in Whitchurch, Shropshire, England, in 1862, and received his musical education at the Royal Academy of Music, London. Since he graduated he has devoted himself almost entirely to composition, and has produced a number of works, including incidental music for Henry Irving's productions of *Richard III.*, *The Tempest*, and *Henry VIII.*, and other plays, and also several suites for piano. D. E. HERVEY.

**German Empire, History of the**: Since the retirement of Bismarck and the accession to his place of Caprivi in 1890, interest has centered around the increase of the army and navy, socialism, AGRARIANISM (*q. v.*), and the development of colonies and trade. The Triple Alliance has continued, somewhat weakened. Its founder, Bismarck, soon began to criticise the Government; he was, however, formally reconciled to the emperor in 1894. The latter pursued his energetic plans in widely different fields. Many of his utterances were construed as indications of a reactionary policy. The year 1891 was marked by the passage of a reformed tax law in Prussia. In the following year the army was increased, and the spread of anti-Semitism was noticeable. In 1893 the Reichstag rejected a new Army Bill, and the chancellor dissolved the house and ordered a general election. The new Reichstag was thus composed: The Clerical or Center, German Conservative, National Liberal, and Socialist parties were the largest groups; the Socialists made significant gains; the *Reichspartei* and the *Volkspartei* (or Radical People's party) had each more than 20 members; then came, with less than 20 members, the Radical Union, anti-Semitic, Polish, South German Volkspartei, Alsatian, Guelph, Danish, and Bavarian Farmers' Alliance groups. The most marked loss was sustained by the divided Radical party. The new house passed the Army Bill, increasing the troops and lessening the service period to two years. In the same year Queen Victoria's second son, the Duke of Edinburgh, succeeded to the duchy of Saxe-Coburg.

A commercial treaty with Russia and the activity of the agrarians were features of 1894, in which year Caprivi resigned, and was replaced by Prince von Hohenlohe-Schillingsfürst (d. 1901), who became both chancellor and premier. Continued agitation by the Socialists led to a frequency of trials for *lèse-majesté*. A new and comprehensive civil code was passed in 1896, and in 1897 the Government carried a measure whose aim was the control of emigration.

The death of Bismarck in 1898 made no difference in German affairs. One of his ablest successors is Miquel, especially noted in finance. The general election in the same year preserved the party lines, but the Socialists were the chief gainers. In the new Reichstag the Center numbers 103 members, the Conservatives 53, Socialists 56, National Liberals 48; no other group has more than 30. In the election for the Prussian Landtag held in 1898 the Conservatives and Clericals had the ascendency.

Foreign affairs have again assumed great importance; the entry of Germany into China in 1897, the marked development of German commerce, the increased attention bestowed on the navy, and the rivalry with England have been leading topics of interest. The sympathy of Germany with Turkey in the Greek war of 1897 was followed the next year by a visit of the German emperor to Constantinople and Palestine.

EDMUND K. ALDEN.

**German Empire, The**: The population of the German empire in 1900 was 56,345,014. The census illustrated the rapid transformation of Germany from an agricultural to an industrial country. In 1882 425 out of every 1,000 persons were of the farming class. In 1895 the number dependent upon the farm for support had dropped to 357 per 1,000 persons. The number supported by industries rose from 355 to 391, and by commerce from 100 to 115 in every 1,000 inhabitants. Most of the towns grew rapidly, while the population of the country districts fell from 78 to 69 per cent. The conversion of Germany to an industrial and commercial nation has imposed hardships upon the farming and landowning classes. The agrarians assert that most of the favors of the Government are reserved for manufacture and trade, while they, bound to their costly lands, which are kept productive only by careful tillage and expensive fertilizers, are exposed to the competition of food-products from newer and more fertile countries. The result of this feeling has been much agrarian agitation in favor of the highest and even of prohibitory tariffs on many articles, and particularly on imports of cereals and meats, though it is becoming more and more difficult for Germany to raise sufficient grain and cattle to feed her people. Most of the sheep-fields of Saxony have been turned into market-gardens. The largest increase in population is in the Rhenish provinces, and is ascribed to the flourishing manufactures of that district; while the lowest increase is in Posen, Silesia, and East Prussia, and is said to be due to the depression in agriculture.

These are the cities which have shown the largest growth in population, according to the census of 1900: Berlin, 1,884,151; Hamburg, 705,738; Munich, 499,959; Leipzig, 455,089; Breslau, 422,738; Dresden, 395,349; Cologne, 372,229; Frankfort-on-Main, 288,489; Nuremberg, 261,022; Hanover, 235,666; Magdeburg, 229,663; Düsseldorf, 213,767; Stettin, 210,680; Chemnitz, 206,584; Charlottenburg, 189,290; Königsberg, 187,897: Stuttgart, 176,318; Bremen, 163,418; Altona, 161,507; Elberfeld, 156,937; Halle-on-Saal, 156,611; Strassburg, 150,268; Dortmund, 142,418; Barmen, 141,947; Danzig, 140,539; Mannheim, 140,384; Aachen, 135,235; Brunswick, 128,177; Essen, 118,863; Posen, 117,014; Kiel, 107,938; Krefeld, 106,928; Kassel, 106,001.

The Germans attach great importance to canals and waterways as factors in their industrial development, and attribute their rapid advance to the third place among industrial nations in part to the development of their interior waterways and the network of canals they have formed extending from one navigable river to another. The German emperor in 1899 approved plans for a ship-canal between Stettin and Berlin, by means of which vessels of heavy tonnage will be able to load and discharge cargoes direct at Berlin.

In 1899 the production of coal in Germany amounted to 101,621,900 tons. Germany is keenly appreciative of the value of her coal in the development of her industries. The motive power used in the empire has increased more than threefold in the last twenty years, and amounted in 1889 to 3,421,194 horse-power, equal to the energy of more than 82,000,000 men. In 1899 the value of exports of the five leading classes of manufactures, in the order of their importance, was: Textiles, $246,238,608; metals and metal wares, $174,032,046; drugs and chemicals, $97,548,822; instruments and machinery, $73,805,942; leather goods $64,454,446. The principal imports of Germany are food and raw materials for manufacture. The principal items of raw material imported, in the order of importance, are woolen yarns, cotton and linen. There has been in recent years a large increase in the imports of breadstuffs, drawn chiefly from the U. S., Russia, and Austria-Hungary. The largest decreases in imports have been from the leading industrial and manufacturing nations. Germany is exporting more and importing less than in former years. The countries that are taking less of her exports are Italy, the U. S., and France. The countries which received most of the increase of her exports were Austria-Hungary, Switzerland, Great Britain, and Russia.

The German Government directly promotes commerce by subventions to two of the great steamship lines plying to Eastern Asia, Australia, and East Africa, and by money paid to lines for carrying the mails. The great growth of German trade is largely due to the improved quality of her manufactures, and this is the result, to no small extent, of the fine technical schools supported in Prussia and the other leading states. Of technical high schools Prussia has 3, in Berlin, Hanover, and Aix-la-Chapelle; Saxony 1, in Dresden; Hesse 1, in Darmstadt; Bavaria 1, in Munich: Würtemberg 1, in Stuttgart; Baden 1, in Carlsruhe. Under the mental and manual training received at these schools a class of highly intelligent and skillful workmen has been developed, and they are nowhere surpassed in their lines of industry. These technical and trade schools have revolutionized the scientific industries of Germany and vastly improved the products of the workshop and factory. The Government pays bounties to the manufacturers of sugar, alcohol, cocoa, and some oil products. Of these articles, however, sugar alone enters largely into the export trade. The number of beet-sugar factories in the country in 1876 was 332, which increased only to 402 in 1899. The sugar-factories formerly made much money, but competition at home and abroad has greatly reduced profits. The large factories, having the latest improvements, are still able to work at a profit, even at low prices for sugar. But the tendency among the smaller concerns is to consolidate or connect themselves with larger factories in their neighborhood.

Cheap ores and cheap transportation place iron and iron manufactures foremost among the exports of the country. Lorraine and Luxemburg furnish a practically inexhaustible supply of ores, which are valued at 50 to 51 cents a ton at the mines. The mines of Silesia, Westphalia, and the Saar region produce an abundance of good coking coal, which, however, is more costly than coal of similar grade in England and the U. S. But if coal is more expensive, the freight rates on the railroads owned and worked by the state are lower than in England, and this fact and the most careful conservation of all the by-products in making coke enable the Germans to balance the higher cost of domestic coal.

One of the most striking features of industrial development of Germany after 1895 was the progress of the tanning and leather industries, which now rank fourth in the productive interests of the country. The importation of American leather into Germany has greatly increased. Many of the tanneries are equipped with American machinery.

In 1891 only 3 cities in the German empire had introduced electric street railroads. In 1898 68 cities were employing electricity in their street-car service, and in 35 other cities or districts electric railroads were in process of construction. Most of the large industrial cities in Westphalia and the Rhine province are connected by a network of electric roads, which serve not only for passengers, but also for freight traffic.

C. C. Adams.

**German Southwest Africa**: a colony of Germany. It extends along the Atlantic coast from the Cunene river to the Orange river, excepting Walfish Bay, which is under the British flag. It adjoins Angola on the N., Cape Colony on the S., Bechuanaland and Rhodesia on the E., and its northern boundary is extended in a narrow strip to the Zambesi river. The needs of an enterprising Bremen trader named Lüderitz led to the acquisition by Germany in 1884 of this territory, which is about twice as large as Germany. Late in 1882 Lüderitz wrote to the German Government asking for protection for any concessions he might obtain from the natives at the Bay of Angra Pequeña or elsewhere on the coast. In May, 1883, he obtained from the tribe at Angra Pequeña, by purchase, some 215 sq. miles of land on the bay, including all rights of supremacy. His purchase included about 10 miles of coast, and extended inland some 24 miles. On Apr. 24, 1884, Prince Bismarck cabled to the German consul at Cape Town ordering him to place all the acquisitions of Lüderitz under German protection. This was the first step taken by the German Government to acquire possessions in Africa. On Aug. 7 the flag was formally hoisted over Lüderitz Bay, about a month after Germany had proclaimed protectorates over the Cameroons and Togoland. In 1885 Lüderitz sold his rights for $75,000 to the German Colonial Society for Southwest Africa, which had been incorporated by the German Government. Courts were established, a military force provided, and an imperial commission was appointed to administer the colony. After long negotiations with Great Britain the right of Germany to the present extensive domain was conceded. For years it was represented that Germany had acquired merely a rainless region of sand and barrens, but it was learned later that the colony had some important resources. Though half of it is within the tropical zone and the other half is sub-tropical, it is the only part of Africa, except Rhodesia, picked up by any European Government since the scramble for colonies began that has attracted a considerable number of European immigrants. In 1896 2,025 whites were living there, of whom 945 were women and children. In

1895 only 750 whites, including very few women, were living in German East Africa, 88 in Togo, and in 1896 there were only 230 whites in the Cameroons. In 1899 the German Colonial Society appropriated a small sum of money to assist women and girls who desired to emigrate to German Southwest Africa.

The evil repute of the colony arose from the fact that nearly the whole coast region is a belt of sand, 10 miles wide on an average, behind which is a zone of barren, rock-strewn steppe from 40 to 50 miles wide. But even in the sand zone, where dunes are raised to a height of 1,000 feet by the wind, some areas of large value have been discovered. The guano deposits at Cape Cross, for instance, are estimated to contain 100,000 tons of the best quality, and they are now being worked. The cool coast waters come in part from the Antarctic current, and in part rise from the cold depths of the sea, making a comparatively cool and healthful climate, while the sealeries and fisheries are of much value. This coast is almost destitute of rain because it is in the region of the S. E. trade winds, and the air-movements are toward and not from the Atlantic. Practically all the rainfall comes clear across Africa from the Indian Ocean, and most of it is precipitated before it reaches the west coast.

Behind the sand and stone wastes of the coast is a region of mountain and plateau, from 3,000 to 7,000 feet high, that makes the chief value of the colony. Most of the colonists are living in the mountainous region back of Walfish Bay, where there is good soil in the valleys. Little has yet been done to tap the sources of underground water, and the rainfall is insufficient to raise crops without irrigation except in Amboland, the northern district, which is still chiefly in possession of the natives. The whites as yet are found only around the springs, where they may get water for their fields. Potatoes and other European vegetables are raised, and also sugar-cane, tobacco, and cotton. Cattle-raising will always be the main business except in Amboland. The natives already have several hundred thousand head, and German explorers say that the larger part of the vast table-land may become a great cattle-raising region where the grazing lands are supplemented by artificial wells, ponds, and reservoirs. The settlers have not yet taken up nearly all the land in the valleys that are available for grazing, at least a part of the year, without artificial water-works. In 1898 measures were adopted to improve the water-supply by the construction of dams. Little has yet been done to develop the discoveries of gold, copper, and lead, which promise an excellent mining future. The exports thus far consist chiefly of ostrich-feathers, hides, horns, ivory, and wool. Railroads to the interior highlands are contemplated. Dromedaries have been introduced in the postal service between Walfish Bay and the interior. Nine companies—4 in Berlin, 2 in Hamburg, and 3 in London—have been organized to carry on colonization, mining, trading, and exploration. Windhoek, the seat of government among the mountains (lat. 22° 35′ S., lon. 17° 30′ E.), has 312 white inhabitants. The harbors are poor, and most of the exterior trade of the country is done through the British port at Walfish Bay. C. C. Adams.

**Gerry**, Elbridge Thomas, LL. D.: b. in New York, Dec. 25, 1837; grandson of Elbridge Gerry, Vice-President of the U. S. and a signer of the Declaration of Independence; graduated at Columbia College in 1857; studied law, and in 1866 was admitted to the bar in the State of New York and of the Supreme Court of the U. S.; was elected a member of the constitutional convention of 1867; soon afterward was associated with Mr. Bergh, the founder of the American Society for the Prevention of Cruelty to Animals, and was chiefly instrumental in securing most of the legislation affecting animals now (1899) on the statute-books of the State of New York; was foremost in procuring the organization of the Society for the Prevention of Cruelty to Children in 1874, and has been president of the society since 1879; in 1886 was chairman of the commission as a result of whose report the present system of electrical execution was adopted in New York State. He has held many offices of trust and honor, and is also well known for his interest in yachting affairs, he having been commodore of the New York Yacht Club 1885–93. He has contributed many articles to the *North American Review* on cruelty to children, capital punishment, and kindred subjects, but is chiefly known for his work in connection with the Society for the Prevention of Cruelty to Children. F. S. A.

**Gibára**: a town of Santiago de Cuba province, Cuba; on a fine bay on the northeast coast, and the outlet of much of the sugar, coffee, tobacco, fruit, and native woods of a large part of the eastern plain of the island. The harbor accommodates vessels of 16 feet draught. Pop. (1899) 6,841.

**Gilbert**, Charles Benajah, A. B.: educator; b. in Wilton, Conn., Mar. 9, 1855; graduated at Williams College 1876; principal of high schools, Mankato and Winona, Minn., Beaver Dam and Oshkosh, Wis., and St. Paul, Minn.; superintendent of schools, St. Paul, Minn., 1889–96; superintendent of schools, Newark, N. J., since 1896; lecturer Teachers College, Columbia University, since 1897. Author (in collaboration) of *Stepping-stones to Literature* and various articles in periodicals.

**Gilson**, Paul: composer; b. in Brussels, June 15, 1865, and educated in the conservatory there. In 1889 he gained the Prix de Rome with his cantata *Sinai*. Since then he has composed much music in the higher forms, including a lyric drama, *Le Démon*; an oratorio, *David*; *Les Suppliantes*; *Daphne*, for soli, chorus, and orchestra; incidental music to Maeterlinck's drama *La Princesse Maleine*; a symphonic poem, *Le Mer*, which created much comment in Paris, and has been played by the Boston Symphony Orchestra, and some other pieces. He belongs to the modern Flemish school. D. E. Hervey.

**Girard**, Jean (Grégoire): Swiss educator; b. in Fribourg, Switzerland, Dec. 17, 1765. At the age of sixteen, having finished rhetoric in the college of the Jesuits in Fribourg, he entered the order of Franciscans. He studied at the various colleges belonging to the order, and during a sojourn in Berne made the acquaintance of Pestalozzi, whose primary school in Burgdorf he visited. In 1804 he was recalled to Fribourg to take charge of the primary school which had just been confided to the Franciscans by the municipal authorities. Here began the pedagogical career of "Father Girard," "the most eminent pedagogue, after Pestalozzi, that modern Switzerland has produced." Endowed with less fire, poetry, and genius than Pestalozzi, he possessed what Pestalozzi did not possess—administrative talent, tact, and balance. He endeavored, unsuccessfully, to enforce obligatory instruction, replaced his associates in the cloister with lay teachers, introduced the Bell and Lancaster plan of mutual instruction, though not in its extreme form, and presently the Fribourg school became the rival of the schools of Fellenberg in Hofwyl and of Pestalozzi in Yverdon. Dr. Bell, visiting his school, hailed him in the words of Shakespeare, "Holy Franciscan friar, brother, hail!" and Pestalozzi, who scorned mutual instruction, said, after visiting the school, "Your Girard works miracles; with mud he makes gold." Owing to Church difficulties, Girard's system was suppressed in the school, and he himself retired in 1823. He was Professor of Philosophy in Lucerne 1828–34, after which date he lived in retirement in a monastery in his native city. He was a man of fine character and great ability, entirely devoted to the cause of education. D. Mar. 6, 1850. C. H. Thurber.

**Girouard**, Désiré Howard, D. C. L.: Canadian lawyer; b. in Montreal, Apr. 2, 1869; educated at the College of Nicolet, Laval University, and McGill University, graduating at the latter as D. C. L. in 1890; called to the bar in 1891. He has devoted a large amount of his time to literary work. He has published, as joint author with his father, a work on *Bills of Exchange*, and a translation of *Lake St. Louis, Old and New*, and *Cavalier de La Salle*.

**Glasson**, Ernest Désiré: jurist; b. in Noyon, France, Oct. 6, 1839; received his doctor's degree at law in 1862; was made a fellow of the faculty of law in Paris in 1867, and instructor in a course of civil procedure in 1872, and Professor of the Civil Code in 1878; in 1879 was appointed to the chair of Civil Procedure; in 1882 was elected a member of the Academy of Sciences; was decorated with the Legion of Honor in 1884. His writings treat of the history of civil institutions of France and England.

**Glazebrook**, Richard Tetley: physicist; b. in Liverpool, England, Sept. 18, 1854; studied at the University of Cambridge and was elected fellow of Trinity College in 1877. In 1882 he became demonstrator of experimental physics in the university, and subsequently assistant director of the Cavendish laboratory. In 1882 he became a fellow of the Royal Society of London. He is the author of numerous papers, chiefly on optics, and of the following text-books: *Physical Optics* (1882); *Practical Physics*, with W. N.

Shore (1884); *Heat, Light, Dynamics*, and *Statics*, companion volumes in the Physical Series of the *Cambridge Natural Science Manual*, of which Glazebrook is general editor. In 1893 he published a volume entitled *James Clerk Maxwell and Modern Physics*. E. L. N.

**Glazier**, Willard: soldier and author; b. in Fowler, N. Y., Aug. 22, 1841; educated at the State Normal School in Albany; taught in Schodack, N. Y., 1859–60, and enlisted in the army in 1861; reached the rank of lieutenant; was taken prisoner in 1863 and sent to Libby prison, afterward being transferred to Columbia, S. C., whence he escaped but was recaptured; escaped from Sylvania, Ga., in 1864. His *Prison-pen and Escape* (1865) is said to have had a sale of more than 400,000 copies. Other of his writings are *Three Years in the Federal Cavalry* (1870); *Battles for the Union* (1874); *Heroes of Three Wars* (1878); *Peculiarities of American Cities* (1883); and *Down the Great River* (1887).

**Glazounoff**, Alexander: composer of the Neo-Russian school; b. in St. Petersburg, Aug. 10, 1865; a pupil of Rimsky-Korsakoff. He holds no official appointment, and composes entirely independent of any external influence. His works contain many striking effects. A medal for his compositions was awarded to him by the jury of the Columbian Exhibition, Chicago, 1893. Some of the most notable of his works are *Suite*, op. 2; *Two Morceaux*, op. 22; *Waltzes*, op. 23; *Prelude and Two Mazurkas*, op. 25; *Three Études*, op. 31; *Nocturne*, op. 37; *Grande Valse de Concert*, op. 41; *Miniatures*, op. 42. D. E. Hervey.

**Godowsky**, Leopold: pianist; b. in Wilna, Russia, Feb. 13, 1870, and began the study of music at the age of five; at nine first appeared in public in his native town, and subsequently in the cities and towns near by. His father sent him to the Hochschule in Berlin, where he remained until 1884, in which year he first went to the U. S., remaining two years, playing in many concerts with great success. In 1886 he went to Paris and studied under Saint-Saëns. In 1890 he went to London and played there, and in 1891 he returned to New York. His compositions are mostly for pianoforte solo. D. E. Hervey.

**Gogorza**, Emilio, de: singer; b. in Brooklyn, N. Y., May 29, 1872, of Spanish parentage. While still an infant his family returned to Europe. He was educated in England, and sang as a boy in several choirs. After his voice changed he went to Paris for further study. His voice developed into a beautiful barytone, and after completing his studies he sang in many concerts with great success. In 1895 he returned to the U. S., and has since sung in many concerts. His repertory of songs and operatic arias is very large. D. E. Hervey.

**Goldbeck**, Robert: pianist and composer; b. in Potsdam, Germany, in 1835; pupil of Litolff in Braunschweig, and later in Paris. Thence he went to London, where he gave concerts, and in 1857 went to the U. S., settling first in New York, then in Boston, and later in Chicago and St. Louis. His compositions are largely for the piano, and are well written and often brilliant. He has also composed two English operas, *Newport* and *The Commodore*. D. E. H.

**Gomez**, A. Carlos: composer; b. in Campinos, Brazil, July 11, 1839. His early studies were in Rio de Janciro, and the emperor, Dom Pedro II., sent him to Milan to complete his musical education. His first opera was produced in Rio de Janeiro in 1861, and in 1867 he produced a little work in Milan, *Se sa Minga*, which was well received. His *La Guarany* was produced in La Scala, Milan, in Mar., 1870, and *La Fosca* in 1873 at the same theater. His next work, *Salvator Rosa*, brought out in Genoa in 1874, was a great success. Then came *Maria Tudor* in 1879 in La Scala, *Lo Schiavo* in Rio de Janeiro in 1889, and *Condor*, his last opera, in La Scala, in 1893. Besides these operas, he wrote *Hymn for the Centenary Celebration of the Independence of the United States*, and the national hymn of Brazil, *Il Saluto del Brasile*. D. in Pará, Brazil, Sept., 1896. D. E. Hervey.

**Gordy**, J. P., Ph. D., LL. D.: educator; b. in Salisbury, Md., Dec. 21, 1861; Ph. D., University of Leipzig, 1884; LL. D., Western University of Pennsylvania, 1897; Professor of Psychology and Pedagogy, Ohio University, 1886–96; Professor of Pedagogy, Ohio State University, Columbus, O., since 1896. He is the author of *Growth and Development of the Normal School Idea in the United States*; *Lessons in Psychology*; *The New Psychology*; *History of Political Parties in the United States*; translator of the first volume of Kuno Fischer's *History of Modern Philosophy*. C. H. Thurber.

**Goudy**, Henry, D. C. L., LL. D: British professor of law; b. in Ireland, Sept. 16, 1848; educated at private schools and at the universities of Edinburgh and Königsberg; practiced as an advocate in Edinburgh 1872–93, and was made Professor of Civil Law in the University of Edinburgh in 1889; was editor of the *Juridical Review* until 1893; curator of the Bodleian Library; was made Regius Professor of Civil Law in Oxford University and fellow of All Souls' College in 1893. He has published, as joint author, *Manual of Local Government in Scotland* (1880); *Treatise on the Law of Bankruptcy in Scotland* (1886); as editor, *Muirhead's Private Law of Rome* (2d ed. 1898); and has contributed articles to cyclopædias, periodicals, etc. F. Sturges Allen.

**Graefe**, grā'fe, Albrecht, von: oculist; b. in Berlin in May, 1828; studied mathematics and natural science, and afterward medicine, in Berlin, Prague, Vienna, and Paris; became a specialist in ophthalmology; founded in Berlin a private establishment for treatment of the eyes; edited, in collaboration with Profs. F. Arlt, F. C. Donders, and Th. Leber, *Von Graefe's Archiv für Ophthalmologie*, the leading journal of its kind in Berlin, most of his important writings being published in it. He was also Professor of Ophthalmology in the University of Berlin. D. in Berlin, July 18, 1870.—His cousin, Alfred Karl, also an oculist, was b. in Martinskirchen, Nov. 23, 1830; made a special study of diseases of the eye under the direction of his cousin and of Arlt in Berlin and Prague, and of Sichel and Desmarres in Paris; founded an ophthalmic institute, and become the first Professor of Ophthalmology in Halle. He has published *Klinische Analyse der Motilitätsstörungen des Auges* (1858); *Symptomenlehre der Augenmuskellähmungen* (1867); *Ein Wort zur Erinnerung an Albrecht von Graefe* (1870); and *Handbuch der gesammten Augenheilkunde* (1874–77).

**Grammar Schools**: originally endowed schools, established in England in large numbers by Henry VIII., Edward VI., Mary, and Elizabeth for instruction in Latin and Greek almost exclusively. They were enriched from the spoils of the monasteries and by private endowment, were to be open to rich and poor alike, and were almost exclusively under Church control. The same type of school was early transplanted to the New World. The General Court of Massachusetts enacted, Nov. 11, 1647, a general school law, the first in American history, in which occurs this clause: "It is further ordered, That where any town shall increase to the number of one hundred families or householders, they shall set up a grammar school, the master thereof being able to instruct youth so far as they may be fitted for the university." A penalty was added for not complying with the law within a year. The grammar school, in both England and America, was therefore originally a college preparatory school. A few private preparatory schools in the U. S. still retain the name, but in the main they have been supplanted by the high schools, while in general practice the name grammar schools refers to the higher grades of the elementary schools. In England they are in no sense elementary schools, but are still largely true to the purposes of their founders, preparing boys for the universities, and being under the control of the Church. But they are no longer free. "It is an interesting fact," says Sharpless, "that the idea of free education was brought into this country by the Puritans of Massachusetts, who had, many of them, received their training at the then free grammar schools of England. They extended the idea by making it possible for all classes to have education free. While we have held to the conception, and worked it out as a universal rule and practice, the schools from which it came have themselves discarded it." See Sharpless, *English Education*; Hinsdale, *Horace Mann*; Boone, *Education in the United States*; Holman, *English National Education*; Leach, *English Schools at the Reformation*; Balfour, *The Educational Systems of Great Britain and Ireland*. C. H. Thurber.

**Grant**, Frederick Dent: soldier; son of Gen. Ulysses S. Grant; b. in St. Louis, Mo., May 30, 1850; graduated at the Military Academy in 1871, and was assigned to the Fourth Cavalry Regiment; served in 1871 as an engineer on the Union Pacific and Colorado Central railroads; later in the same year went to Europe with Gen. Sherman, and in 1872

commanded the escort of the party making the preliminary survey for the Southern Pacific Railroad; served as lieutenant-colonel on Gen. Sherman's staff 1873–79, participating in expeditions against the Indians; resigned from the army in 1881; was minister to Austria during President Harrison's administration; police commissioner in New York city 1895–97; re-entered the army as colonel in 1898, becoming brigadier-general; served in Puerto Rico until Apr., 1899, and later was sent to the Philippine islands.

**Grau**, Maurice: opera manager; b. in Brunn, Moravia, in 1849, and went to the U. S. with his parents when five years old; educated in the New York public schools; graduated at the Free Academy (now the College of the City of New York) in 1867, and then began the study of law, but abandoned it and entered the employ of his uncle, Jacob Grau, an operatic and dramatic manager. In 1872, in conjunction with Charles A. Chizzola, he brought Aimée to the U. S., and in the same year directed a series of concerts with Anton Rubinstein. In 1873 he formed and managed the Clara Louise Kellogg English Opera Company, and in October of that year began a series of dramatic performances with Tommaso Salvini. He successively directed tours of Rossi, the tragedian, Ristori, Theo, Judic, Bernhardt, and the Capoul-Paola Marie Company. In May, 1887, he entered into partnership with Henry E. Abbey and John B. Schoeffel, continuing with them until the failure of the company in 1896. In May, 1897, the Maurice Grau Opera Company was incorporated in New York, since which time Mr. Grau has been the sole manager of the Metropolitan Opera-house, and in addition is manager of the Royal Opera in Covent Garden, London. D. E. Hervey.

**Gravity, Force of**: The term force of gravity is used to designate the attraction between material bodies. Whether this force is exerted between molecules, planets, or solar systems, it is but the expression under different manifestations of one and the same law pervading all nature. Ever since Newton made known the fact that the mutual attraction between bodies varies directly as their masses and inversely as the square of their distance apart, the measurement of this force has been the subject of more or less persistent inquiry. A little more than two hundred years ago science was confronted with a new and hitherto inexplicable fact. It was noticed that a clock carried from a northern latitude to the equator lost two minutes in a day. As this occurred at a time when Newton's theory was still unaccepted in some scientific quarters, the fact had great influence in strengthening the theory that the earth was an oblate spheroid, this theory resulting from the recently expounded law of gravitation. The above incident doubtless turned the thoughts of scientific men to the method of determining the shape of the earth from observations of the pendulum in different latitudes.

The force of gravity can be determined in several ways, but the result from observation of the oscillations of a pendulum is by far the most accurate. This method is now almost exclusively employed in determining the shape of the earth, as it appears from many considerations to be the most worthy of confidence.

The flattening being connected with the variations of gravity, this last phenomenon can be employed to determine the former. It follows from the theory of attraction that the ellipticity of the earth can be expressed by a formula which contains, besides known terms, the length of the seconds pendulum at the equator and at the pole. Experiment has also shown the law of change, so that in order to determine the ellipticity we have only to find the lengths of pendulums beating seconds in a number of places, and combine them to deduce the quantity sought. In round numbers it may be stated that a seconds pendulum on the equator and at the level of the sea has a length of 990·9 mm. At the pole it would be necessary to increase this to 996·2 mm. in order under the same conditions to have an equal period of oscillation. The difference is 5·3 mm., let us say $\frac{1}{189}$th part. It is shown in celestial mechanics (Clairaut's theorem) that the ellipticity of the earth is $2\frac{1}{2}$ times the ratio of the centrifugal force at the equator to the force of gravity less the increase of gravity in passing from the equator to the pole. Now this is equal to the quantity 5·3 mm., found above, divided by the length of the pendulum at the equator (in round numbers, 991 mm.). The ratio of the centrifugal force to the force of gravity is known to be $\frac{1}{289}$, so that, roughly speaking, the ellipticity would be $2\frac{1}{2} \times \frac{1}{289} = .0053$, or approximately $\frac{1}{300}$th part. This is nearly correct, and would give a difference between the polar and equatorial diameters of the earth of about 26 miles.

In order that the best value attainable may be reached, observations covering the greatest possible extent of geographical limits are included. This necessitates treatment by the method of least squares. For every station at which the pendulum is swung a conditional equation may be written of the form

$$V^2 = v^2 (1 + g \sin^2 L),$$

where $V$ = the number of vibrations made in latitude $L$, $v$ = the number of vibrations at the equator, and $g$ = the increase of the force of gravity from the equator to the pole. The normal equations being formed in the usual way and the solution effected, by substitution in the formula of Clairaut, cited above, we arrive at an ellipticity, in the determination of which all observations enter with due weight and combine to establish one homogeneous and consistent result.

The final value of the ellipticity now largely accepted in the scientific world is $\frac{1}{299}$, and it may be mentioned in this connection that the discrepancy which formerly existed between the determinations of this quantity by pendulum observations and by the measurement of arcs on the earth's surface by triangulation has practically disappeared. The earlier arc measures gave $\frac{1}{298}$. This was changed as new and more accurate data came to hand, first to $\frac{1}{299}$ and finally to that given above. The first pendulum results were in error on the other side, and a value of $\frac{1}{288}$ was accepted from this work. Later observations modified this and changed the value in the direction of a result given by the measurement of arcs, so that both classes of determinations now seem to be in accord within limits of error usually ascribed to this class of operations.

About 1,400 stations have been occupied for gravity observations up to the present time (1899). Almost half of these belong to Austria. Germany comes next in point of number, and the U. S. third. The greater part of the remainder falls to England, Denmark, Russia, Switzerland, France, and Italy. Almost every civilized country has now engaged in this work, and many observations have been made by exploring expeditions originally projected with other ends in view, but whose wide geographical limits of operation made them splendid opportunities for this particular line of research. Among the older work of this kind may be cited the investigations of Foster and Sabine on the part of England; De Freycinet and Duperrey on the part of France; and Lutke and Sawitsch on the part of Russia. These expeditions embrace stations on both sides of the equator, and four points are well within the Arctic circle. The northern work is, of course, especially valuable. An effort has always been made, the opportunity presenting itself, to measure the force of gravity as near the pole as possible. The most northern station at which the pendulum has been swung is that of Greely, at Lady Franklin Bay, in lat. 81° 44′. The highest station thus far occupied is that of Basevi, in the Himalayas, at an altitude of more than 15,400 feet. The difficulties in the way of successful work in the last two cases may be understood when we remember that in the former the temperature was sometimes — 70° F., and in the latter the pressure of the atmosphere was approximately only half that at the sea-level.

In the determination of the force of gravity by means of the pendulum either of two methods may be employed. First, we may find the absolute force at each station occupied by noting the time of oscillation and measuring the length of the pendulum. These two quantities enable us by a simple arithmetical process to find the value of gravity. Second, we may perform the operation just described at an initial station and deduce the value of gravity at any other station by simply comparing the times of oscillation of any pendulum made to vibrate in the two places. As the measurement of the length is a much more costly and difficult operation than the measurement of time, it is needless to state that by far the greater part of the determinations of the force of gravity are merely relative, and are referred to some base station taken as a standard. A number of such points have been established in different parts of the world, each country engaging in this work generally selecting one within its own territory.

The limits of this article will not allow a full development of the details of pendulum work, nor will more than a very general description of the different types of instrument be possible. From the two methods already mentioned of pursuing gravity work have sprung as many forms of apparatus, each one adapted to the particular end in

view. The reversible pendulum, symmetrically made as regards its exterior form, but unequally weighted within, is used in absolute determinations. The invariable one of various patterns and lengths is employed in relative work.

Any one of these instruments is capable of furnishing its period of oscillation correct to within a few millionths of a second. The operation at each station, briefly stated, is as follows: In either absolute or relative work a meridian telescope is mounted, and the passage of stars across the meridian is noted electrically by means of a chronograph. This is done before starting the pendulum and again after the close of the oscillations. Transits of the pendulum are also registered on the chronograph, or in some other way referred to the same timepiece as that used in the star observations. We thus have the period of oscillation of the pendulum in known units of time. The procedure thus far is identical for both the reversible and invariable pendulums—that is, for absolute and relative determinations of gravity. If now we wish the absolute force, the length of the reversible pendulum is measured and a simple calculation gives the result. If relative gravity is desired, it is only necessary to compare the time already found with that derived in precisely the same way at another station.

It is not within the province of this article to deduce fundamental formulæ nor to follow mathematically the steps leading to the legitimate conclusions of pendulum work bearing on the shape of the earth. It will be well, however, for each of the two classes of operations just outlined to throw light on the points of departure and indicate briefly the line of thought.

It can be proved in several ways that the ratio of the length of the seconds pendulum to the force of gravity in different latitudes is a constant quantity, and is equal to the square of the ratio of the diameter to the circumference of a circle. From this fundamental relation between the length of a pendulum, its time of oscillation, and the force of gravity, another one can be deduced from which the first quantity is eliminated and the connection between the last two is established. This relation is that when the same pendulum is carried from one place to another the squares of the times of oscillation are inversely as the forces of gravity at the two places. We have therefore a means of determining the relative forces of gravity at two stations, independently of the length of the pendulum employed, by simply counting the oscillations made in a given time at one place, carrying it to another, and repeating the operation under the same conditions. It is necessary, of course, that the length of the pendulum remain invariable, since this is a direct function of the time of oscillation. It has been stated that the experiments should be made under similar conditions. This, however, can be only approximately realized, and certain corrections to the observed period of vibration are always applied before the quantities sought are strictly comparable. These may be enumerated briefly as follows: First, for the arc of oscillation; second, for the temperature of the pendulum; third, for the pressure of the atmosphere. These are the principal ones. Besides, when the quantity is appreciable the flexure of the support must be taken into account. The period thus reduced is still further to be corrected for height above the sea-level, and the resulting values for different stations should then only show the effect of a change of latitude, together perhaps with accidental errors and differences depending on a change of density in the earth's crust.

The value of the determinations of the force of gravity consists principally in their ability to throw light on the shape of the earth. They may also be used in finding its density, which phase of the subject will be touched upon later. Stations have been occupied in all parts of the world, including islands of the sea and the highest mountain peaks. Particularly have efforts been made to make these determinations as near as possible to the poles and on the equator, since the force of gravity has its maximum and minimum values at these points. It is evident that the deduced figure of the earth will be a surface of revolution, and therefore, in order to prepare the data to enter the problem with the proper influence, all results, as before intimated, must be reduced to what they would be on this surface of revolution at the mean level of the sea. A simple example will show the nature and necessity for the correction for elevation, or, in other words, the difference between the force of gravity observed on the top of a mountain and that at the sea-level. The fundamental law of gravitation is that the force varies inversely as the square of the distance. It is also easily shown that in a vibrating pendulum this force varies inversely as the square of the time of oscillation. Hence from these two assertions it is evident that the period of a pendulum varies directly as its distance from the earth. So that if we should carry a pendulum to the top of a mountain one mile high, since the distance from the center of the earth is increased in round numbers by its $\frac{1}{4000}$th part, we should find that the time of oscillation was increased in the same ratio. A seconds pendulum, therefore, that would beat in a mean solar day 86,400 times at the sea-level would lose 21·6 seconds on the mountain-top. At a distance of 2 miles above the surface of the earth it would lose 43·2 seconds, and so on. All this is quite irrespective of the matter composing the mountain, and takes account only of the increased distance. As a matter of fact, it is found that when pendulum observations are made on mountains the decrease in the force of gravity is not as much as one would expect. A few years ago a pendulum was carried to the top of Haleakala, an extinct crater about 2 miles high in the Hawaiian islands. Calculation showed that 41 oscillations less should be made in a day on the summit than at the sea-level. When the results were made known it was found that there were lost actually only 28 seconds, so that the outstanding difference of 13 seconds must have been due to the accelerating effect of the mountain mass immediately under the pendulum. Parenthetically it may be stated here that this result gave unexpected evidence in favor of certain geological theories on the internal structure of the volcano. The same experiment was made on an adjacent island, where the pendulum was swung on top of Mauna Kea, 2½ miles above the sea. Here the calculated loss was 54 oscillations in a day. The number actually lost by count was 32, showing again a downward attraction of the mountain, amounting in this case to 22 seconds in a day.

Besides the correction for elevation and those specified above, the timepiece by means of which the period of oscillation is measured is subject to variations of rate, which necessarily involves a still further modification of the observed time. An idea of the magnitude of these corrections may be had from the following statement: The period of oscillation of a pendulum beating seconds would be changed by approximately its $\frac{1}{100000}$th part by a change of rate of one second a day in the timepiece employed, by a change of 1° C. in the temperature of the pendulum, by a change of 1 inch in the pressure of the atmosphere, by an amplitude of $\frac{1}{100}$th of the radius, by an elevation of 100 meters, and by a change of latitude of 20′. All these changes have about the same effect on the time of vibration. From this statement one may realize how minute the corrections are to reduce the observed periods of oscillation to a basis of comparison arbitrarily chosen as a standard, because from station to station the variations in the conditions need not be more than $\frac{1}{10}$th of those indicated.

One of the interesting manifestations of the force of gravity is a phenomenon known as the deflections of the plumb-line, since from these deflections it is possible to determine the mean density of the earth. When a system of triangulation is carried over an extent of country, and the geographical co-ordinates as deduced by computation are compared with those resulting from direct observation, certain discrepancies are brought out. These are produced by virtue of the fact that the vertical position of the instrument, as defined by the level and plumb-bob, is not what it would be on the surface of an ellipsoid of revolution composed of homogeneous layers of matter. The excess of material in mountains or its defect in valleys, and a change of density in the underlying strata on a perfectly plain surface, may change the direction of resulting gravity. When this change in direction can be measured, and the attractive force of the matter causing the disturbance can be estimated, we are in possession of a simple linear equation involving as the only unknown term the mean density of the earth. This same quantity can be determined from measurements of the force of gravity at the foot and summit of a mountain, because we have here an equation involving the ratio between the density of the earth taken as a whole and the density of the mountain, with other quantities readily determined by observation. We, therefore, not only have two distinct and independent methods of arriving at the same result, but also have a check on either procedure by comparison.

A striking example of the operation just described was had on the island of Maui. The circumstances for this

work were especially favorable, because the mountain rises abruptly from a deep sea, and there were no surrounding masses to complicate the solution. The diminution of the force of gravity in passing from the sea to the summit was determined, as well as the average density of the rocks, from an analysis of specimens obtained on all sides of the mountain. A triangulation was now made around the island, and the latitudes found by this means were compared with those deduced from direct observations on the stars.

We have in the foregoing data two ways of getting the earth's mean density. From the change of the force of gravity the following equation holds:

$$\frac{dg}{g} = -\frac{2h}{r}\left(1 - \frac{3}{4}\frac{\delta}{\Delta}\right),$$

where $g$ stands for the force of gravity ($dg$ being its differential), $h$ is the altitude of the mountain, $r$ is the earth's radius, $\delta$ is the mean density of the mountain, and $\Delta$ is the mean density of the earth. All the quantities except $\Delta$ being known, either from observation or previous knowledge, this is easily found.

By the method of triangulation we have

$$D = 12''{\cdot}44\frac{A}{\Delta},$$

where $A$ = the mountain attraction, $D$ = the angular deflection resulting therefrom, and $\Delta$ = the earth's mean density—an equation containing only $\Delta$ together with known or determined quantities.

Without going into a complete analysis of the two equations cited above, in order that the thought embodied therein may be appreciated, it is worth while to state the considerations on which they are based. The former is simply an expression of the difference of vertical attractive force between the earth, taken as a whole, and the mountain. The first term, $\frac{2h}{r}$, shows the decrease of the force of gravity, with an increase of elevation from Newton's law of the inverse square of the distance, and the second term, $\frac{3}{2}\frac{h}{r}\frac{\delta}{\Delta}$, shows the downward attraction of the mountain considered as a cone having a base very large in comparison with its height. This condition is nearly always realized. It might be remarked in passing that the combined effect of these two terms, when the density of the earth's crust is assumed to be one-half the earth's mean density, amounts to $\frac{5}{4}\frac{h}{r}$. This is the quantity which has passed into gravity literature under the name of Young's rule, but which was really first applied by Bouguer many years before. From the first formula written above, it appears that if the density of the earth's crust between the sea-level and the upper station is one-third as much again as that of the earth, the downward attraction of the mountain would just balance the diminution of gravity on account of increased distance, so that as far as these two causes are concerned the force of gravity would be the same at the upper station as it would be at the lower with no mountain existing.

The second formula, like the first, is based on a comparison of the attractive forces of the earth and the mountain, but here the mountain's horizontal force is balanced against the earth's vertical one, and the resultant is the angle of deflection, brought out by comparing the astronomic and geodetic latitudes. Knowing the earth's dimensions, an expression of its attraction in terms of its density is readily written, since it is treated as a sphere. Not so, however, with the mountain, since this method requires an accurate estimate of its mass. This is made by the aid of an elegant method of finding its volume due to Hutton, which is as follows: A contour map of the country is first made. From the station for which the attraction is to be calculated concentric circles and radial lines are drawn, so that the map is divided into a number of compartments. By the aid of the contours the heights of these compartments above a given horizontal plane are found by inspection. Writing first a general algebraic expression for the mass of one of these prisms of matter, bounded by a horizontal plane below, by the surface of the mountain above, and on the four sides by imaginary surfaces through the radial lines and concentric circles just mentioned, we proceed to integrate this expression between appropriate limits for azimuth height and distance. The result is a definite integral giving the attraction of the mountain at the point chosen. By an ingenious artifice in laying out the compartments the computation can be greatly simplified. Let us suppose that the sines of the azimuths of the radial lines from the true north are taken in arithmetical progression, and that the radii of the circles are in geometrical progression. The determination of the attraction is then reduced to simply summing the heights of the compartments and multiplying by a common factor.

The work just described furnishes a remarkable example of verification in operations of this kind. From the determinations of the force of gravity at the sea-level and at the summit the mean density of Haleakala was found to be 2·72. Employing this value and calculating the effect of the mountain on a plumb-line at the sea-level, or, as it is technically called, "the deflection of the vertical," a value of 27·9 seconds was derived. By carrying the triangulation around the mountain and over it by two series through a total number of 22 geometrical figures a deflection of 29·4 seconds appeared, agreeing remarkably well with the predicted value from determinations of the force of gravity and calculation of the attraction of the mountain. Although these two results do not accord perfectly, the agreement must be considered eminently satisfactory when we consider the great uncertainty necessarily involved in some of the data employed.

Other notable results from work in this direction are, first, investigation of the relative densities of the different parts of mountains, and, second, comparative studies of the change of density in the earth's crust. It has been shown that the lower half of volcanic mountains may be nearly twice as dense as the upper; and in a region where enough gravity stations appear for the purpose a connection is easily traced between the excess or defect of gravity, on the one hand, and the geological formation on the other. It is not too much to say that the time may come when the pendulum will be employed to reveal the internal structure of our globe. Some experiments seem to lead to the belief that the force of gravity may be subject to periodic changes in given localities, and a recent discussion of results from 500 stations foreshadows the establishment of a different curvature for the northern and southern hemispheres of the earth.

Two facts are now well established in regard to variations of the force of gravity—viz., that there is an excess of this attraction on islands, and an apparent defect on elevated portions of continental plateaus. This defect was at one time thought to be excessive. The first pendulum observations made in South America gave the result that the Andes were not much heavier than water. More recently the Alleghanies, in Pennsylvania, were shown to be extremely light. A pendulum carried to the summit of the Himalayas at an elevation of 15,400 feet was found to make 22 oscillations a day less than would be expected, judging from the accepted volume and density of the underlying matter. All these facts seemed to point to the existence of great cavities under the surface of the visible mountain masses, or at least a decided attenuation of the inside material. More recent work has not fully confirmed this extreme view, yet it has generally given evidence in the same direction, and the best opinion at the present time doubts the propriety of making any correction at all for continental attraction. It was certainly a remarkable coincidence that the defect of gravity on the summit of the Himalayas turned out to be precisely the amount by which the force of gravity was corrected for the downward attraction of the matter lying between the upper station and the level of the sea; so that had no correction been made for this matter, the force of gravity determined at the summit and reduced to sea-level, simply on account of the distance therefrom, would have agreed with the theoretical value, depending only on a change due to a change in latitude. One or two exceptions to the above rule may be noted. Mauna Kea, in Hawaii, has been shown to be fully as heavy as its size and material would indicate, the mean density of the mountain, from pendulum observations, being 2·9, and an analysis of the rocks gives the same figure.

On the other hand, the force of gravity determined at the sea-level on islands surrounded by a deep ocean appears to be in excess. This has been shown repeatedly, and the effect is most marked in the case of St. Helena and Ascension. The cause of the phenomenon is still a mooted question. It would seem that this additional effect might in many cases be accounted for by the additional attraction of the sea-water.

The determinations of the force of gravity by means of

the pendulum have led to work of extreme precision in the measurement of both length and time. The comparison of the length of the pendulum with the standard is effected in both a horizontal and a vertical position, the precision attained being such that a perceptible difference between the two results appears in the heavier pendulums employed. In finding the lengths of the period of oscillation the accuracy now reached may be stated as one-millionth of a second. Individual swings generally show discrepancies not much greater than this, and the mean period finally deduced under different conditions and accepted as the time of vibration at a station is never in error more than the quantity stated.

Closely connected with many questions in practical geodesy is the establishment of the mean level of the sea, since this is the fundamental plane to which are referred physical measurements involving elevation. Now it turns out that this datum plane, once thought to be irreproachable as a standard, is subject to disturbances in the vicinity of continents. It has been shown that the attraction of the Himalayas on the waters of the Bay of Bengal may produce an elevation of the surface of the sea of several hundred feet, and the Andes, on account of their great proximity to the ocean, may distort its surface to the extent of a thousand feet or more. This shows the importance of the measurements of the force of gravity, and the great value attached to the determinations of the density of elevated plateaus near the sea.

An account of gravity work may be appropriately concluded with a statement of some of the practical devices employed to find the number of oscillations made by a pendulum in a given time. This is a necessary step in the determination of the time of vibration. In the older work the gravity pendulum was swung in front of and in close proximity to a clock pendulum—the rate of the clock being found by astronomical observations. If the times of vibration of the two pendulums are not equal one will gain on the other, and after an interval, depending on their respective rates, will have gained one complete excursion. If they start in coincidence, that is, pass the equilibrium-point together, going in the same direction, and after diverging come again to this phase, one will have gained in the interval two oscillations on the other. This furnishes sufficient data to determine the time of vibration of the gravity pendulum in terms of the clock pendulum, and through this medium its value in absolute units of time. The characteristic feature of this method is that the observation of the coincidence may be in error several seconds without introducing any appreciable error in the result.

A more laborious method of finding the time of vibration, but one that has been used extensively in the U. S., is that of registering on a chronograph the transits of the pendulum across the field of a telescope. A chronometer at the same time automatically marks seconds on the same sheet, and by reference thereto the time of vibration of the pendulum becomes known. In order to verify the count, intermediate transits of the pendulum are taken, and this is done often enough to make sure that the uncertainty of the determination of one oscillation by means of these short intervals will not in the total time accumulate to be more than half or at most three-fourths of an oscillation. If the pendulum is always observed when it is moving in the same direction, any interval will contain an even number of oscillations. An uncertainty, therefore, of even three-fourths of a vibration can throw no doubt on the actual number made during the time considered. Thus the pendulum may be allowed to swing many hours, and the number of oscillations made can be determined as unerringly as though each vibration was counted by some automatic means.

A third way of finding the period of the pendulum is by coincidences of beams of light. One ray is thrown on a mirror attached to the moving pendulum, while another falls on a stationary mirror near by. Both find their way after reflection back to the starting-point, and are received in the field of a small telescope suitably adjusted for the purpose. As long as the pendulum is stationary and at the equilibrium-point a coincidence of the two rays occurs. If the pendulum now be made to oscillate, and if its period is slightly different from the intervals at which the beams of light are made to appear by the timepiece, a displacement of the images is seen. This displacement increases with each flash until the extreme amplitude is reached, when the images begin to approach, and so continue until the pendulum again appears at the equilibrium-point at the exact moment of the flash, when another coincidence occurs. If the coincidences have been noted with the pendulum moving in the same direction, it has in the interval made two oscillations more or less than the timepiece has marked seconds, and thus a comparison can be made between them.

Summing up the origin, methods, and results of gravity work, it may be said that the first experimental proof of a change of the force of gravity with a change of latitude was had more than two hundred years ago, when an astronomical clock was carried from Paris to Cayenne and found to lose about two minutes each day. This fact revealed the possibility of determining the ellipticity of the earth by means of the pendulum. The methods of measuring the force of gravity as now pursued are purely differential, and consist in observing the relative number of oscillations made by any pendulum of invariable length in different places. The result from all the work done thus far is that the difference between the polar and equatorial diameters of the earth is $\frac{1}{292}$d part, which is equal to about 26 miles.

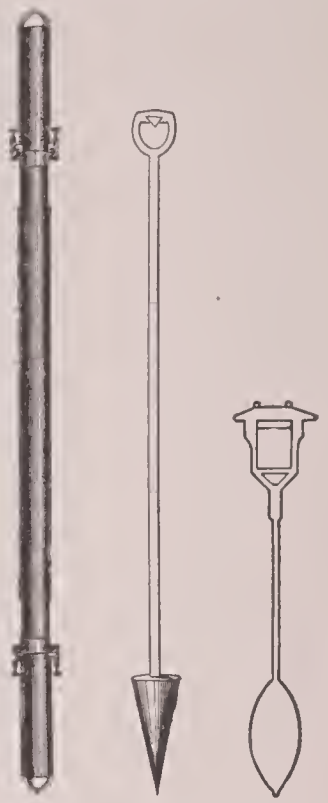

Fig. 1. Fig. 2. Fig. 3.

The three principal types of pendulums used in gravity measures are shown in Figs. 1, 2, and 3. Fig. 1 is reversible and is used in absolute measures. Figs. 2 and 3 are invariable and are employed in relative work. Figs. 1 and 2 have a virtual length of 1 meter and beat seconds. Fig. 3 is one-fourth as long, and has a period of oscillation of half a second.

Erasmus D. Preston.

**Great Britain**: The census of the United Kingdom was last taken in 1891, but the population of the chief cities and towns in England and Scotland was ascertained in 1897, as follows: England—Greater London, 6,292,000; London County, 4,421,000; Liverpool, 633,000; Manchester, 534,500; Birmingham, 506,000; Leeds, 409,500; Sheffield, 352,000; Westham, 274,000; Nottingham, 233,000; Bristol, 232,000; Bradford, 231,000; Kingston-upon-Hull, 225,000; Newcastle-upon-Tyne, 217,500; Salford, 213,000; Leicester, 203,500; Portsmouth, 182,500; Cardiff, 170,000. Scotland—Glasgow, 715,000; Edinburgh, 292,500; Dundee, 163,000; Aberdeen, 138,000.

Of the total area of the United Kingdom, which is 77,672,816 acres, 19,943,843 acres are arable land and 27,924,710 acres are in permanent grass, making a total of 47,868,553 acres devoted to agriculture. Great Britain produces more per acre of every staple food suited to her soil and climate than any other country in the world, but has a larger population in proportion to the cultivable area than any other country in Europe, and it is impossible, therefore, to provide the food required without very large importations. The land is high-priced, and ocean transportation has become so cheap that the farmers of Great Britain find it almost impossible to compete with wheat from India and the U. S., cattle from the plains of Colorado and Texas, mutton from New Zealand, and fruit from various foreign sources of supply. The result has been a long period of agricultural distress, which was partly relieved by the better prices and large crops of 1898, though years of prosperity will be required to restore to British farmers the comparative comfort of twenty years ago. The troubles of the tenant farmers in recent years would have been even far more serious had it not been for the small cost of agricultural labor. Wheat, which had always held the first place in British agriculture, gave place to oats in 1893. Thirteen years earlier the area devoted to wheat was more than twice as much as that given to oats, but in 1893 the acreage in oats was 1,914,373 acres, and in wheat 1,798,869 acres. Much of the land lost to wheat culture has been put into pasturage. Owing to better prices for wheat, a much larger acreage was devoted to that cereal in 1898, though the acreage of oats still led by about 900,000 acres. Besides the very large quantity of

cereals and meat imports, Great Britain imports annually more than $205,000,000 worth of perishable food-products such as butter, cheese, milk, eggs, poultry, fruit, and vegetables. Broadly speaking, the areas that have suffered most severely from agricultural depression are the arable counties lying in the eastern half of the island from and including the East Riding of Yorkshire southward. Rents of farm lands in some of these counties have fallen to nominal figures, in many cases to less than 50 per cent. of their former values, and a considerable extent of land has passed out of cultivation owing to the inability of the farmer to compete with the cheap prices at which food-products are imported from abroad.

While the enormous industrial development of the U. S. has given it the first place among manufacturing nations, Great Britain, of course, continues to hold the highest rank among other industrial lands, though it does not so greatly surpass Germany as it did formerly. The strongest pillar of English industry is cotton-spinning, in which it far surpasses all other nations, employing more than 600,000 workmen. The gradual change in the proportions of the cotton manufactures of the leading countries within the last sixty years is illustrated in the following table showing percentages of cotton manufactures at various periods since 1831:

| | 1831-35. | 1851-55. | 1871-75. | 1891-94. |
|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | Per cent. |
| Great Britain..... | 58 | 51 | 48 | 32 |
| European Continent | 30 | 31 | 34 | 41 |
| United States..... | 12 | 18 | 18 | 27 |

The quantity of cotton consumed by the leading manufacturing countries in the season 1896–97, as compared with 1860–61, in bales of 500 lb., was:

| | 1896-97. | 1860-61. |
|---|---|---|
| Great Britain ..... | 3,224,000 | 2,091,000 |
| European Continent..... .. | 4,368,000 | 1,379,000 |
| United States..... | 2,738,000 | 807,000 |
| India..... | 1,000,000 | 52,000 |

In 1897 Great Britain had 370,000 fewer spindles than in 1893; the European Continent, 3,470,000 more spindles; U. S., 1,715,000 more; India, 424,000 more.

The cotton exports from Great Britain have for years been slowly decreasing, though Great Britain is still far ahead of all other countries in this branch of her export trade. A number of the industries of the west of England have almost ceased to exist. The manufacture of lace is no longer prosperous, as the introduction of machinery has caused it to suffer more and more. The exports of woolen manufactures have not fallen off to any important extent and in some lines have increased. Great Britain consumes about six-elevenths of her woolen manufactures. Some grades of carpets once famous have ceased to be manufactured. The linen industry has declined. The silk industry has grown considerably within the last twenty years, but the product falls far short of meeting the home demand. Silk is the only textile industry for which England is dependent, in part, upon other countries. The metal manufactures, which take the second place in English industries, and which were long unequaled in quantity, excellence, and cheapness, have recently suffered severely from American and German competition, and within two years England has been surpassed by the U. S. in the cheapness and quantity of iron and steel produced. In the British iron and steel trades the opening of new markets, the cost of labor, and the success of foreign competition are important questions, but a still more pressing matter is the problem how and whence the British blast-furnaces are to secure adequate supplies of ore at a reasonable cost. The supplies of home ores have been falling off from year to year for at least fifteen years, until the Cleveland and West Cumberland mines are now regarded as the only sources of supply that may be depended on for large future requisitions; and the ores of these home districts can not now compete in cost with the ores imported from Bilbao, Spain, 1,000 miles or more from England, or from Swedish Lapland, more than 1,600 miles distant. As the Bilbao ores are nearly exhausted, it seems likely that Great Britain must depend in future upon ores imported from other and more remote parts of Spain or from mines situated within the Arctic circle and capable of being worked only six or seven months of the year.

The shipbuilding product of 1898 was enormous, amounting to 1,610,000 tons, nearly 300,000 tons more than the output of 1889, which had hitherto been the record year for the United Kingdom. The two chief centers of shipbuilding were the northeast coast and the Clyde district. Considerably more than half the production was from Blyth, the Tyne, the Wear, West Hartlepool, the Tees, and Whitby. At the Belfast yards two steamers of more than 12,000 tons figured in the returns, and on the Tyne a steamer of nearly 10,000 tons was built.

The country is slowly introducing electric tramways, and trolley routes are now in operation in Glasgow and Liverpool. The project of utilizing water-power furnished by the lochs in the Highlands of Scotland for the production of electric power with which to run mills is under consideration, and it is thought that the prediction of Lord Kelvin, that "the production of electricity by means of waterfalls will some day attract a prosperous population to the Scottish Highlands," will come true. C. C. Adams.

**Great Britain, History of**: In 1890 Lord Salisbury was still in office, at the head of a ministry composed of Conservatives and Liberal-Unionists. Gladstone was still the leader of the Liberals, who were acting with the Parnellites in behalf of home rule for Ireland. The Irish cause, however, seemed on the wane. A parliamentary commission tried to connect Parnell with the violent acts of the extremists, and the London *Times* severely assailed "Parnellism and crime." The latter charges were indeed refuted, but the Irish party was hopelessly split in consequence of a divorce case in which Parnell was involved. The division continued after his death in 1891, and the whole matter alienated many English supporters of home rule. The Conservative majority, however, was dwindling. In the election of 1892 a home-rule majority of about 40 was secured, composed of Liberals, Parnellites, and anti-Parnellites. For the fourth time Gladstone became Prime Minister.

The Home-rule Bill was again brought forward in 1893. It passed the Commons, but was rejected overwhelmingly by the House of Lords. This act and others have caused a considerable agitation in favor of "ending or mending the House of Lords." Beaten on home rule, Gladstone's Government passed measures reforming local government and improving the system of taxation. The venerable Premier retired from office in 1894, and was succeeded by Lord Rosebery. The Liberal majority gradually disappeared and the Conservatives resumed power under Lord Salisbury in 1895, and were sustained in a general election by a decisive vote; they numbered 411 members, against 177 Liberals, while the Liberal-Unionists and Irish factions formed smaller groups. The Conservatives have dealt with Irish land and the school question. In 1897 the Queen's jubilee was the prominent event. Foreign affairs have been of great interest. The usual number of petty wars have occurred, as in West Africa and India. From the Transvaal, where the ill-advised "Jameson's raid" nearly caused grave complications in 1896, to Egypt, the Dark Continent has been a scene of great activity. Lord Kitchener reconquered the Egyptian Sudan in 1898. Strife with France in that region was narrowly averted in the same year. The Far East has been in these years the theater of events which have deeply interested British feeling. Friendly relations with the U. S. were temporarily checked at the close of 1895, in consequence of opposition to the extension of British territory in the direction of Venezuela. The good feeling was, however, conspicuously shown during the American-Spanish war of 1898, and in connection with the control of Samoa in 1899. For Transvaal War see Africa. Edmund K. Alden.

**Greatorex**, Eliza: painter; b. in Manor Hamilton, Ireland, Dec. 25, 1819; went early to the U. S.; studied painting in New York under William H. Wotherspoon and James Hart, and in Paris under Émile Lambinet; was made an associate of the National Academy of Design, New York, in 1870. Her principal works include *Bloomingdale* (1868); *Château of Madame Oliffe* (1869); *The Old Porch*, *Views of Amsterdam*, *Old St. Paul's* (1876); besides a number of pen-and-ink drawings, of which *Albert Dürer's House in Nuremberg* belonged to Pius IX.; *The Homes of Oberammergau* was reproduced and published in Munich in 1871. D. in Paris, Feb. 9, 1897.

**Greece**: Only one-third of the wheat consumed in Greece is raised in the country, the rest being imported from Russia, Roumania, and Turkey, to the average value of more than $5,000,000. The country imports little from the U. S. except petroleum. Woolen and cotton manufactures are

developing. The production of cotton textiles has attained considerable prominence in Athens and Phaleron, but is chiefly developed in Piræus. There are also spinning-mills in Livadia, Chalcis, Patras, and Syra, with a total of 100,000 spindles. The dyeing of fabrics is still very primitive. Except a part of the textiles, wine, spirits, soaps, flour, and a few other articles, all manufactured goods are imported, mostly from other European countries. Raw cotton comes from New Orleans and Egypt, and hides chiefly from Argentina. The principal ports are Piræus, Patras, and Syra on the island of that name. The larger part of the imports are received through Piræus, whose fine harbor has been enlarged and deepened to accommodate the larger modern steamships. Piræus is the chief commercial center, as it is in regular communication with markets of production and consumption, both home and foreign, and is the starting-point of nearly all the railroads yet working in the country. Patras, however, holds the first place in the export trade, as it is nearer the chief areas of currant-growing, currants being the chief exports of the country. In 1897 currants were two-fifths of the total exports, and cereals were about one-fourth of the total imports. The total exports were $15,581,676, and imports $22,148,975. The figures were less than the usual returns, as Greek trade was greatly hampered by the war with Turkey during more than half the year. The total trade has sometimes reached $45,000,000. In 1899 the exports were $18,270,462.92, and the imports $24,720,579.86; the exports to the U. S. were $213,507. Nature has helped to retard the industrial development of the country. The amount of water-power is small, and coal and wood are not in sufficient quantity to serve the purposes of large manufacturing. As in all very mild climates, also, human energy is not intense. The country is sparsely peopled; most of the inhabitants are poor, have few needs, and these for the most part are easily supplied. Labor is not abundant, and in all the larger undertakings, such as mining and railroad construction, many foreign workmen are employed. Home industries in provincial towns supply a considerable part of the demand of the peasantry for leather and metal goods, clothing, carpets, etc. The capital needed for the larger enterprises is lacking. The trade of Greece, however, is capable of much greater development. The country specially needs machinery, metal ware, grain, and cotton, and many Greek merchants in 1898 expressed a desire for better trading facilities with the U. S. Up to the close of that year all goods imported from the U. S. came by British, French, German, or Italian steamers, with one or two transshipments and consequent heavy freight rates, damage to goods, and loss of time.

C. C. Adams.

**Green**, Andrew Haswell: lawyer; b. in Worcester, Mass., Oct. 6, 1820; educated at Worcester Academy. In 1837 he went to the West Indies for a year. On his return he studied law, was admitted to the bar, and began practice in New York. In 1855 he became president of the board of education, and while holding this position was made commissioner of Central Park. He held successively the offices of treasurer, president, and comptroller of the park. He exercised a controlling influence in the development of the zoölogical garden, Riverside and Morningside Parks, and the system of drives and boulevards. In 1871, after the exposure of the frauds committed by the Tweed ring, Mr. Green was appointed deputy comptroller, and later comptroller of the city of New York. In spite of great difficulties, he succeeded in saving the city treasury from wreck, and at the same time settling lawful claims upon its funds. In 1883 he was appointed a member of the Niagara Park Commission, and soon afterward became its president. The idea of consolidating New York and the neighboring cities originated with Mr. Green, and he was one of the commissioners appointed to draft the charter of the enlarged city.

**Green**, Joseph F.: naval officer; b. in Maine, Nov. 24, 1811. He was entered as midshipman in 1827, became passed midshipman 1833, and was commissioned lieutenant 1838; he took part in all the important actions on the Pacific coast during the Mexican war, being attached to the Ohio; served at the Boston navy-yard and at the Naval Academy 1850–58; was advanced to commander in 1855, to captain in 1862; from 1862 to 1864 commanded the Canandaigua, of the South Atlantic blockading squadron, taking part in the bombardment of Fort Wagner in 1863; was on ordnance duty at the Boston navy-yard 1866–68, and was made commodore 1867; commanded the Southern squadron of the Atlantic fleet in 1870; was made rear-admiral in the same year, and was retired in 1872. D. in Brookline, Mass., Dec. 9, 1897.

**Green**, Traill, LL. D.: chemist; born in Easton, Pa., May 25, 1813; graduated in medicine at the University of Pennsylvania in 1835, and opened practice in Easton. He became Professor of General and Applied Chemistry at Lafayette College in 1837, and of Natural Sciences at Marshal College, Mercersburg, in 1841, returning to Lafayette College in 1847, where he organized the Pardee scientific department. He was the first president of the American Academy of Medicine, president of the Pennsylvania Medical Society in 1868, and served under several State appointments. Washington and Jefferson College gave him the degree of LL. D. in 1866. D. in Easton, Pa., Apr. 29, 1897.

**Greene**, Harry Plunket: singer; b. in County Wicklow, near Dublin, Ireland, in 1865, and was intended for the legal profession, and was preparing to enter Oxford University, when he was seriously injured in a game of football. After recovery he went to Stuttgart, where he studied music for three years. Next he went to Florence, Italy, for voice-culture, but stayed there only six months, and finished his studies in London. Since then he has made singing his profession, and has appeared every season with great success. He sings only songs, and generally gives an entire recital himself alone. He sang in the U. S. for the first time in the season of 1894–95, and has sung there every season since. His voice is a pure, sweet, and flexible bass, with considerable barytone quality.

D. E. Hervey.

**Greenland**: The Danish possessions on the west coast are divided, for administrative purposes, into two inspectorates: North Greenland, consisting of the districts Upernivik, Omenak, Ritenbenk, Jakobshavn, Christianshaab, Egedesminde, and Godhavn; and South Greenland, consisting of the districts Holstensborg, Sukkertoppen, Godthaab, Frederikshaab, and Julianehaab. The entire Danish coast not covered with glaciers is estimated at about 34,300 sq. miles, or nearly as large as Iceland. The population in 1890 was 10,516, including about 300 Europeans. The only settlement on the east coast is Angmagsalik, lat. 65° 37′ N., where 431 natives lived in 1885, and in Aug., 1894, Capt. Holm, of the Danish navy, established a trade, missionary, and meteorological station there, which is maintained by the Danish Government. All the Danish possessions in Greenland are closed to the trade of other nations, and the natives have thus been saved from many demoralizing influences. The Danish Government endeavors in all ways to promote their welfare. The colony of Julianehaab contains 8 trading stations and 2,308 inhabitants, but, though it lies nearest to Europe, it is the most isolated of the districts, for, on account of the drift-ice from the open sea, it is usually reached only by a long detour to the N. Frederikshaab has 865 inhabitants and 6 trading stations, of which the most important is Ivigtut, the principal source of the mineral cryolite, considerable quantities of which are annually exported to Europe and America. This place is the scene of much activity in the summer months, when cryolite is being mined and shipped. It contains very few Eskimos. The district of Godthaab has 946 inhabitants and 6 stations, of which the settlement of the same name is the most important place in Greenland. Thirty Europeans live here, it is the seat of government for South Greenland, and its stone church is the largest building and its seminary the most important educational institution in the country. The district of Sukkertoppen is a very mountainous coast strip, with 955 inhabitants, including only five Europeans, and 6 trading stations, of which the most important is the picturesquely situated settlement of the same name. The most northern district of South Greenland is Holstensborg, whose importance has waned with the decline of the whaling industry. It has 585 inhabitants and 4 trading stations. Nord Ström Fiord, in lat. 67° 40′ N., is the boundary between the North and South inspectorates. The most southern district of the North inspectorate is Egedesminde, consisting chiefly of a large number of comparatively flat islands. The population numbers 1,016, and there are 9 trading stations. Christianshaab, with 503 inhabitants and 4 trading places, has a less wild aspect, for between the mountains are wide valleys with lakes and small rivers. Jakobshavn, with 8 stations and 432 inhabitants, has the same topographic aspect. The residence of the inspector of North Greenland is

Godhavn, and its only important trading-point is the town of that name on the south coast of Disco island, which has 213 inhabitants, who catch seals and walrus in the spring, and obtain skins, ivory, and oil, which are sent to Denmark. No other settlement is so much frequented, as it is visited by most whalers and explorers during the five months of navigation. A considerable quantity of vegetables are raised in its gardens, which have a southern exposure. The town, known to whalers as Lievely, was much more important during the best days of the Greenland whaleries. The narrow Ritenbenk district has 5 trading stations and 494 inhabitants. Omenak, or Umanak, has 6 stations, 922 inhabitants, and is an important center of the sealing industry. The most northern district, Upernivik, has 761 inhabitants, of whom 83 live in the famous settlement of that name, which has figured in the writings of many Arctic explorers. Tasiusak, in this district, is the most northern permanent abode of the white race. It is in lat. 73° 24′ N. The entire trade is a monopoly of the Danish Government, which buys of the natives the seal and sea-lion skins, fish, walrus-hides, oil, eider-down, walrus and narwhal ivory they collect at very low rates, and sells them supplies at correspondingly low prices. Dr. Rink estimated in 1877 that the average annual income of an Eskimo family from the proceeds of the hunt was $40, and that the Danish Government had made a clear profit from its Greenland possessions since 1790 of $800,000. The exports in 1899 were worth $87,100, and the imports, chiefly food-supplies, $169,108. C. C. Adams.

**Greer**, David Hummell, D. D.: clergyman; b. in Wheeling, W. Va., Mar. 20, 1844; graduated at Washington College, Pennsylvania, and at the Gambier Theological Seminary of the Protestant Episcopal Church; became rector of Trinity church, Covington, Ky., 1868; of Grace church, Providence, R. I., 1872; of St. Bartholomew's church, New York city, 1888. He delivered the Lyman Beecher lectures at Yale in 1895, which were published (New York, 1895). His parish is remarkable for its great wealth and abundant benevolences. The parish-house, built during his rectorate, is a center of charitable activity, and of effort to elevate the dependent classes by means of men's and boys' clubs, a loan association, penny provident fund, and employment bureau. The parish also provides vernacular services for Armenians, Swedes, and Chinese. S. M. J.

**Gregory**, Daniel Seely, D. D., LL. D.: Presbyterian clergyman; b. in Carmel, Putnam co., N. Y., Aug. 21, 1832; graduated at the College of New Jersey, Princeton, 1857, and at the Theological Seminary there 1860; after pastoral service for eleven years, became professor in the University of Wooster, Ohio, 1871; president of Lake Forest University, Illinois, 1878; resigned 1886. He was managing editor of the *Standard Dictionary* (New York, 1893–95), and since of the *Homitetic Review*. He is the author of *Christian Ethics* (Philadelphia, 1865); *Why Four Gospels?* (1876); *Practicat Logic* (Philadelphia, 1881); *The Tests of Phitosophic Systems* (1886); *Christ's Trumpet-call to the Ministry* (New York, 1896); and with S. B. Halliday *The Church in America and its Baptisms of Fire* (1896). S. M. J.

**Grenfell**, George: African explorer and missionary; b. in Sancreed, England, Aug. 19, 1849. He arrived on the Congo as a missionary of the Baptist Missionary Society of Great Britain in 1879. His explorations in the Congo basin in 1884–85, on the missionary steamer Peace, completely changed the prevailing ideas as to the hydrography of the southern part of the basin. He showed that most of the south tributaries of the Congo, instead of having an approximately N. and S. course, as was supposed, rose in the E. and flowed far to the W. before reaching the Congo. The rivers he explored and mapped were the north affluents, Mobangi, Mongalla, and Aruwimi, and the south tributaries, Chuapa, Lulonga, Ruki, and Lomami. He discovered the greatest Congo affluent, the Mobangi, by accident. While ascending the Congo he steamed into the hitherto unobserved mouth of the Mobangi and ascended the river about 100 miles before he discovered that he was not on the Congo. He then explored the Mobangi for 400 miles to the rapids at Zongo. He discovered the Batwa dwarfs S. of the northern bend of the Congo. He was the first white man to visit many tribes, and usually won their confidence by his tact and invariably peaceful attitude. In the extent of his travels and discoveries in the Congo basin he is second only to Alexander Deleommune. In 1891–92 he was the delegate of the Congo Free State for the delimitation of the boundary between that country and Angola. He married a black woman who had been educated at one of the coast mission stations, and she was his intelligent and helpful companion in his explorations. He is still a missionary on the upper Congo, and has not returned to Europe for many years. He has never written a book, but his reports and maps are still the basis of information regarding the regions in which he was the pioneer explorer. C. C. Adams.

**Gridley**, Charles Vernon: naval officer; b. in Logansport, Ind., Nov. 24, 1845; graduated at the Naval Academy in 1863, and saw active service in the last two years of the war, being attached as ensign to the Olympia, of the West Gulf blockading squadron. He was then ordered to the steam-sloop Brooklyn, flag-ship of the Brazil squadron, where he served till 1867, being promoted lieutenant Feb. 21, 1867. From 1867 to 1869 he was attached to the Kearsarge, of the South Pacific squadron, receiving his commission of lieutenant-commander Mar. 12, 1868. In 1870 he was assigned to the Michigan, in 1873 to the Monongahela, and from 1875 to 1879 was stationed at the Naval Academy. He became executive officer of the flag-ship Trenton, of the European station, in 1881; was at the torpedo station, Newport, the following year; and at the navigation office of the Boston navy-yard from Oct., 1882, to Feb., 1884, being commissioned commander Mar. 10, 1882. He commanded the Jamestown 1884–86, when he was ordered to the Portsmouth. He was inspector of the Tenth lighthouse district 1887–91, and was then ordered to the Washington navy-yard, where he remained till put in command of the Marion, in July, 1892. After serving as lighthouse inspector 1895–97, he was put in command of the Olympia, flag-ship of the Asiatic station, July 28, 1897, having been promoted captain Mar. 14 of the same year. At the outbreak of the war with Spain in 1898 he was seriously ill, but nevertheless commanded his ship in person in the battle of Manila, May 1, 1898. Soon after the battle he was granted sick-leave, and died on his way home, at Kobe, Japan, June 5, 1898.

**Griggs**, John William: lawyer; b. in Newton, Sussex co., N. J., July 10, 1849; graduated at Lafayette College 1868; admitted to the bar in Paterson, N. J., 1871; elected to the General Assembly 1875 and 1877, and to the State Senate 1882, 1884, and 1886, and president of the Senate in his last term; Governor of New Jersey 1896–98; U. S. Attorney-General Jan. 1898–1901.

**Grinnell**, Josiah Bushnell: b. in New Haven, Vt., Dec. 22, 1821; graduated at Auburn Theological Seminary; entering the ministry of the Presbyterian Church, preached in Union Village, N. Y., Washington, D. C., and New York city; founded the Congregational church at Grinnell, Iowa, 1854, which town was named for him, and after preaching there for several years became a wool-grower; was a member of the State Senate 1856–60, special agent of the Post-office Department 1861–63, and a Republican Representative in Congress 1863–67; was a special agent of the Treasury Department 1868, and commissioner of the national bureau of animal industries 1884. He took an active part in establishing the Iowa free-school system; was intimate with John Brown, and frequently aided fugitive slaves, a reward at one time having been offered for his head; laid out five towns in Iowa; was president of Grinnell University, which he materially aided. Besides numerous pamphlets, he published *Home of the Badgers* (1845) and *Cattle Industries of the United States* (1884). D. in Marshalltown, Ia., Mar. 31, 1891.

**Groesbeck**, William Slocomb: lawyer; b. in New York city, July 24, 1815; graduated at Miami University, Oxford, O., in 1835; studied law and opened practice in Cincinnati. He was a member of the State constitutional convention in 1851, served on the commission named in 1852 to codify the State laws, was a Republican Representative in Congress 1857–59, member of the Peace Congress in 1861, State Senator in 1862, and delegate to the National Union convention in Philadelphia in 1866. He was counsel for President Johnson in the impeachment trial in 1868. He was nominated for President in 1872 by a convention of Liberal Republicans, but received no votes in the Electoral College except one for Vice-President. He was a delegate to the International Monetary Congress in Paris in 1878. D. in Cincinnati, July 7, 1897.

**Grosvenor**, Edwin Augustus: historian; b. in Newburyport, Mass., Aug. 30, 1845; was prepared for college by his

mother, and graduated at Amherst in 1867 and at Andover in 1872. He took a post-graduate course in Paris 1872–73, and was Professor of History in Robert College, Constantinople, 1873–90; Professor of French Language and Literature at Amherst 1892–95; Professor of History, Smith College, 1892–94; Professor of European History, Amherst, 1895–98; and became Professor of Modern Government and Administration, Amherst, in 1898. He became an honorary member of the Hellenic Philologic Syllogos, Constantinople, in 1888; a member of the Society of Mediæval Researches, Constantinople, in 1889; of the Syllogos Parnassos, Athens, Greece, in 1890; of the American Historical Association in 1895; of the American Antiquarian Society in 1896; and of the Authors' Club in 1897. He made extended tours in Europe and Western Asia, and has lectured extensively on historical and diplomatic subjects. He is the author of *Hippodrome of Constantinople* (1889); *Constantinople* (2 vols., 1895); *Contemporary History* (1898); *Duruy's History of Modern Times* (translated from the French and edited, 1894); *Andronike* (translated from the Greek, 1897); and *Duruy's General History* (translated from the French, 1898).

**Grubb**, Sir Howard: instrument-maker and astronomer; b. in Dublin, Ireland, July 28, 1844. He was brought up in the optical instrument works of his father, Thomas Grubb, the celebrated maker of telescopes. Since the death of his father in 1878 he has been the director of the establishment. He is a member of the Royal Astronomical Society of London, of the Royal Society of Dublin, and of many other scientific bodies. He is the builder of numerous important telescopes, including those at Oxford, and at the Potsdam Observatory, and has invented many improvements in astronomical instruments. He has likewise published numerous papers on applied optics. E. L. N.

**Grubb**, Thomas: optician and instrument-maker; b. in 1801. He was perhaps the most celebrated maker of telescopes in his day. He constructed the great reflector at Melbourne, the 27-inch telescope of the Vienna Observatory, and numerous other instruments. He was likewise the author of many papers on applied optics. During his later life his son, Sir Howard Grubb, was associated with him. D. Sept. 19, 1878. E. L. N.

**Grundemann**, Peter Reinhold, D. D.: German Protestant theologian; b. in Bärwalde, Brandenburg, Jan. 9, 1836; studied at Tübingen, Halle, and Berlin; has been since 1869 pastor at Mörz. He is noted for his work in the literature of foreign missions, especially in cartography—e. g. *Allgemeiner Missionsatlas* (Gotha, 1867–71); *J. F. Riedel, ein Lebensbild* (Gütersloh, 1873): *Kleiner Missionsatlas* (Calw and Stuttgart, 1883; 2d ed. 1886); edited an edition of Burkhardt's *Kleine Missionsbibliothek* (Bielefeld, 1876–81, 4 vols.); *Die deutsche Schutzgebiete in Afrika und in der Südsee* (1886); *Dornen und Aehren vom Missionsfelde* (Leipzig, 1887, *sqq.*); *Die Entwickelung der evangelischen Mission im letzten Jahrzent* (Bielefeld, 1890); *Missions-Studien und Kritiken in Verbindung mit eine Reise nach Indien* (Gütersloh, 1894; 2d series 1898); *Neuer Missionsatlas* (Calw and Stuttgart, 1896). S. M. J.

**Grünfeld**, Albert: pianist; b. in Prague, Bohemia, July 4, 1852, and began the study of music when five years old. He gave his first concert Apr. 2, 1865, in Prague. He later studied under Theodore Kullak and Liszt, and in 1869 he accepted a position in Kullak's music academy. Beginning in 1876, he made many concert tours in Europe. He has been decorated with the titles court pianist to his Majesty the King of Prussia and court pianist to the Emperor of Austria. In 1891 he went to the U. S., and made a tour in company with his brother Heinrich, a violoncellist. D. E. Hervey.

**Guam**: the largest and most southern island of the Ladrone group in the Pacific Ocean, lat. 13° 30′ N., lon. 144° 45′ E. The seventeen islands of the group contain scarcely 560 sq. miles, nearly half of which are comprised in Guam. The population numbers more than 9,000, about six-sevenths of the people inhabiting the entire archipelago. The very numerous native Chamorros mostly perished under the rule of the Spaniards in the eighteenth century, and were replaced by Tagal emigrants from the Philippines, who absorbed most of the surviving aborigines. Guam was seized by the U. S. on June 21, 1898, during the war with Spain, which country ceded the island to the U. S. under the terms of the treaty of peace signed at Paris on Dec. 10, 1898. Under the Spanish *régime*, Agaña, on the west coast of Guam, was the capital of the archipelago, and it contains about two-thirds of the entire population of the island, which has steadily increased in numbers since the epidemic of measles in 1856. The natives are friendly toward the U. S. The climate is not unhealthful, and much resembles that of the Hawaiian group. The mean temperature is about 73° F. The soil is productive, though agriculture is in a very backward position. The island is directly in the line of travel between the U. S. and the Philippines. There are a number of low mountains from 1,300 to 1,600 feet high, and they dominate the grassy or wooded plateaus and the steep coast-line of the picturesque island. Sugar-cane, rice, and cocoa-palms flourish, and the trade has hitherto been chiefly in the hands of Manila merchants. C. C. Adams.

**Guanta**: the port on the Caribbean Sea of the city of Barcelona, Venezuela. Barcelona is 12 miles inland, at the west extremity of the Cumana coast range, and is very conveniently situated for the export of cacao, coffee, skins, dyewoods, and other local produce. It is connected by rail with Guanta, which is a large harbor with 30 feet of water at the pier. Coal of good quality is mined within 13 miles of Guanta, and brought to the port by rail. The coal is being mined in 1899 by an Italian syndicate. C. C. A.

**Guard Rent**, or **Castle-guard Rent**: in English land law, an annual money payment for which was compounded a form of military service formerly common to the counties in the south and east of England, and existing to some extent in other counties. This was a form of feudal service due from tenants whose duty was to defend the castle of their feudal chief, as distinguished from the ordinary feudal service which required the tenant to follow his lord to war. Such tenants were obliged to assemble at the lord's castle upon the approach of an enemy, and assist in its defense. There is still preserved in the *Red Book of the Exchequer* a list of guard rents in connection with Dover Castle, dated 46 of Henry III., and a similar list at the Public Record Office of the date of about 1680. The Earl of Chichester still receives guard rents of tenants in the Rape of Hastings, as owner of Hastings Castle. See Elton's *The Tenures of Rent* (London, 1867): *Red Book of the Exchequer*, vols. cxciv. and cxcv.; *Archæological Review*, i., 57 (London, 1888). F. Sturges Allen.

**Guiana**: Georgetown, the capital of British Guiana, is on the Demerara river, which forms an excellent national harbor, a mile and a half in width, in which a multitude of ships may find safe anchorage. The city has a population of more than 50,000, and is the chief commercial port. A railroad, 60 miles long, from Georgetown, parallel with the coast to New Amsterdam and Plantation Philadelphia, serves an important sugar district. The Essequibo and Demerara rivers have been connected by a railroad 18 miles long. Other railroads are under consideration, and the rivers, which have an enormous flow of water in the rainy season, afford considerable navigation. The Corentyn river is navigable 150 miles, the Barbice, for vessels of light draught, 150 miles, the Demerara 85 miles, and the Barima 80 miles. The Essequibo, the largest of all the rivers, has the shortest navigable course, being interrupted by cataracts about 60 miles from the sea. The sugar industry has suffered severely on account of the bounty paid by foreign governments to their own citizens on their exports of beet-sugar. The result is that many plantations have been abandoned. In 1897 there was less acreage in sugar culture by more than 10,000 acres than in 1892. In 1896–97 only two-fifths the amount of sugar shipped in 1889 was exported. Gold has been chiefly found on the Essequibo river and its tributaries, and to the northward and westward. The practical problem is to find gold in sufficient richness of deposit to give remunerative returns. Great expense is incurred in conveying laborers, with their food, tools, and machinery, to the spot. Everything must be taken by boat, and then on the backs of men along paths that must be cut in the forest. Gold is being found in paying quantities, particularly on the Essequibo, Potaro, Cuyuni, and Barima rivers and their tributaries, but the deposits are alluvial, and finally become exhausted. The most successful miners are those who have found fresh deposits after the earlier finds have ceased to be profitable. Quartz veins said to be rich in gold have been found in some places, and are now being worked. The total exports of the country in 1900 amounted to $9,382,417, of which nearly $4,000,000 was sugar sent to the U. S. (four-fifths of the sugar produced in the colony) and $2,027,530 gold sent to Great Britain. The imports

amounted to $6,417,458, of which the U. S. supplied goods to the value of $1,915,192, and the United Kingdom sent $4,393,414 of products. French Guiana, in 1899, exported $1,320,906 of products, and the imports amounted to $1,949,248. Most of the trade is with France. The total foreign trade of Dutch Guiana in 1898 was $4,387,649, of which $1,724,397 was with the U. S.

C. C. Adams.

**Gully**, William Court: lawyer and statesman; b. in London, Aug. 29, 1835; educated at Trinity College, Cambridge; studied law and was called to the bar in 1860, and practiced on the northern circuit; was made queen's counsel 1877, and bencher of the Inner Temple in 1879; has been a member of Parliament for Carlisle since 1886, and was elected Speaker of the House of Commons in Apr., 1895, and again in Aug., 1895.

**Guthrie**, Frederick: physicist; b. in London, Oct. 15, 1833; educated in the German universities and received the degree of doctor of philosophy from the University of Marburg in 1856. In the following year he was appointed demonstrator in chemistry at Owens College, Manchester, and in 1859 became demonstrator in the same subject at the University of Edinburgh. In 1861 he was appointed Professor of Chemistry in the Royal College at Mauritius. He returned to England in 1869 and became Professor of Physics in the Royal School of Mines in London. This post he held until the reorganization of the school in 1881, when he was appointed to the same chair in the newly constituted School of Science. He was a fellow of the Royal Societies of London and Edinburgh, and was the author of a textbook on *Magnetism and Electricity* (London, 1875), and of numerous papers on chemical and physical topics. He is best known for his work on the *Properties of Liquids*, and on *Electrolysis*. D. in London, Oct. 21, 1886. E. L. N.

**Guts Muths**, Johann Christoph Friedrich: educator; b. in Quedlinburg, Saxony, Aug. 9, 1759; studied at the gymnasium in his native town and at the University of Halle; in 1785 became assistant to Salzmann in his famous school in Schnepfenthal, where he organized the first modern system of gymnastic instruction. "In the first edition of my *Gymnastics*," he says, "appeared the first modern treatment of a subject very much forgotten, and only represented in historical allusions." Spiess says: "If Jahn is called the father of German gymnastics, then, in justice, the grandfather and the great-grandfather of the same, Guts Muths, should not be forgotten." His book was translated into French, English, and Danish. Several other books in the same field followed at intervals, the most notable of which, from a modern standpoint, is a book on play (1796), in which he seems to have anticipated much of the latest thought on the educational value of plays and games. He taught also geography and technology in Salzmann's school, and enjoyed the lifelong friendship of Karl Ritter, who was one of his first pupils. Full of years and of honors, he died, near Schnepfenthal, May 21, 1839. See Dittes, *Schule der Pädagogik*; Schmid, *Pädagogisches Handbuch*; also the article on Physical Education. C. H. Thurber.

**Gutta-percha**: At least four-fifths of the total product goes to Great Britain, which in the twelve years ending 1894 imported an average of 2,450 tons a year. As gutta-percha is the best insulator known, and the coming century bids fair to extend its usefulness in manifold applications of electricity, some concern has been expressed lest the product be wholly exhausted. The custom has been to kill the tree to obtain the gum, but it is now asserted that this sacrifice of a useful plant is not necessary. The gum has been utilized for insulating purposes for more than sixty years. Only the two varieties found in the Malay Peninsula are of much use for the purpose, and no adequate substitute has been found. The laying of an American cable recently raised the price nearly 50 per cent. It has been proposed that extensive nurseries be established for rearing the trees, which may be grown to advantage in Java, Sumatra, and Borneo.

C. C. Adams.

**Guy**, Seymour Joseph: artist; b. in Greenwich, England, Jan. 16, 1824. Having studied under Ambrosini Jerome in London, he settled in New York city in 1854, first painting portraits and then devoting himself to genre pictures; became an associate of the National Academy in 1861, Academician in 1865, and was one of the founders of the American Society of Painters in Water-colors 1866. Among his paintings, which chiefly represent child life, are *The Good Sister*: *After the Shower*; *More Free than Welcome*; *The Little Stranger*; *Playing on the Jew's-Harp*; *The Street Fire*; *Fixing for School*; *The Little Orange Girl*; *Cash on Hand*; and *See-saw, Margery Daw*.

**Gypsy Moth**: a European moth (*Ocneria* or *Liparis dispar*, in America sometimes called *Porthetria dispar*) belonging to the family *Noctuidæ* (see Lepidoptera). Like all lepidopterous insects, it passes through the stages of larva and pupa before reaching the adult condition. The eggs are laid in clusters of 400 or 500, usually in more or less concealed places. The egg-clusters have a downy or spongy appearance, due to hairs rubbed from the female abdomen. The caterpillar, or larva, hatches from these eggs, and, feeding upon leaves of trees, etc., rapidly grows to full size, when it is about an inch and a quarter in length, with a general grayish color, with a pair of bluish tubercles on each of the first five segments behind the head, reddish tubercles on the remaining segments. The body is also covered with numerous fine long hairs. The pupa is inclosed in a very loose and slight cocoon of silken threads, and varies in color from dark-reddish brown to chocolate. The adult male moth has a spread of wings from 1½ to 2 inches, the female being about half an inch longer. The wings in the males are brownish yellow, the fore wings crossed by darker brown bands; the females are yellowish white, with usually brown and grayish cross-bands. What gives the gypsy moth great interest in America is that a few specimens were introduced into Massachusetts in 1868 or 1869 to try the experiment of utilizing their silk. Some escaped, and ten years later became a serious pest. In 1889 two towns were badly infested with them. A year later they were found in nine towns, and in 1896 they had extended to about thirty towns. They feed on almost every kind of tree and shrub, and being removed from the natural enemies which occur in Europe, they have done an immense amount of damage, stripping the leaves from every tree which they attack and destroying large tracts of forest land as well as innumerable fruit-trees. The State of Massachusetts began war upon them in 1890 by appropriating $25,000 to be used in their extermination, since which time the work has been continued by yearly appropriations, including that of 1899 of more than $1,200,000. All that can be said of the results is that the commission charged with the work has kept the pest from doing any serious damage, but each year sees it distributed over a larger territory, and no one familar with the habits of the insect and its great prolificacy has hopes of its ever being exterminated. J. S. Kingsley.

**Gzowski**, Sir Casimir Stanislaus, K. C. M. G.: Canadian lawyer and statesman; b. in St. Petersburg, Russia, in Mar., 1813; entered the military engineering college of Kremnitz and remained there until 1830; later entered the Polish army, and was one of the prisoners taken at the battle of Boremel; exiled to the U. S., where he arrived in 1833; taught languages in New York for a time, and subsequently studied law in Pittsfield, Mass., and in 1837 was admitted to the bar in Pennsylvania; in 1841 went to Toronto and entered the public service in the department of public works. He has been connected with many of the important public works of Canada, including the superintending of the engineering of rivers and harbors in Western Ontario, the engineering of harbor works at Montreal 1850–53, consulting engineer of the ship-channel improvement between Montreal and Quebec 1850–53, between which time and 1870 he was engaged in railway construction; in 1871 was engineer of the international bridge across the Niagara. He has been actively engaged in military affairs, and in 1879 was appointed honorary aide-de-camp to the Queen; in 1896 was administrator of the Government of Ontario; is now (1899) president of the corporation of Wycliffe College.

F. Sturges Allen.

**Hadley**, Henry K.: musician; b. in Somerville, Mass., in 1871, and studied in Boston under Stephen A. Emery and George W. Chadwick, and then went to Vienna for further study, taking up the violin in addition to other branches. He returned home in 1895 and was appointed instructor in music in St. Paul's School, Garden City, Long Island. In his short career he has already composed much good music, including songs and piano pieces; a concert overture, *Hector and Andromache*, performed by Damrosch's orchestra in 1892; a symphony entitled *Symphony of Youth and Life*, played by Seidl's orchestra in New York, Dec. 15, 1897; a festival march, played by Sousa's band in 1896; some trios, quartets, and other chamber music; *The Fairies*,

ballad for solo, chorus, and orchestra; *Lelawala*, legend for solo, chorus, and orchestra; several orchestral suites, a violin sonata, etc. D. E. Hervey.

**Hagarty**, Sir John Hawkins: Canadian lawyer and jurist; b. in Dublin, Ireland, Dec. 17, 1816; was educated at Trinity College, but left his course before its completion to go to Canada; took up his residence at Toronto in 1835, and was called to the bar there in 1840; received the degree of D. C. L. in 1855 from Trinity University; was created queen's counsel in 1850, and made puisne judge of the common pleas court in 1856, and judge of the court of queen's bench in 1862; was appointed chief justice of the common pleas Nov. 12, 1868, and chief justice of the queen's bench in 1878; president of the court of appeal and of the supreme court of judicature, under the title of chief justice of Ontario; was administrator of the Government of Ontario in 1882, and was knighted in 1897, in which year he retired from the bench. He has written some scattering poems and pamphlets, among which are the *Legend of Marathon* and an essay on *Law Reform*. F. Sturges Allen.

**Hagood**, Johnson: soldier; b. in Barnwell, S. C., Feb. 21, 1829; graduated at South Carolina Military Academy in 1847; elected master in equity, and held the position until the outbreak of the war. He entered the Confederate service as a colonel under Gen. Beauregard, was made brigadier-general in May, 1862, after the battle of Manassas, assigned to duty on the South Carolina coast, and was in command of Battery Wagner in the siege of Charleston. In 1864 he was engaged at Walthall Junction and Swift Creek, Virginia, against Gen. Butler, and in the battle of Drury's Bluff and the operations that confined Gen. Butler to Bermuda Hundred. He was with Lee's army in the battle of Cold Harbor, and, returning to Beauregard's command, his brigade served with distinction in the trenches during the siege of Petersburg. He was in the battle of Weldon Road and the operations N. of the James river after the fall of Fort Harrison. In Dec., 1864, he joined Gen. Bragg in North Carolina, commanded the rear-guard of Bragg's army at Fort Fisher, and participated in all operations to and including the battle of Bentonville. After the war he was prominent in exposing financial frauds in the South Carolina State government, and was elected comptroller-general in 1876, and Governor in 1880. He was president of the South Carolina State Agricultural Society and chairman of the board of visitors of the South Carolina Military Academy. D. in Barnwell, S. C., Jan. 4, 1898.

**Haidinger**, Wilhelm, von: crystallographer and physicist; b. in Vienna, Feb. 5, 1795; was trained in mineralogy at Gratz and Freiberg. He afterward traveled as a private tutor, and from 1827 to 1840 was engaged in the manufacture of porcelain in the establishment of his brothers at Elnbogen. Subsequently he was appointed director of the Royal Geological Institute in Vienna, which position he held through the greater part of his life. Haidinger is best known for his work on the optics of crystals, and particularly for his studies of polarization phenomena in such bodies. He was the discoverer of the so-called *Haidinger brushes*, a peculiar bluish bundle of light which appears whenever the eye is fixed upon a bright surface from which polarized light comes. This curious phenomenon, which was first described by Haidinger, makes it possible to detect the presence of polarized light without the use of a Nicol prism or other artificial analyzer. D. in Vienna, Mar. 19, 1871. E. L. N.

**Hailmann**, William Nicholas, Ph. D.: educator; b. in Glaris, Switzerland, Oct. 20, 1836; studied in gymnasium, Zürich, Switzerland, and with tutor; studied in medical college, Louisville, Ky., 1855–56; A. M., University of Louisville, 1864; Ph. D., Ohio University, Athens, O., 1885; teacher of natural sciences, Louisville, Ky., high schools, 1856–65; director of the German and English Academy, Louisville, 1865–73; director of the German and English Academy, Milwaukee, Wis., 1873–78; director of the German-American Seminary, Detroit, Mich., 1878–83; superintendent of public schools, La Porte, Ind., 1883–94; national superintendent of Indian schools, 1894–98; superintendent of instruction, Dayton, O., 1898. He is the author of *Outlines of a System of Object Teaching*; *History of Pedagogy*; *Kindergarten Culture*; *Letters to a Mother*; *Early Education*; *Primary Helps*; *Primary Methods*; *Application of Psychology to Teaching*; *Froebel's Education of Man*, etc. Editor of *Erziehungsblätter* 1870–83; *Kindergarten Messenger and New Education* 1876–83.

**Hale**, George Silsbee: lawyer; b. in Keene, N. H., Sept. 24, 1825; graduated at Harvard in 1844; taught in Richmond, Va.; admitted to the bar in Boston in 1850. He edited four volumes of the *United States Digest* and three of the *Boston Law Reporter*. He wrote *Memoirs of Joseph Parker* (1876); *Memoirs of Heron Metcalf* (1876); and contributed to the *Memorial History of Boston*. D. in Schooner Head, Me., July 28, 1897.

**Haliburton**, Sir Arthur Lawrence, G. C. B.: statesman; b. in Windsor, Nova Scotia, Sept. 26, 1832; was admitted to the bar in 1858. He entered the commissariat service of the British army in 1855, and was transferred to the civil service in 1870. He became permanent Under-Secretary of War in 1895, and retired in 1897, having reached the age limit. He was created K. C. B. in 1885, and promoted to G. C. B. in 1897, on the occasion of the Queen's diamond jubilee.

**Haliburton**, Robert Grant, Q. C.: author and scientist; b. in Windsor, Nova Scotia, June 3, 1831; graduated from King's College, Windsor, with high honors, taking his degree of M. A. in 1852. He was called to the bar in 1853, and rapidly built up a large practice in Halifax. In 1871 he went to England, where he spent five years in the interest of his extensive coal properties in Nova Scotia, at the same time devoting a large share of his attention to politics, making a brilliant fight against the disintegration policy of the Government. Returning to Canada, he resumed his profession, practicing with marked success for several years, when failing health forced him to seek a milder climate. Dropping his law business, he turned his attention to the study of ethnology, which had long interested him. Among his numerous scientific papers may be mentioned *Dwarf Races and Dwarf Worship* (1891); *The Dwarfs of Mount Atlas* (1891); *Racial Dwarfs in the Atlas and the Pyrenees* (1893); *Survival of Dwarf Races in the New World* (1894); *Dwarf Survivals and Traditions as to Pygmy Races* (1895); *Indian Ghosts and Conch Feasts* (1897). His numerous miscellaneous publications include poems, lectures, and addresses, covering a wide range of subjects. He is a fellow of the Royal Geographical Society, the Royal Society of Northern Antiquaries, and of the American Association for Advancement of Science.

**Hall**, George Henry: artist; b. in Manchester, N. H., Sept. 21, 1825. He studied art in Düsseldorf, Paris, and Rome 1849–52, when he settled in New York city; was elected associate of the National Academy in 1853, and a member in 1868; has visited Spain and Egypt. Among the pictures exhibited by him at the academy are *Precious Lading*; *Thursday Fair at Seville*; *A Young Lady of Seville and her Duenna*; *Lilacs*; *The Four Seasons*; *The Roman Fountain*; *Autumn*; *Winter*; *A Rug-Bazaar at Cairo*; *Oven at Pompeii*; and *Pomegranates and Grapes*.

**Hall**, James Barclay: educator; b. in Lawrencetown, Nova Scotia, in 1850; graduated from the University of Acadia College in 1873. He took the degree of M. A. at the same college, and that of Ph. D. in 1877 at Boston University. He was one of the prime movers in introducing the kindergarten into Nova Scotia. In connection with his work in improving the common schools, he spent some time in visiting the common schools of many European cities, besides studying under prominent teachers of the German universities. In 1879 he took charge of the department of education and method in history and literature in the Provincial Normal School, Truro. He has published *Notes on the German Schools*; *Outlines of Physiology and Logic*; *History of Education*.

**Hall**, John Smythe, D. C. L.: legislator; b. in Montreal, Aug. 7, 1853; graduated at McGill University in 1874. Two years later he was admitted to the bar, of which he soon became a prominent member, and in 1895 was given the honorary degree of D. C. L. from Lenoxville. At one time he was president of the McGill University Society, and was afterward twice elected a member of the corporation of the university. He was counsel for the Quebec Government in the interprovincial arbitration, and was made a queen's counsel in 1887. Entering the militia in 1881, he filled the several ascending grades, and retired with the rank of major in 1895. Beginning with 1886, he held a seat in the Quebec Assembly, and was Provincial Treasurer 1892–94.

**Hallé**, Wilma Norman-Neruda, Lady: violinist; b. in Brünn, Austria, Mar. 29, 1839, where her father, Josef Neruda, was the cathedral organist. When six years old

she was sent to Vienna to study the violin under Leopold Jansa; she progressed rapidly, and in Jan., 1847, gave three public concerts in Vienna, following with concerts in Leipzig, Berlin, and Hamburg. She played at a Philharmonic concert in London, June 11, 1849. She married Ludwig Norman Jan. 27, 1864, but they soon separated, and he died in 1885. She continued playing in concert tours, but made her home in London in 1869. In 1888 she married Mr. (afterward Sir) Charles Hallé. She made her first American visit in the season of 1898–99, her first appearance being with the Boston Symphony Orchestra in New York on Feb. 22, 1899. D. E. Hervey.

**Halleck**, Reuben Post, A. M.: educator; b. in Rocky Point, Long Island, N. Y., Feb. 8, 1859; prepared for college at Gen. Russell's military school, New Haven, Conn.; A. B., Yale, 1881; A. M., Yale, 1896; principal of Cherry Valley, N. Y., academy 1881–83; assistant principal of Louisville, Ky., male high school 1883–96, and principal since 1896. Author of *Psychology and Psychic Culture* (1895); *The Education of the Central Nervous System* (1896); edition of *Last of the Mohicans* (1898). C. H. Thurber.

**Hamilton**, James Clelland, LL. D.: Canadian lawyer and author; b. in Belfast, Ireland, May 21, 1836; educated at Hanover College and Rutgers College, U. S., and received the degree of LL. D. in Ontario in 1861, in which year he was called to the bar. He has achieved considerable success as a lawyer, but is chiefly known for his literary and scientific work, especially in the subject of Canadian history. Has published a number of works, including *The Great Center: an Astronomical Study*; *The Panis: an Outline of Canadian Indian Slavery in the Eighteenth Century*; *The Prairie Province*; *Sketches of Travel from Lake Ontario to Lake Winnipeg* (1876); *The Georgian Bay* (1893). F. Sturges Allen.

**Hammond**, Edward Payson: Presbyterian evangelist; b. in Ellington, Conn., Sept. 1, 1831; graduated at Williams College 1858; studied at Union Theological Seminary, New York city, 1858–59, and at the Free Church College, Edinburgh, 1860–61; has been an evangelist since 1863 on both sides of the sea; especially noted for his success in inducing children to make a profession of religion. Among his publications are *Jesus the Way* (London, 1868); *Sketches of Palestine*, in verse (Boston, 1868; reissued 1874); *Conversion of Children* (New York, 1878; new ed. 1882); *Gathered Lambs* (1882). S. M. J.

**Handwriting**: characters made by a person who writes with the hand. A study of writing includes the history of the signs used, or, in other words, the history of the alphabet (see Alphabet), and the history of the methods in which these signs are combined and written or given. (See Writing.) The study of handwriting has an importance, however, aside from its historical importance, arising out of questions of forgery and the identification of the age of an instrument or document by a comparison of handwritings or a study of the materials with which it is made. For the purpose of forgery such a study is of great importance, since upon the accuracy of the information or knowledge obtainable by it frequently depend the life and fortunes of human beings. The study of handwriting may be generally divided into a physical examination of its form and appearance and an examination of the way in which it was made. These matters involve a study of the position of the hand, of the instrument used, of the writing-fluid, of the paper on which the writing is made, of the age and physical condition of the writer, etc.

*Position of the Hand.*—The position of the hand in writing varies with nearly every individual, although the modern school training has a tendency to bring about a more uniform position than would otherwise obtain. Thus it is found that persons such as paying clerks in large mercantile establishments, who continually write a few words, do so without any support for the arm at all; others pivot the wrist on the table; others hold the pen in an unusual position and bring the different parts of the hand in contact with the paper. The usual position, however, is that where the elbow forms one point of rest and the little finger and the ring-finger, or the little finger alone, forms another point of rest, the fingers moving along the paper as the writing progresses and the elbow forming a pivot for the forearm. All habitual positions in writing may be reduced to a pretty regular position of pivot and radius, which, combined with the use of the fingers, give to the handwriting its characteristic features.

The principal features of most importance for identification of different handwritings or detection of variations or forgeries are those which are made unconsciously, and which are not easily noted by superficial examination. The height, the spread of the letters, the flourishes, and the general shape are easily noted by the casual observer and readily imitated with ordinary accuracy; but the peculiarities of angles of upright strokes with the horizontals, the regularity or irregularity of the lower extremities of the letters with reference to an imaginary base-line, the shading or emphasizing of parts too small to be noted with the naked eye, etc., can not be noted so as to be accurately copied except by tracing. A tracing which is apparently an exact copy of a signature or writing may be made, but when several tracings have been so made they show their character by an exact similarity when superposed.

*Writing Instruments.*—The modern writing instrument mostly used, of course, is the steel pen, which has superseded all other implements for ordinary practical purposes. The writing instrument of the ancients was a stylus or pointed instrument of steel or metal, which was used to trace characters on a surface prepared with wax or other substance to receive and leave an impression. The modern steel pen is the successor of the quill pen, and depends for its action on the capillary attraction of the parts of the split point, the breadth of the line made varying with the width of the column impressed on the surface of the paper by pressure on the point or nib of the pen. Here arises one of the characteristic differences between writings. The quill pen is very soft and delicate, and seldom leaves an impression or furrow on the substance on which the writing is made; whereas in writing done with metal pens furrows are easily observable under the microscope. The difference between steel and quill pens is also discernible from the fact that a steel pen leaves a uniform thickness and smoothness of lines throughout, but the quill pen, which needs constant shaping with the penknife, causes a difference of thickness and smoothness of lines, even when written by the same person at one sitting.

The furrow left by a steel pen also affords a clew as to the methods in which the characters were made by the presence or absence of variation in pressure, tremors, etc., in the point of the pen within the ink-line, evidences of which are observable under the microscope. The stylographic pen leaves an impression differing from either of these, appearing under the microscope as a furrow or depression narrower than the ink-line which stands beyond its edges. Writing done with a stylograph has less character and individuality by reason of its uniformity of fluid and shading and the absence of the indications of tremor or unsteadiness of hand.

*Writing-fluids.*—The ordinary writing-fluid is called *ink*. The different varieties in common use are probably not more than fifteen or twenty, including the most used—black, red, blue, and green. Among these, however, there is a distinct difference in character, some being glossy and others lusterless; some thick, others thin; some flowing freely from the point of the pen, others slowly. Those which are heavy and glossy in character and flow slowly from the pen usually do not grow dark with exposure. These include the copying inks and those containing a large amount of gums or thickening matter. The pale inks flow readily from the pen, and usually grow dark with exposure to sunlight and air. See Ink.

*Detection of Forgery.*—The inspection of a document for the detection of forgery is the most important legal purpose in which the study of handwriting is used. Such an inspection involves a general scrutiny of the document, by reading its lines, noting the groups of letters, the spaces between words, etc., in order to obtain a general idea of the character of the writing; an examination of the document by transmitted light, which reveals erasures and water-marks, which latter may show a date of manufacture inconsistent with the supposed date of the handwriting. Examination by transmitted light also very often reveals pencil or other tracings made for the purpose of subsequent inking.

Forgery may exist either in the writing of a document entirely or in the erasure of marks from an instrument. Erasures are usually made by scratching or rubbing the paper or abrading its surface, which is discernible from the resulting removal of the surface of the paper, making it rough to the eye. This evidence is frequently removed, however, by the forger, by applying to the scratched or

abraded surfaee sandaraeh, rosin, alum, paste, or the like, which also prevents an abnormal absorption of the ink by the paper. The original ink-marks whieh have been superficially removed are restored by passing a hot flat-iron over the paper placed under another sheet, wetting with aleohol, ete.

The use of the microseope enables the eye to judge between dark ink and light, whieh has been made to appear blaek by being heavily massed. This difference may also be noted by the use of reflected light, which brings out most clearly the luster and thickness of the ink-film. To determine which of two cross-lines was written first, the use of the mieroscope and of reflected light is frequently of great importanee, as one ink will be usually found to be more lustrous than another, or to have some other difference which shows plainly when examined under reflected light with the mieroscope. The microseope best suited to be used for this purpose is not the eommon microscope, but one with a low-power objective and a long focus.

*Paper or Substance written on.*—Although paper is now the almost universal substance on which writing is done, cloths and parchment are sometimes used, especially parchment for eeremonial purposes. Parchment is the only one of these substances that has no recognizable fiber, it being usually made of the skin of sheep or lambs. The smoother or finer kinds, called vellum, are made from the skins of very young calves, the present process of preparing it being only very slightly different from that employed since the Middle Ages. Papers and eloths have readily recognizable fibers and films, differing in appearance from each other. In the proeess of making them certain chemicals or filling —such as common clay, kaolin, agatite, etc.—are employed, and in addition the paper is sized, or immersed in a substanee to render it less pervious to ink. When an erasure is made on ordinary paper the surfaee and size are removed, leaving the films torn and showing themselves under a microscope to have the general direction of the force used in making the erasure or scratch. The water-marks on various papers show the date and place of manufacture, often assisting materially in the identification of differcnt instruments. See PAPER.

In the examination for the distinction of ink-marks for the detection of forgery the most prominent eharacteristics to be noted are the colors, the presence of opaque particles in the ink, the luster of the ink, and its change of color under different conditions of illumination. Although it is difficult to judge of the colors or intensity of ink-marks with the naked eye, they can usually be distinguished with a magnifying glass of low power. Aniline inks nearly always have a characteristic metallic luster which is unmistakable. Many inks are dichroic—that is, usually have two distinet eolors when illuminated and viewed from different directions. The ink-marks of very old writing usually show a yellowish tinge around the letters, with a gradual shading into the color of the letters. Besides these methods of distinguishing between physical characteristics of the handwriting itself, as it appears to the senses, others called quantitative methods, or those relying on a study of different specimens of what are supposed to be the same handwriting, include a study of the average form in which a person writes, the charaeteristie distances, inclosing of his letters, etc.

See Frazer's *Manual of the Study of Documents*; *Philosophy of Handwriting*, by Dori Felix de Salamanea; *Progress of Handwriting*. by W. Anderson Smith (1887). See also EXPERT TESTIMONY and FORGERY. F. STURGES ALLEN.

**Handy**, MOSES PURNELL: b. in Warsaw, Mo., May 26, 1847; educated at the Virginia Collegiate and Military Institute, Portsmouth, Va.; entered the Confederate army in 1862 as a private, and rose to the rank of major. He wrote for the press descriptions of some of his adventures as a special courier, and this led to his employment in 1866 as a reporter for the Richmond (Va.) *Dispatch*. He was afterward conneeted with many prominent newspapers, as eorrespondent and editor, and founded the Philadelphia *Evening News*. He wrote letters for the Boston *Herald*, the Chicago *Tribune*, and the Cincinnati *Enquirer*, and published occasional articles in prominent magazines. In 1876 he was the Virginia member of the U. S. centennial commission in charge of exhibition in Philadelphia, and in 1893 ehief of the department of publicity and promotion of the Columbian Exposition in Chicago. In July, 1897, he was appointed special commissioner of the U. S. for the Paris exposition of 1900. D. in Augusta, Ga., Jan. 8, 1898.

**Hankel**, WILHELM GOTTLIEB, Ph. D: physicist; b. in Ermsleben, Germany, May 17, 1814; graduated at the University of Halle, from which institution he received the degree of doctor of philosophy in 1839. He taught in the Science High School at Halle, and was subsequently professor at the university in that city. In 1849 he was ealled to the ehair of physics in the University of Leipzig. This position he held nominally to the time of his death, in Leipzig, Feb. 18, 1899, but he was retired from aetive serviee in 1887. Hankel is best known to scienee through his investigations in thermo-eleetrieity and on the electrieal properties of erystals, eoncerning whieh subjects he was an eminent authority. From 1839 until a few years before his death he was a frequent eontributor to Poggendorff's *Annalen* and to the *Transactions* of the Saxon Academy of Sciences.

E. L. N.

**Hanson**, JOHN WESLEY, D. D.: author; b. in Boston, Mass., May 12, 1823; received education at the Lowell high school, and served in a counting-room in that city for seven years; held Universalist pastorates in Wentworth, N. H., Danvers, Mass., Gardiner, Me., Haverhill, Mass., and Dubuque, Iowa, 1845–69; in 1848 edited the *Massachusetts Era*, the first Republican paper in Lowell; served as chaplain of the Sixth Massachusetts Regiment, and was army correspondent of the Boston *Journal* and the New York *Tribune*, 1863–64. Besides various histories of localities, he has published *Bible Threatenings Explained* (1847); *Witnesses to the Truth*, quotations from the poets (1850; enlarged as *A Cloud of Witnesses*, 1883); *Aion-Aionios* (1876); *Bible Proofs of Universal Salvation* (1877); *Twelve Sermons on the Lord's Prayer* (1883); *The New Covenant* (1883–85); and *Voices of the Faith* (1884).

**Hanus**, PAUL HENRY, B. S.: educator; b. in Hermsdorf-unter-dem-Knyast, Prussia, Mar. 14, 1855; went to the U. S. when four years of age; graduated B. S. at University of Michigan 1878; teacher of mathematics and science, Denver high school, district No. 1, 1878–79; Professor of Mathematics, University of Colorado, 1879–86; principal of Denver high school, district No. 2, 1886–90; Professor of Pedagogy, Colorado State Normal School, 1890–91; Assistant Professor of the History and Art of Teaching, Harvard University, since 1891; author of *Elements of Determinants* (1886); *Geometry in the Grammar School* (1893); *Contemporary Educational Problems* (1899); contributor to *Educational Review* and *School Review*. C. H. THURBER.

**Hardy**, GEORGE E.: educator; b. in New York city in 1859; graduated at the College of the City of New York in 1878, and began teaching in the publie schools; was elected president of the State Teachers' Association in 1886; was Professor of the English Language and Literature in the College of the City of New York from 1894 until his death, in Roselle, N. J., Apr. 15, 1897. He was a writer and lecturer on educational subjects, and one of the founders of the Catholic Summer School of America. *Five Hundred Books for the Young* is his most important publication. He left unfinished a *History of England* and a *History of English Literature* for schools.

**Harper**, JOHN MURDOCH: educator and author; b. in Johnstone, Renfrewshire, Scotland, Feb. 10, 1845; completed the course at the Glasgow Training College with the highest certificates granted. He graduated from Queen's University, Kingston, Ontario, and in 1881 received his degree of Ph. D. from Illinois University. He gained an enviable reputation as a teaeher, and was appointed inspector of superior schools in the Province of Quebec. He has published many papers on educational subjects.

**Harraden**, BEATRICE: novelist; b. in Hampstead, England, Jan. 24, 1864; was educated in Dresden, and at Cheltenham College, Queen's College, and Bedford College, London, and took the degree of B. A. at London University; traveled on the Continent and in the U. S. Her publieations are *Things will Take a Turn* (1891); *Ships that Pass in the Night* (1893); *In Varying Moods* (1894); *Hilda Strafford* (1897); and *Untold Tales of the Past* (1897).

**Harrison**, CONSTANCE CARY: author; b. in Vaucluse, Va., Apr. 25, 1846; was married to Burton N. Harrison in 1867, and removed to New York eity; has traveled extensively; has written plays, ehiefly making adaptations from the French. Her prineipal works are *Golden Rod* (1880); *Helen Troy* (1881); *Woman's Handiwork in Modern Times* (1881); *Old-Fashioned Fairy-Book* (1884); *Folk and Fairy Tales* (1885); *Bric-à-Brac Stories* (1886); *Bar Harbor*

*Days* (1887); *The Anglomaniacs* (1887); *Flower de Hundred* (1891); *Crow's Nest and Bilhaven Tales* (1892); *A Daughter of the South* (1892); *Sweet Bells Out of Tune* (1893); *A Bachelor Maid* (1894); *An Errant Wooing* (1895); *Externals of Modern New York* (1896); *A Merry Maid of Arcady, and other Stories* (1897); *A Son of the Old Dominion* (1897); and *Good Americans* (1898).

**Harrison**, Gabriel: author and artist; b. in Philadelphia, Pa., Mar. 25, 1825; early went to New York city, where he became a member of the American Histrionic Society; appeared on the stage as Othello in 1838, in Washington, D. C.; was associated with the Park theater in New York in 1845; organized the Brooklyn Dramatic Academy in 1851; was manager of the Adelphi theater, Troy, N. Y., in 1859; opened the Park theater, Brooklyn, in 1863, managing an English opera troupe; was for a time lessee and manager of the Brooklyn Academy of Music; prosperously advanced the free art schools of the Brooklyn Academy of Design; was one of the organizers of the Faust Club of Brooklyn, and largely instrumental in having the bust of John Howard Payne placed in Prospect Park; has painted both landscape and portraiture, his portraits including Edwin Forrest as Coriolanus; has taught elocution and acting in Brooklyn. His writings include *The Life and Writings of John Howard Payne* (1873); a dramatization of Hawthorne's *Scarlet Letter* (1876); *Melanthia*, a tragedy written for Matilda Heron; *The Author*: *Dartmore*; *The Thirteenth Chime*; *Magna*; and *Edwin Forrest*: *the Actor and the Man, Critical and Reminiscent* (1889); has made adaptations of Schiller's *Fiesco* and *Don Carlos*.

**Harrison**, James Albert: philologist; b. in Pass Christian, Miss., Aug. 21, 1848; graduated at the University of Virginia in 1866; visited Germany in 1871; was Professor of Latin and Modern Languages in Randolph-Macon College, Va., 1871–76, when he took the chair of English and Modern Languages in Washington and Lee University: delivered a series of ten lectures on Anglo-Saxon poetry at Johns Hopkins University in 1883; was given the degree of doctor of letters at the centennial anniversary of Columbia College in 1887; is chairman of the editoral committee of the Modern Language Association, a member of the American Philological Association, and founder and editor of the *Library of Anglo-Saxon Poetry*. His principal publications are *Greek Vignettes* (1875); *Spain in Profile* (1878); *History of Spain* (1881); *Beówulf*, with Robert Sharp (1883–86); *Exodus and Daniel*, with Prof. Theodore W. Hunt (1885); *Story of Greece* (1885); and *A Handy Anglo-Saxon Dictionary*, with Dr. William M. Baskerville (1886).

**Harsha**, David Addison: author; b. in Argyle, N. Y., Sept. 15, 1827; was classically educated and studied theology, but was physically unable to preach. He has published *The Heavenly Token* (1856); *The Star of Bethlehem* (1864); *Manual of Sacred Literature* (1866); *Lives of Charles Sumner, Doddridge, Baxter, Addison, and Bunyan* (1868); *Lives and Selected Works of Isaac Watts, George Whitefield, James Harvey, and Abraham Booth* (1869); *Devotional Thoughts of Eminent Divines* (1869); *The Golden Age of English Literature* (1872); and *The Life and Times of Virgil* (1887).

**Hart**, Charles Henry: author; b. in Philadelphia, Pa., Feb. 4, 1847; received classical and scientific education; studied law, and was admitted to the bar in 1868; is connected with many historical and scientific associations; after serving as corresponding secretary of the Numismatic and Antiquarian Society of Philadelphia, 1865–67, was made its historiographer; has devoted himself to literature and art. His publications include *Remarks on Tabasco, Mexico* (1865); *Historical Sketch of National Medals* (1866); *Memoir of William Hickling Prescott* (1868); *Bibliographia Lincolniana*, reprinted as *Biographical Sketch of Abraham Lincoln* (1870); *Turner, the Dream-Painter* (1879); *Bibliographia Websteriana* (1883); memoirs of *William Willis* (1870), *George Ticknor* (1871), *Samuel S. Haldeman* (1881), *Lewis H. Morgan* (1883), *Lucius Q. C. Elmer* (1884), and others; and *A Treatise on the Doctrine of Equitable Conversion*.

**Hart**, George Vaughan, LL. D.: Irish professor of law; b. in Dublin, June 5, 1841; was educated at St. Columba's College and at Trinity College, Dublin; was called to the Irish bar in 1865; was crown prosecutor at Londonderry 1870–91; appointed King's Inn Professor of the Law of Personal Property in 1880, and held this office until 1886; was revising assessor for the borough of Dublin 1881–91; appointed Regis Professor of Feudal and English Law in Trinity College, Dublin, in 1890; and is now (1901) one of the examiners of titles of the Irish Land Commission.

F. Sturges Allen.

**Hart-Dyke**, Sir William, M. P.: English public man; b. in Kent, Aug. 7, 1837; educated at Harrow and Christ Church, Oxford, where he took his degree in 1861. He entered Parliament in 1865, and has held several prominent positions, being Chief Secretary for Ireland in Lord Salisbury's administration 1885–86, and vice-president of the committee of council on education in Lord Salisbury's second administration. He has been connected with some of the most important recent educational movements in Great Britain.

C. H. Thurber.

**Hartley**, Jonathan Scott: sculptor; b. in Albany, N. Y., Sept. 23, 1845; was educated at the Albany Academy, and early began to work in marble; passed three years in England, entering the Royal Academy; after visiting Germany, Paris, and Rome, settled in New York city; was an original member of the Salmagundi Sketch Club, was Professor of Anatomy in the schools of the Art Students' League 1878–84, and president of the league 1879–80. His productions include *The Young Samaritan*; *King René's Daughter*; *The Whirlwind*; a statue of Miles Morgan, erected at Springfield, Mass., 1882; and bas-reliefs on the monument in Saratoga commemorating the defeat of Burgoyne.

**Hartlib**, Samuel: English social reformer; b. in Elbing, Poland, early in the seventeenth century. His father was a Polish merchant, his mother an Englishwoman. He went to England about 1640, while still young, and became noted for his public spirit, which was shown in several plans for educational and social reform. In 1651 he wrote *Propositions for Erecting a College of Husbandry*, for which Cromwell granted him a pension. Milton addressed to him his famous *Tractate on Education*. It was at Hartlib's instance that the English Parliament, in 1641, called Comenius to England to undertake the reform of English schools, a move which, owing to the troubled state of public affairs, had no result. Sir William Petty, the economist, addressed a letter, printed in London in 1647, to his "honoured friend, Master Samuel Hartlib," on the plan of a trade or industrial school. The date of Hartlib's death is not known.

C. H. Thurber.

**Haseltine**, James Henry: sculptor; b. in Philadelphia, Pa., Nov. 2, 1833; studied in Paris and Rome; enlisted in the U. S. army in 1861, became major, and served through the civil war; returned to Europe, and settled in Nice. His principal works are *Happy Youth*; *America Honoring her Fallen Brave* (owned by the Philadelphia Union League); *Love*; *Ingratitude*; *New Wine*; *Superstition*; *Religion*; *America Victorious*; *Nissa, Wife of King Candaules of Lydia*; *The Ball-Player*; *Kissing Cherubs*; *Captivity*; *The Morning Star*: *Fortune*; *Hero*; and portraits of Longfellow, Thomas Buchanan Read, and Gens. Sheridan, Forsyth, Merritt, Duryee, and Hartsuff.

**Haseltine**, William Stanley: artist; b. in Philadelphia, Pa., Jan. 11, 1835; brother of James Henry Haseltine; graduated at Harvard in 1854; studied art at home, in Düsseldorf, and in Rome; became a member of the National Academy in 1861. His paintings include *Indian Rock, Nahant*: *Castle Rock, Nahant*; *Calm Sea, Mentone*: *Bay of Naples*; *Ischia*; *Spezzia*; *Ostia*; *Pontine Marshes*; *Venice*: *Ruins of a Roman Theater, Sicily*; and *Natural Arch at Capri*.

**Haskell**, James Richard: inventor; b. in Geneva, N. Y., Sept. 17, 1825; educated at Western Reserve College, O., and entered business as a manufacturer in New York city in 1853. In 1854, after experiments with steel breech-loading rifled cannon and small-arms, he made twenty-five of the former for the Mexican Government. In 1855 he began making experiments with multicharge guns with Azel S. Lyman, who originated the idea of accelerating projectile velocity by means of a series of successive charges of powder, and in 1856 a gun was constructed with a number of powder-pockets along its bore, so that as each pocket was passed by a shot its charge was exploded and increased the velocity of the shot. Subsequent developments in gun-making are said to have prevented the adoption of the multicharge guns. In 1862, with Rafael Rafael, Mr. Haskell invented and constructed a rapid-fire gun that was approved by a board of army officers, but not adopted. He was a member

of the American Association for the Advancement of Science. He wrote several pamphlets on national armament and on ordnance. D. in Passaic, N. J., Aug. 15, 1897.

**Haskins**, CHARLES HOMER, Ph. D.: historian; b. in Meadville, Pa., Dec. 21, 1870; A. B., Johns Hopkins University, 1887; Ph. D., Johns Hopkins University, 1890; studied in Berlin and Paris; instructor in history, Johns Hopkins University, 1889–90; instructor in history, University of Wisconsin, 1890–91; Assistant Professor of History, University of Wisconsin, 1891–92, and Professor of History there since 1892; author of various articles and monographs in the *American Historical Review* and the papers of the American Historical Association. C. H. THURBER.

**Haswell**, CHARLES HAYNES: civil engineer; b. in New York city, May 22, 1809; received education at the high school of Jamaica, Long Island, and in a classical school in New York city; served in a steam-engine factory for several years; was appointed chief engineer in the U. S. navy in 1836, and was on the board that designed the steam-frigates Missouri and Mississippi; was promoted to engineer-in-chief in 1844; left the service in 1850; designed and constructed the first practicable steam-launch in 1837, and was first to protect marine steam-boilers and the holds of iron vessels from the galvanic action of salt water and copper by the application of zinc instead of iron lining; designed and superintended the completion of Hoffman island, in the lower bay of New York, and the crib bulkhead at Hart's island. He has published *Mechanic's and Engineer's Pocket Book* (1844; 63d ed. 1895); *Mechanic's Tables* (1856); *Mensuration and Practical Geometry* (1858); and *Reminiscences of an Octogenarian of the City of New York* (1896).

**Haultain**, THEODORE ARNOLD, M. A.: journalist; b. in Kannanur, Madras, India, Nov. 3, 1857; attended school in England and entered the University of Toronto in 1877, where he took the degree of B. A. (1879) and of M. A. (1880). He studied medicine, but soon gave it up and devoted his time to writing for Canadian newspapers. He has published a short history of the war in the Sudan (1885) and numerous essays. Among them are *A Critique of Cardinal Newman's Exposition of the Illative Sense*; *A Christmas Chat*; *A Fragmentary Dialogue on Love and Religion.*

**Hauptmann**, GERHARDT: German poet and dramatist; b. in Salzbrunn, Silesia, Nov. 15, 1862. His work is characterized by its pessimism, and by its interweaving of German national traditions with those of a newer Scandinavian school. His more remarkable plays, or rather dream-poems, are *Hannele Mattern* (1894); *Die Versunkene Glocke* (1898); *Christus* (1898); and *Fuhrmann Henschel* (1898).

**Havelock-Allan**, Sir HENRY MARSHMAN: soldier; son of Sir Henry Havelock; b. in Chinsurah, India, Aug. 6, 1830. He entered the army in 1846; was commissioned as lieutenant in 1848, captain in 1857, brevetted major in 1858, and in the same year received the baronetcy that had been intended for his father, who died the day before the patent was sealed. He served as his father's aide in the mutiny campaigns, was on the staff of Gen. Luard at Azimghur, and in the operations against the Jugdespur rebels, and commanded cavalry in Oude under Lord Clyde. In 1863 he held a command in the war against the Maoris in New Zealand. Later he served in Canada and in Ireland, being made a major-general in 1878 and lieutenant-general in 1881. As Sir Henry Havelock he entered the House of Commons as an advanced Liberal in 1874, representing Sunderland till 1881, when he was appointed to command a brigade at Aldershot; was returned to Parliament from Durham in 1884, again in 1886, lost his seat in 1892, and was again returned in 1895. The surname Allan was added to his own in 1880 at the testamentary request of a relative. Being with Sir William Lockhart's army in Khyber Pass, he was killed by Afridi sharpshooters, Dec. 30, 1897.

**Hawaiian Islands**: The value of the imports into the Hawaiian islands in 1899 was $19,059,000, an increase of $7,409,000 over 1898. The value of the exports was $22,628,000, a gain of $15,282,000 over the preceding year. The increase in imports was especially notable in provisions, wearing apparel, hardware, agricultural implements, and machinery. The increase in exports was due mainly to the larger output of sugar, of which the export value was $21,898,190. Of the imports the U. S. contributed 78.8 per cent.; Great Britain, Canada, and other British colonies, 11.25 per cent.; and the rest was distributed about equally between Germany, China, and Japan, with small amounts coming from a few other countries. Of the exports, 99.5 per cent. went to the U. S., and sugar represented 97 per cent. of the total. The machinery used in the sugar factories is largely made in Honolulu. Plows and other farm implements and the small locomotives used on some of the estates usually come from the U. S. C. C. ADAMS.

**Hawaii, History of**: An attempted *coup d'état* by the last native monarch, Queen Liliuokalani, led in Jan., 1893, to a revolution. A provisional republic was established, with men of American descent in power. Strong attempts were made to effect the annexation of the islands to the U. S., but these attempts developed a considerable opposition in both countries. Meanwhile a permanent republic was proclaimed in 1894, with Sanford Dole as President. The annexation agitation continued, and in accordance with a resolution of Congress of July 7, 1898, the islands were formally annexed to the U. S., Aug. 12, 1898. On June 14, 1900, the islands were constituted the Territory of Hawaii, with a government similar to those of the other organized territories of the U. S. For military purposes Hawaii is a part of the department of California. EDMUND K. ALDEN.

**Hawkins**, ANTHONY HOPE, M. A.: author; b. in London, Feb. 9, 1863; educated at Marlborough College and Baliol College, Oxford; studied law, and was admitted to the bar in 1887, but after a short time devoted himself to literature. His first book, *A Man of Mark*, was published in 1890, and was followed by *Father Stafford*, *Mr. Witt's Widow*, *Sport Royal*, *Half a Hero*, and *The Prisoner of Zenda*, the last of which is probably the best known of his writings, and has been dramatized. Among his later books are *The God in the Car*; *The Dolly Dialogues*; *Count Antonio* (1895); *Comedies of Courtship* and *The Heart of Princess Osra* (1896); *Phroso* (1897); *Rupert of Hentzau* (1898).

**Hawkins**, HAMILTON SMITH: soldier; b. in South Carolina in 1834; graduated at the Military Academy in 1855; was commissioned second lieutenant in the Sixth Infantry in 1861; first lieutenant in the same year; was advanced to captain in 1863; major of the Tenth Infantry in 1883; promoted to lieutenant-colonel of the Twenty-third Infantry in 1889; made commandant of cadets at West Point in 1888; colonel of the Sixteenth Infantry in 1894, and in the same year became commandmant of the infantry and cavalry school at Fort Leavenworth; in the Spanish-American war, in the second day's fight at Santiago, commanded the division that captured San Juan hill, where he was wounded in the foot; was promoted to brigadier-general in 1898, and soon after receiving his commission was retired, under the thirty years' service provision, at his own request.

**Hawkins**, Sir HENRY: English lawyer and statesman; b. Sept. 14, 1817; educated at Bedford, and called to the bar in 1843; was created queen's counsel in 1858; appointed judge of queen's bench division in Nov., 1876, and in the same month transferred to the exchequer division. He practiced on the "home circuit" before his appointment as judge, and was for a long time one of the leaders of the bar of that circuit. He was knighted in 1876.

**Hawley**, BOSTWICK, D. D.: clergyman and author; b. in Camillus, N. Y., Apr. 8, 1814; graduated at Wesleyan University in 1838; taught in Cazenovia, N. Y., 1838–42; in 1839 joined the Oneida conference of the Methodist Episcopal Church, and has held many pastorates in New York State. Among his works are *Close Communion* (1863); *Manual of Methodism* (1868); *Nature, Design, and General Rules of the Methodist Episcopal Church* (1870); *Working and Speaking for Christ* (1873); *Ministerial Education* (1875); *Dancing as an Amusement* (1877); *Beauties of the Rev. George Herbert* (1877); *A Plea for the Intemperate* (1879); *Culture and Christianity* (1880); *Prominent Doctrines and Peculiar Usages of the Methodist Episcopal Church Stated and Defended* (1879); *The Gospel and Skepticism* (1880); *The Shield of Faith* (1880); and *The Lenten Season* (1882).

**Hawley**, CHARLES B.: singer and composer; b. in Brookfield, Mass., in 1858; educated at the Cheshire Military Academy; went to New York in 1875, and studied voice-culture under George J. Webb, P. A. Rivarde, and Gustav Federlein, and composition under Dudley Buck, Joseph Mosenthal, and C. B. Rutenber; appointed bass soloist in Calvary Episcopal church; later, assistant organist at St. Thomas's Episcopal church; and since 1883 bass and director of the choir of the Broadway Tabernacle. For many years he has been a member of the Mendelssohn Glee Club,

for which he has composed many beautiful part songs. Mr. Hawley's compositions are entirely vocal, and many of his songs have become widely popular. He has also written some church music. D. E. HERVEY.

**Haynes**, HENRY WILLIAMSON: archæologist; b. in Bangor, Me., Sept. 20, 1831; graduated at Harvard in 1851; studied law; took the chair of Latin in the University of Vermont, and afterward that of Greek, resigning in 1873 to devote himself to archæology; spent six years in Europe, studying the antiquities of various countries and participating in several international congresses; spent the winter of 1877–78 searching for proofs of the Palæolithic age in Egypt, the results of his researches, for which he was awarded a medal and a diploma, being presented at the International Congress of Anthropological Sciences held in Paris in 1878, and subsequently published in the *Memoirs of the American Academy of Arts and Sciences*. On his return to the U. S. he was made a trustee of the Boston Public Library.

**Headley**, PHINEAS CAMP: author; b. in Walton, N. Y., June 24, 1819; studied law and was admitted to the bar in 1847; graduated in theology at the seminary in Auburn, N. Y., and held pastorates in Presbyterian and Congregational churches. His publications embrace *Historical and Descriptive Sketches of the Women of the Bible* (1850); *Life of the Empress Josephine* (1851); biographies of *Kossuth, Lafayette, Mary, Queen of Scots*, and others (1852–54); *Hero Boy, or Life of General Grant* (1863); *Life of Ericsson* (1863); biographies of *Sheridan* and *Farragut* (1864); *Life and Military Career of Maj.-Gen. W. T. Sherman* (1865); *Life and Campaigns of Gen. U. S. Grant* (1866); *Court and Camp of David* (1869); *Island of Fire* (1874); *Evangelists in the Church* (1875); and *Public Men of To-day* (1882).

**Health Laws**: laws or ordinances passed for the regulation of the acts of private citizens in order to protect the health of the community. The chief matters regulated by laws for the preservation of the health of the community are adulteration of food, liquor, and drugs; the location and use of cemeteries, and the interment of the dead; drains and sewers; the selling of drugs and liquors; the regulation and conduct of hospitals; the cleaning of the streets; the supply of water; sanitary regulation of hotels, dwellings, and lodging-houses; regulation of workshops, factories, and mines, both as to sanitation and as to employment of children therein; prevention and abatement of nuisances and of trades offensive to the public comfort or offensively carried on; regulation of the practice of medicine and surgery; treatment of contagious and infectious diseases; and the use of public parks and baths.

The right to the enjoyment of such degree of health as a person's habits and constitution admit of is an inalienable right to which every man is entitled as a part of the right of personal security, and this right gives him the right to preserve his health from injury by reason of any acts or practices on the part of others. An infringement of this right arises whenever a person sustains an injury to his health, or is likely to sustain one, from the unlawful acts or omissions of another or from the lawful acts of another performed in an unlawful manner. The enforcement of this right and the prevention of such wrongful and unlawful acts is the first aim and object of all health laws so called. Such laws are most numerous and of chiefest importance in thickly settled communities, where the acts of the individual members of the community necessarily closely affect the condition and welfare of the fellow-inhabitants. The power of a government or body politic to regulate the acts affecting the public health comes under the head of police power, which is an inherent power in every civilized community. (See POLICE POWER.) The most complete statute providing for the preservation of the public health of a community is the Public Health Act of Great Britain passed in 1875 (38–39 Vict., cap. 55). Such statutes are generally in force in the various States of the U. S., and deal more or less fully with the matter according to the requirements of the community affected. The most complete act in the U. S. is that of the State and local government in the State and city of New York, where a State health board was created by an act of the Legislature in 1880, and continued in existence under the new law of 1893, known as the Public Health Law. Health laws usually provide for general sanitary authorities known as boards of health, who are vested with a discretionary power, more or less restricted, for the making of rules and regulations to protect the health of the community. See HYGIENE.

The violation of the right of a citizen to the enjoyment of his health is a tort which gives rise to a cause of action for damages if the injury can be so compensated; but if the injury result from a continuous act and can not be compensated for in damages, an injunction may be obtained, with or without damages, as the case may be. The practice of doing acts injurious to the health of the community or any individual of it is not legalized or justified by the previous continuance of such act or acts for any length of time whatever. It is usually provided that acts and practices injurious to the public health, or likely to injure the public health, shall be ground for indictment on the complaint or action of the public health authorities.

The rules and regulations of the Public Health Act of Great Britain may be taken as typical of the usual provisions of such laws. This act provides for the constitution of local sanitary districts, urban and rural, and the appointment or selection of local boards of health vested with powers to enforce the provisions of the act. The act vests in these bodies the regulation of *sewers and drains*, including the power to purchase, make, and maintain sewers; the control of the purification of sewage discharged into streams; the alteration, discontinuance, and cleansing of sewers; and the regulation of the powers of owners and occupiers to drain into the local sewers; and also regulates, directly or through the local boards, the disposal of sewage and the provision of privies and closets for factories, public buildings, etc. It requires the local authorities to provide for the *cleansing of streets* and removal of refuse, and imposes a penalty for the neglect of the local authority to do this. The local authority is also authorized to make by-laws imposing the duty of cleansing the street upon occupiers, and requires them to provide receptacles for the deposit of rubbish, etc. It also provides for the compulsory *purification of houses* on the certificate of an officer of the health or of two medical practitioners that this is essential to the public health, and imposes a penalty for the maintenance of certain nuisances on premises—such as the keeping of swine or pigsties in dwelling-houses; the suffering of stagnant water to remain in cellars; allowing the contents of a water-closet, privy, or cesspool to overflow, etc. General powers are granted for providing each district with a *pure water-supply* by the construction of reservoirs, carrying-mains, and other works necessary to that end. The local authorities are restricted, however, as to the manner and extent of the water-works erected. The local authorities are also vested with authority to prevent the pollution of streams, to close polluted wells, and to impose a penalty for causing water to be polluted by gas-washings.

The occupation of cellars as dwellings and as common lodging-houses is regulated, and the occupation as a dwelling of any cellar built after the passage of the act is prohibited under strict penalties; and all cellars whatsoever occupied as dwellings are required to comply with certain sanitary regulations intended to preserve the health of the occupants. Common lodging-houses are required to keep registers, and may be kept only by registered keepers, and registration may be denied by the local authority.

The preservation of cleanliness, the treatment of persons affected with contagious diseases, inspection of premises, etc., are strictly regulated.

The statute provides for inspection by the local authority for the detection of *nuisances*, and vests in the local authority or court the power of summary jurisdiction in dealing with them, by the suppression or regulation of their causes or origin. The carrying on of offensive trades in an urban district is prohibited, and the urban authority is under obligation to complain to the justice of the nuisance arising from the prosecution of such a trade.

The local authority is vested with the power to protect the public from unhealthful food, and for that purpose to inspect and examine any animal, carcass, meat, poultry, game, fish, fruit, bread, or other thing exposed for sale or deposited in any place for the purpose of sale or preparation for sale and intended for food for man, and to seize and carry away the same in order to have the matter dealt with by a justice of the peace. If it appears to the justice that the thing so seized is diseased, or unsound, or unwholesome, or unfit for food, he is required to condemn it or to order it to be so disposed of as to prevent it from being exposed for sale, or being used for food for man, and the person so having it in his possession is liable to a fine or to imprisonment.

The local authority is vested with the power to take ac-

tion, on the certificate of its medical officer of health or of any legally qualified medical practitioner, for the closing and disinfecting of infected houses, or the disinfecting of articles contained in such houses, for the prevention or checking of *infectious diseases*. first giving notice in writing to the owner or occupier requiring him to do this within a specified time. They may convey infected persons to hospitals or other places of detention. Exposing of the public to infection from a public conveyance in which an infected person has been knowingly conveyed, or from a house, room, or part of a house contaminated by a dangerous infection to the knowledge of the owner or letter, is visited with a severe penalty. The local board is also authorized to make regulations for the prevention of diseases, and to enforce observance of such regulations for that purpose, and for this purpose has authority to enter on any premises or vessel.

The local authorities also have power to provide mortuaries or resting-places for the dead pending their interment, to provide places for post-mortem examinations, and to provide for the decent and economical interment of any dead body that may be received into the mortuary.

Besides the foregoing general provisions the law provides in detail for local regulation of highways and streets, pleasure-grounds, markets and slaughter-houses, and for police regulations. It also vests the local authorities with power to contract for the purchase of lands, the arbitration of claims, and the enactment and regulation of by-laws for their guidance, including the appointment of officers and the conduct of business.

The contracting and borrowing powers of the local authorities for the purpose of carrying out the provisions of the law are specifically prescribed, and the auditing of local accounts is required. The method of the prosecution of penalties is particularly laid down, prescribing what notices shall be given, and how, when, and where they shall be given, and when and how appeals may be taken. Besides this there are numerous other particulars of local interest only.

For particular treatment of many of the subjects contained in the foregoing, which may be taken as typical of the general provisions of the health laws of the various States of the U. S., see ADULTERATION, HYGIENE, NUISANCE, SEWERAGE, DISINFECTION, PLUMBING, WATER, WATER-WORKS, QUARANTINE, etc. See also *Lumley's Public Health Acts* (5th ed. London, 1896); Balch's *Manual for Boards of Health* (New York, 1893). F. STURGES ALLEN.

**Healy**, TIMOTHY MICHAEL: politician; b. in Bantry, County Cork, Ireland, May 17, 1855; educated at the Christian Brothers' School, Fermoy; after some years spent as a business clerk and as shorthand writer for a railroad company, he became in 1878 a newspaper correspondent in London, and in 1880 visited the U. S. with Charles Stewart Parnell and John Dillon; on his return was active in the Irish Land League agitation; was arrested in Oct., 1880, because of a speech in Bantry; elected to Parliament while under indictment, and was tried and acquitted in Dec., 1880. He was active in the discussion of the Land Bill in 1881, and secured the inclusion of a clause exempting tenants' improvements from rent charges. In Nov., 1881, he attended a convention in Chicago, Ill., that voted $250,000 in support of the Irish movement, and spoke for the Land League in all the principal cities of the U. S., returning to London in Mar., 1882. In Jan., 1883, he was sentenced to six months' imprisonment because of one of his speeches, but was released after four months. He has been returned to Parliament from Wexford, from Monaghan, from South Derry, and from North Longford. He was called to the Irish bar in 1884. He was prominent in opposition to Parnell's leadership in 1891, and against the leadership of Dillon in 1896. Author of *A Word for Ireland*, and of textbooks on the Land Acts.

**Heap**, DAVID PORTER: engineer; b. in San Stefano, Turkey, Mar. 24, 1843; was educated at Georgetown College, D. C., and at West Point, where he graduated in 1864; served in the engineer corps in the civil war, with the Army of the Potomac; was breveted captain in 1865 for gallant and meritorious services; was advanced to captain in 1867 and major of engineers in 1882; after the war engaged in the construction of fortifications and improvement of harbors; explored the Yellowstone Park region in 1871; had charge of the engineering section of the War Department exhibit at the Philadelphia Centennial; represented the U. S. at the Paris congress of electricians in 1881. He has published *History of the Application of the Electric Light to Lighting the Coasts of France* (1883); *Electrical Appliances of the Present Day* (1884); and *Ancient and Modern Lights* (1887).

**Heaton**, AUGUSTUS GEORGE: artist; b. in Philadelphia, Pa., Apr., 1844. He early studied and modeled in the Philadelphia Academy of Fine Arts, and abandoned preparation for college for the profession of painting. Upon Cabanel's approbation of his work, in 1863, he was enrolled in that artist's class in Paris, being the first American to enter the École des Beaux Arts. After two years' study and travel he returned to Philadelphia, and was appointed first professor at the School of Design for Women, teaching and lecturing for two years, his principal works at this period being *The First Mission of Washington* and *Columbia's Night-Watch*. He was president of the Philadelphia Sketch Club and an annual exhibitor at the Academy. Returning to Paris, he studied under Bonnat for a year; was represented in the Salon, 1879–80, his *Bathing-Hour at Trouville* receiving high praise. In 1881 he made studies in Spain for one of his most notable canvases, *The Recall of Columbus*, which was purchased by Congress in 1883, and hangs in the Senate corridor of the Capitol; this picture was reproduced in 1893 on the 50-cent Columbian stamp. Among his celebrated portraits are those of Emma Nevada, Amélie Rives, Bishop Bowman, Mrs. Jefferson Davis, Winnie Davis, and the *Promoters of the New Library Building* in Washington, a life-size group of 18 prominent statesmen who all gave sittings. Having lived and worked in Washington city since 1884, he went to Oklahoma in 1897 and engaged in the study and painting of Indian life.

**Hebert**, LOUIS PHILIPPE: sculptor; b. in Ste. Sophie d'Halifax, Province of Quebec, Jan. 27, 1850; was educated in the public schools. He always had an inclination for wood-carving, and in 1873 obtained a prize at the provincial exhibition for a small bust carved in wood. He studied in an artist's studio for five years, and then spent a year in Paris. He designed several public statues erected in Ottawa and in Montreal. He also executed several historical statues for the legislative buildings in Quebec. In 1894 the Government of Canada awarded him the Confederation medal. His studio is in Paris.

**Hebrew Laws**: The laws of the Jewish people, like its political organizations, were theocratic. They were in character the normal result of the nomadic history of the Jewish people, which, after their departure from Egypt and conquest of Canaan, became a nation with a history and institutions peculiar to itself. After the death of Moses and Joshua the bonds of union between the tribes became very loose, and the ordinary government of the people was local and tribal. Though the national character was largely restored under the kings, after several generations of unity of faith and nationality the tribes formed two separate kingdoms, grouping themselves as Ephraimites and Judahites. The exile of the Jews destroyed the tribal organization, except in Judah, Benjamin, and Levi, and Israel ceased to be an independent kingdom and Judæa itself was made subject to Syria. Its laws, while still retaining the Jewish character, partook largely of the character of the ruling nations from among whom the governors received their appointments, these nations being successively Persia, Greece, Syria, and Rome.

The political organization of the Jewish people was, first, the ancient tribal organization prior to the time of Moses. This was based, like other tribal organizations, on birth and family, and out of this developed the local government of the Jews in later times. Succeeding this form of political organization came the monarchical form, with the king over all, and under him his subordinate civil and military officers. The monarchy, however, disappeared with the Babylonian captivity, and the imperfect tribal organization alone survived. In the congregation of Israel each tribe was organized under princes, elders, judges, and scribes, the ruling classes being the princes and elders, from among whom were chosen the judges and scribes. The congregation of Israel, broadly speaking, consisted not only of native-born Israelites, but also of circumcised strangers dwelling in the congregation, but only native male Israelites of twenty years of age and upward had the full privilege and powers belonging to the members of the congregation. The highest functions of the political organization, as well judicial as political, were exercised by the congregation, which was summoned together to take action for such purposes.

The status of strangers and their government is constantly recognized in the law. They could not be admitted into the ranks of the covenant people except by circumcision, and under any circumstances had to conform to the fundamental regulations of the Mosaic law in regard to idolatry, the Sabbath, eating of blood, etc., but apparently they were not bound by all of the statutes which were binding upon the Israelites themselves. The number of strangers residing in the land of Israel was very large, and many of them seem to have lived on terms of equality among the Israelites, some of them even being landholders. Others, like the Gibeonites, were slaves, and during the reigns of Solomon and David many strangers were made slaves and used as laborers on the public works.

The various kinds of rulers and chief men which are indefinitely designated by the English word "prince" belonged mainly to two ruling classes—one of the earliest and one of the latest period of Jewish history before the exile. These classes in neither case derived their authority or designation from any relations to the king, but from their membership in Israel's official class.

In the books of Numbers and Joshua the term prince is used of heads of a father's house or family. In the later days of the monarchy the term was not connected with any particular class or tribe, but princes constituted a class exercising a powerful political influence, which in general was for evil, and after the disappearance of the royal line of David they were at the head of Jewish affairs. The tribal organization was, as in other cases, an immediate development of the family; the official elders were the aged men of mature judgment. Seventy elders were chosen by Moses to represent the covenant people of Sinai (Ex. xiv. 1); and they received the commands which were to be given to any congregation; and they also, with the priests, received the law from Moses. The local government seems to have been largely in their hand, as provided by the law (Deut. xxi. 2, 4, 6, 19), and the same is indicated by the historical parts of the Bible (Judges viii. 14; 1 Kings xxi. 8). They had also judicial functions separately, and as a body represented the nation and the king, and after the exile they were associated with the princes in the government of Israel (Ezra v. 5; vi. 14; x. 8).

As in other theocracies, the Supreme Judge of Israel is God. Before the time of Moses the heads of families—that is, the elders and princes—were probably Israel's judges. Moses for a time was the single supreme judge of the people (Ex. xviii.) until he chose rulers of tens, fifties, hundreds, and thousands from the upright men of the tribes. Moses still remained the chief judge, however.

The tribunals of the Israelites consisted of local tribunals (Deut. xvi. 18) and superior courts, the local tribunals being required to refer matters too hard for them to decide to the higher courts. The judges of these courts were secular judges associated with the priests. The highest court in Israel according to the law was that of the high priest after the judgment of Urim (Num. xxvii. 21). The high priests were afterward superseded as chief judges by the extraordinary judges and by the kings, the office of chief justice not existing as a separate office; yet Saul was appointed to "judge" the people, as were also David and Solomon.

The synagogue was the local Jewish ecclesiastical tribunal, exercising also judicial functions, sometimes even in foreign lands. The synagogue, however, was subordinate to the sanhedrin at Jerusalem, which was the highest Jewish court, both civil and ecclesiastical, and under the high priest administered the civil and ecclesiastical affairs of the nation. The sanhedrin had extensive powers, and had officers of its own to execute its sentences and decrees; but forty years before the destruction of Jerusalem matters of life and death were removed from its jurisdiction, and the Roman authorities could remove any prisoner from it. The territorial extent of its jurisdiction varied at different times. In the time of Christ it was restricted to Judæa proper, but its decisions were nevertheless considered binding by the Jews everywhere, and it took upon itself to issue letters to the various synagogues at different places directing their course of action under trying conditions. Besides this national sanhedrin, there were other local courts in the Jewish cities which were known by the same name.

The time during which the Israelites were ruled by the officers known as the judges, and for whom the book of Judges is named, was of unknown length, but probably less than two hundred years. It was a time of disorganization idolatry, and subjugation to foreign rule. These judges were more than civil officers, but their influence was local and limited. They were not religious teachers, but strong leaders of the people. Samuel, reckoned to be the last of the judges, was a man of different type from the others.

Judicial procedure among the Israelites was very simple. Deborah (the only woman noted as acting as a judge of Israel) judged Israel under a palm-tree (Judges iv. 5), and Samuel traveled on circuit to give justice (1 Sam. vii. 16); but generally justice was administered at the gate of the city. The pleadings and complaints were made orally and there were no advocates. Two witnesses at least were required to obtain a conviction on any charge, capital or otherwise. Women and slaves were incompetent witnesses, and false witnesses were visited with the same punishment as that affixed to the crime with which they had charged others. There is no proof that the witnesses were sworn before testifying, but all persons present at the time of the trial or hearing were directed to declare what they knew concerning the case being heard.

The punishments of the Mosaic law were intended to eradicate evil, and also to administer retribution for offenses. The theory was an eye for an eye and a tooth for a tooth. The ordinary method of administering capital punishment was by stoning. Executions took place outside of the city; and the dead body was sometimes burned or hung on a tree, in which latter case it was cut down and buried the same day. Beating with a rod, fines, sale into slavery, and the infliction of the same injury which had been inflicted by the wrongdoer were all recognized modes of punishment. The law did not recognize imprisonment or banishment, but under the kings and in some other cases imprisonment was inflicted as a punishment. The convicted person alone was punished, and not his wife or his family with him, and torture was not allowed in any case. F. Sturges Allen.

**Hecker**, Johann Julius: German educator; b. in Werden, Nov. 2, 1707; studied at the gymnasium in Essing and at the University of Halle, where he came under the influence of A. H. Francke. After serving as teacher in the *Pädagogium* in Halle, he became, in 1735, teacher, preacher, and school inspector of the military orphan asylum at Potsdam; in 1739 he was installed as pastor of the Church of the Trinity in Berlin. In this position he set vigorously to work to provide instruction for the common people, a matter quite neglected up to that time, and on May 9, 1747, opened his economic-mathematical *Realschule*. His aim was to furnish instruction in all subjects of practical utility for those who could spend only a limited time in school. Pictures and models were largely used in instruction, a great museum being collected for the purpose. Nothing was excluded from the curriculum that pertained to trade and industry, to civic life, or that was indispensable to man. In 1748 he opened a seminary for the training of teachers. He was favored by Frederick the Great, who had him draw up the law promulgated in 1763 making instruction compulsory for all children from the fifth to the thirteenth year of age—a law not at once effective. Hecker's school was the first *real-school*. He also introduced the normal school into Prussia. D. June 29, 1768. See Von Raumer, *Geschichte der Pädagogik*; Schmid, *Pädagogisches Handbuch*.

C. H. Thurber.

**Hedge Schools**: a name given in derision to the schools conducted by the priests in Ireland in the last century, when the terrible penal laws prohibited instruction in the Catholic faith, or by Catholic priests, under pain of death. These schools were held "on the hillside, in the ditches, and behind hedges, in the precarious shelter of the ruined walls of some ancient abbey, or under the roof of a peasant's cabin." But under all these difficulties the schools continued, though the penalty of death was too often paid. The name has since been applied to any country school without permanency, such as are sometimes called ambulatory schools. See J. H. McCarthy, *Ireland since the Union*.

C. H. Thurber.

**Hegius**, Alexander: one of the leaders in the revival of learning; b. in Heck, Westphalia, about 1433; studied under Thomas à Kempis; was for thirty years a teacher of the classics in Deventer, being the first who introduced the study of Greek into Holland. He wrote little; Erasmus said that perhaps his only fault was that he cared so little about worldly fame. His dialogues were published after his death. Many famous leaders in the revival of classical learning were his pupils, but most famous of all was Erasmus, to whose writings we owe much of our information

concerning Hegius's character. See Von Raumer, *Geschichte der Pädagogik*. C. H. THURBER.

**Heilprin**, ANGELO: naturalist and artist; b. in Satoralja-Ujhely, Hungary, Mar. 31, 1853; removed to the U. S. in 1856, soon afterward returning to Europe for education, studying natural history in London, Geneva, Florence, and Vienna; became Professor of Invertebrate Paleontology at the Philadelphia Academy of Natural Sciences in 1880, curator in charge of the museum in 1883, and Professor of Geology at the Wagner Free Institute of Science in 1885. Among his paintings are *Autumn's First Whisper* and *Forest Exiles*. His scientific works include *Contributions to the Tertiary Geology and Paleontology of the United States* (1884); *Town Geology: The Lesson of the Philadelphia Rocks* (1885); *The Geographical and Geological Distribution of Animals* (1887); and *Explorations on the West Coast of Florida and in the Okeechobee Wilderness* (1887).

**Helium**: a gaseous element originally discovered by Prof. William Ramsay, of London, England, in the mineral cleveite. This chemist, in trying to find a substance that would combine with argon, was led to examine the gases given off by heating certain uraninites. His attention to these gases was perhaps due to the fact that Hillebrand had previously announced the presence in uraninite of an unknown gas, which he suggested was impure nitrogen. Ramsay examined about thirty minerals, in which he determined the presence of helium in quantities from the merest trace to a point where the gas consisted almost entirely of the new element. Helium as evolved from minerals was frequently mixed with hydrogen, which was removed by the aid of hot copper oxide or of metallic palladium. Nitrogen was also a usual constituent, and was removed with hot magnesium or by sparking with an excess of oxygen over a solution of caustic soda, the oxygen residue being afterward removed by the aid of potassium pyrogallate. The density of the gas thus obtained was after further purification found to be 2·133. Determinations of the wave-length of sound in the purified gas gave, as the ratio between the specific heats, the figure 1·632, and finally, after further experiments, 1·652, the theoretical figure for a monatomic gas being 1·66. According to Ramsay, "the results of these experiments go to prove that the density of the gas named helium is not less than 2·13, and that it has the same claim to be considered a monatomic gas as mercury gas; or if it be a mixture it must be a mixture of monatomic gases." Further investigation showed that one volume of water was capable of dissolving only 0·0073 volume of helium, which is the lowest coefficient known, while alcohol and benzine do not dissolve it at all. The spectrum was examined by Sir William Crookes, who found the line $D_3$ to be its most characteristic feature. Its refractive index was found by Lord Rayleigh to be 0·146, the lowest yet reported. In addition to its original sources, helium is now recognized as a constituent of certain spring-waters and of the air. It was liquefied in 1898. MARCUS BENJAMIN.

**Heller**, STEPHEN: pianist; b. in Pesth, Hungary, May 15, 1815. Studied in Vienna, and when twelve years old played in public concerts in Vienna and Pesth. Soon afterward he made a tour through Poland and Northern Germany. Then he studied composition, and in 1836 came under the notice of Schumann, who greatly encouraged him. He went to Paris in 1837 and continued his studies. There he remained for the rest of his life, devoting himself to composition and teaching, appearing occasionally in concerts. His compositions, almost entirely for the pianoforte, are very beautiful, but his fame rests chiefly on his numerous studies, which are in constant use by piano students all over the world. These comprise 20 books, containing 170 studies, besides 50 or 60 more contained in 2 sets of preludes. Most of his compositions are short, but all are gems. He wrote a few works in the larger forms, but they are forgotten in smaller and more beautiful works. D. in Paris, Jan. 15, 1888. D. E. HERVEY.

**Helper**, HINTON ROWAN: b. near Mocksville, N. C., Dec. 27, 1829; educated at the Mocksville Academy; after spending several years on the Pacific coast, was appointed U. S. consul at Buenos Ayres in 1861, and after 1867 traveled extensively; projected the "Three Americas Railway," intended to form a line from Bering Strait to the Strait of Magellan; originated and promoted the commercial commission from the U. S. to Central and South America. By his prophetic *Impending Crisis of the South* (1857), a work in which he advocated the abolition of slavery on economical principles, he was brought prominently into notice, that work having been used as a campaign document by the Republican party in 1860. He also wrote *The Land of Gold* (1855); *Nojoque, a Question for a Continent* (1867); and *The Negroes in Negroland, the Negroes in America, and the Negroes Generally* (1868).

**Henderson**, CHARLES HANFORD, Ph. D.: educator; b. in Philadelphia, Pa., Dec. 30, 1861; prepared for college in Philadelphia private and grammar schools; B. S., University of Pennsylvania, 1882; student in University of Zurich 1891–92; Ph. D., Zurich, 1892; graduate student, Harvard University, 1897–98; instructor in physics and chemistry, Philadelphia Manual-training School, 1886–91; principal Northeast Manual-training High School, Philadelphia, 1892–96; head master Chestnut Hill Academy, Philadelphia, 1896–97; lecturer in education, Harvard University, 1897–98; director of Pratt Institute High School, Brooklyn, since 1898; author of *The Philosophy of Manual Training* (in *Popular Science Monthly*, 1898) and various other scientific and educational papers. C. H. THURBER.

**Henderson**, CHARLES RICHMOND, D. D.: educator; b. in Covington, Ind., Dec. 17, 1848; A. B., University of Chicago, 1870; D. B., Baptist Union Theological Seminary, 1873, and D. D. in 1885; pastor, Terre Haute, Ind., 1873–83, Detroit, Mich., 1883–92; Professor of Sociology, University of Chicago, since 1892; author of *Introduction to the Study of Dependents, Defectives, and Delinquents*; *Development of Doctrine in the Epistles*; *Social Spirit in America*; *Social Elements*; *Social Settlements*; associate editor of *American Journal of Sociology* and *American Journal of Theology*. C. H. THURBER.

**Henderson**, WILLIAM JAMES: journalist; b. in Newark, N. J., Dec. 4, 1855; graduated at Freehold (N. J.) Institute in 1873, and at Princeton University in 1876; studied the piano under his mother and Carl Langlotz, of Trenton, N. J., and after finishing his college course continued studying harmony, counterpoint, theory, etc., mostly without a master, but with frequent professional help. He wrote many studies for orchestra which were played at the Standard theater, New York, where his father was manager, thus acquiring a practical as well as a theoretical knowledge of the orchestra. He served as a reporter on the *Tribune* and *Times* in New York city, and was appointed music critic of the *Times* in the fall of 1887, and still retains that position. He has published *The Story of Music* (1889); *Preludes and Studies* (1891); *What is Good Music?* (1897); *How Music Developed* (1898); and *The Orchestra and Orchestral Music* (1899), besides giving many lectures on musical subjects. He has also written *Sea Yarns for Boys*; *Afloat with the Flag*; *Last Cruise of the Mohawk*; and *Elements of Navigation*. The last is the official text-book of the naval militia of the U. S. He is an officer in the First Naval Battalion of New York. D. E. HERVEY.

**Heneker**, RICHARD WILLIAM, LL. D.: bank president; b. in Dublin, Ireland, May 2, 1823; attended University College School, London, and afterward studied architecture and surveying. Entering an architect's office, he practiced his profession till, in 1855, he became commissioner of the British American Land Company in Canada, which position he still holds. In 1859 he was instrumental in establishing the Eastern Townships Bank, of which he has been president for many years. He is at the head of numerous business enterprises, and has long been prominent in educational matters. He has received honorary degrees of M. A. and D. C. L. from Bishop's College, Lennoxville, and LL. D. from McGill University.

**Henley**, WILLIAM ERNEST, LL. D.: author and editor; b. in Gloucester, England, Aug. 23, 1849; was educated at the Crypt Grammar School, Gloucester, and at St. Andrews University, and from the latter in 1893 received the degree of LL. D.; has edited *London* (1877–78); the *Magazine of Art* (1882–86); the *Scots Observer*, afterward the *National Observer* (1888–93); and became editor of the *New Review* in 1894. He is the author of *A Book of Verses* (1888; 4th ed. 1893); *Views and Reviews* (1890); *Song of the Sword* (1892; 2d ed. 1893); *The Centenary Burns*, with T. F. Henderson (1896); *Works of Lord Byron* (1897); *English Lyrics* (1897); *Poems* (1898); *The Poetry of Wilfrid Blunt*, with George Wyndham (1898); and *London Types*, with W. Nicholson (1898).

**Henselt**, ADOLPH (von): pianist; b. in Schwabach, Bavaria, May 12, 1814; pupil of Hummel and Sechter. In

1838 he went to St. Petersburg, where he lived for the rest of his life. There he gained a great reputation, and was appointed instructor to the imperial children and inspector of the imperial Russian female seminaries. He composed much for the piano, and his works have remained very popular. His concerto in F minor is frequently played in concerts, and his study *Si j'etais oiseau* is in the repertory of every pianist. Two sets of *Études*, op. 2 and 5, 12 each, are ranked next to Chopin's. A number of smaller pieces are also gems much appreciated by pianists. He visited England in 1867, but did not play in public. D. in Warmbrunn, Silesia, Oct. 10, 1889. D. E. Hervey.

**Hereford,** Henry James, LL. D., First Baron James of: English lawyer and statesman; b. Oct. 30, 1828; was educated at Cheltenham College and the Inner Temple, and called to the bar in 1852; was made postman of the Court of Exchequer in 1867, and queen's counsel in 1869; appointed Solicitor-General in 1873; served as Attorney-General 1873–74 and 1880–85; was Liberalist member of Parliament for Taunton 1869–85, for Berry 1885–86, and Liberal-Unionist for Berry 1886–95; acted as attorney-general to the Prince of Wales for the duchy of Cornwall 1882–95; was created baronet in 1873. F. Sturges Allen.

**Heriot**: in English feudal law, the repayment on the death of a thegn, out of his chattels, of the gift of arms and equipment given to him upon the grant to him of bocland by his lord. It was customary when the lord granted bocland to his tenant to make a gift at the same time to the tenant of arms and equipment, and at the death of the tenant it was originally customary for the heir to make repayment of this gift from the chattels of the deceased, which repayment afterward became compulsory. The heriot was formerly confused with the *feudal relief*, which was connected with the tenure of the land, the estate in the land returning to the overlord until the relief was paid; but in the case of the heriot the title passes direct to the heir. The right of heriot still exists in connection with copyhold land in Kent and in many other parts of England, and in some other places on manorial freehold lands; and by virtue of the right the lord at the death of the tenant, and in some cases on alienation, has the right to seize the best beast on every tenement held by the deceased or alienating tenant. In some manors the lord has the right to seize the best chattel, as a pearl necklace. The determination as to whether land is subject to heriots or not is difficult to make. The general right is not barred by the statute of limitations, although a long-continued failure to exercise the right would be evidence of the intent to extinguish it. Sec. 7 of the Copyhold Act of 1887 provides for the compulsory extinguishment of heriots at the instance either of the lord or of the tenant, the compensation payable to the lord in such case being ascertained in the same way as in the case of the enfranchisement of copyhold land. See Elton's *Treatise on the Law of Copyholds and Customary Tenures* (2d ed.); Stubbs's *Constitutional History*, vol. i. F. Sturges Allen.

**Herminyard,** Aimé Louis: French Reformed Church layman; b. in Vevey, Switzerland, Nov. 7, 1817; studied at Lausanne, and was for many years a teacher in Russia, France, and Germany, but of late years has lived at Lausanne, and devoted himself to the production of his annotated edition of the correspondence of the French Reformers among themselves and with foreigners, *Correspondance des réformateurs dans les pays de langue française* (Geneva, 1866; vol. ix., covering 1543 and 1544, 1897). S. M. J.

**Hertzian Waves** [so called from Heinrich Hertz, who discovered them and developed the method of producing them]: waves in the luminiferous ether due to electrical oscillations. Hertz showed in a series of brilliant memoirs, afterward collected into a volume under the title *Untersuchungen über die Ausbreitung der Elektrischen Kraft*,* that these electro-magnetic waves are identical in character with those by means of which ordinary radiant energy and light are transmitted. He likewise pointed out that the electro-magnetic theory of light, which had its origin in the ideas of Faraday, and the development of which was perhaps the most notable achievement of Clerk Maxwell, leads up directly to the remarkable phenomena described in his own papers, and that those phenomena substantiate and confirm the theory in a most complete manner. In approaching the subject of the nature of the Hertzian waves, it is useful to recall Faraday's view concerning electrical influence (or induction). The influence (of a charged body), he says, consists in a certain state of polarization produced by an electrified body in the different parts of the ether, a state characterized by the fact that the particles have positive and negative parts which are arranged symmetrically with regard to each other. This arrangement of the particles is a state of constraint which, however, is kept up in the insulators only temporarily, for the different particles stay in their position of constraint only as long as electricity is present. The attraction acting in the particles of ether in the direction of the lines of induction is accompanied by a repulsive force acting laterally and causing a divergence of the lines of induction. In every point the insulator suffers a stress proportional to the square of the intensity of the electric field and tangential to the line of force passing through the point. It also suffers a pressure equal to the stress at right angles to the line of force.

Now suppose that the charge of an electrified body changes rapidly. Corresponding changes in every part of the ether will take place: waves are the result, and these waves possess certain properties common to all wave-motions, which are of great importance in this connection. Thus, a tuning-fork gives off energy in the form of air-waves and is able to excite vibrations in other suitable elastic bodies. If the receiving body is damped, so that when left alone it speedily returns to rest, it will respond to almost any sound; but if the body has a persistent period of vibration of its own, that is, if it remains in motion after the cause has ceased, it will respond very much more freely, but a more accurate agreement between radiator (i. e. vibrator) and receiver is required, otherwise the latter will fail partially or completely to respond. A pair of tuning-forks in or out of consonance respectively afford a good illustration of this point. The same thing is true in the inverse sense. If the source is a persistently vibrating body, correct tuning is essential, whereas almost everything will respond equally well to a strongly damped exciter.

The above statements are true of all vibrations in a medium that is capable of transmitting waves. Thus, the sudden electrical charge or discharge of a body produces waves in the surrounding ether because the charge does not settle down immediately into equilibrium, but surges to and fro several times in the conductor,* and the surgings and oscillations are followed by corresponding changes in the polarization of the ether—that is, by waves. At the end of each half swing they cause electro-static and at the middle of each half swing electro-magnetic effects. If a wire is present these waves will use it for a path, but if no conductor is present they will spread in all directions with the velocity of light. Maxwell and his followers knew that such waves should be the result of electrical oscillations, and Hertz verified this by bringing suitable conductors into the region where such waves might be expected to exist. Fig. 1 shows the form of the standard Hertz vibrator. Two wires ($d\ d'$) 5 mm. thick and 75 cm. long are connected with the poles of a large Ruhmkorff coil; to one end of each wire is fastened a sphere (K K′) of zinc 30 cm. in diameter. At its other end each wire carries a carefully polished sphere ($k\ k'$) of brass 3 cm. in diameter. The distance between these two spheres measures 0·75 cm. When the primary circuit in the Ruhmkorff coil is closed or the current is interrupted, one of the spheres, K′, for instance, is charged to a high positive value of potential, while the other sphere, K, is charged to a high negative value of potential, and consequently these charges, trying to compensate each other, cause a spark to pass between K and K′. Owing to the rapid discharge from the two poles, a superfluity of both electricities will stream over, and this has to stream back again, a process which will be repeated several times. The result is a vibration or oscillation to and fro of the electric charges between the poles, which subsides more or less gradually according to the existing conditions. This rapid change in the electrical condition of the two electrodes is accompanied, as stated above, by equally rapid changes of

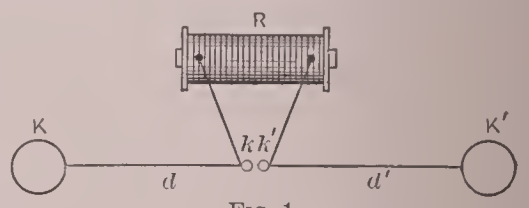

Fig. 1.

* Translated into English by D. E. Jones, under the title *Electric Waves*, London, 1893.

* This fact was first experimentally shown by Feddersen, 1858. *Poggendorff's Annalen*, vol. ciii., p. 69; vol. cviii., p. 497; vol. cxii., p. 454; vol. cxiii., p. 437; vol. cxvi., p. 132.

polarization at every point of the surrounding ether—that is, by waves. The following computation will give an idea of the influence of the dimensions of the apparatus upon the period of the vibration and upon the length of the waves:

The time of vibration in the case of such electrical oscillations is

$$T = 2\pi\sqrt{LC},$$

where $L$ is the coefficient of self-induction and $C$ is the capacity of the circuit. According to Poincaré, the self-induction in this case is

$$L = 2l\left(\text{log. nat. }\frac{4l}{d} - 1\right)$$

where $l$ is the length of the wire and $d$ its thickness. If we put $l$ equal to 150 cm. and $d$ equal to 0·5 cm., we find the value of the self-induction is $l = 1{,}827$. Since the spheres in Hertz's apparatus have a radius of 15 cm.,

$$T = 2\pi\frac{\sqrt{L\frac{R}{2}}}{v} = 2\pi\frac{\sqrt{1827 \times 7{\cdot}5}}{3{\cdot}10^{10}} = 2{\cdot}5 \times 10^{-8},$$

and the corresponding wave-length in the air is

$$2{\cdot}5 \times 10^{-8} \times 3 \times 10^{10} = 750 \text{ cm.}$$

The existence of such waves in the air surrounding his vibrator was proved by Hertz through the observation of minute sparks which passed between the points 1 and 2 (Fig. 2) of a rectangular frame of wire called the *resonator*. These sparks are generated because the electricity in the wire is brought by the action of the ether-waves into a state of vibration similar to that of the radiator described above. The oscillation or surging to and fro of the electrical charges thus generated causes sparks in the air-gap between the terminals of the wires. In order that a detector or resonator of this form should respond to the ether-waves it is necessary that its natural or free period of vibration should correspond exactly to that of the radiator. As constructed by Hertz it was made of copper wire, 2 mm. in diameter, and was set up with the side *c d* parallel to the wires of the radiator. Hertz used also circular resonators (see Fig. 2). The radius of these was 35 cm. and the air-gap was adjusted by means of a micrometer-screw. Resonators of these forms are not capable of detecting any waves excepting those to which they are tuned; they are not good absorbers, but are persistent in vibration and are adapted for picking up disturbances of precise and measurable wave-length.

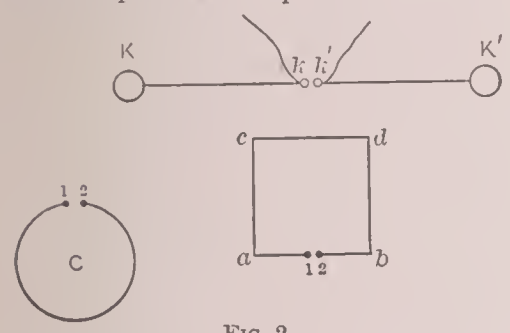

Fig. 2.

There are many different forms, both of radiators and receivers or resonators, of which it will be possible to mention only a few in this article. Hertz's radiator, already described, has great radiating power, and the oscillations are therefore damped down very rapidly, so that not more than three alternations show themselves. When such an instrument is set in action the presence of waves is shown in metals in the neighborhood in a variety of ways. Thus, a gas-leak can frequently be ignited by means of the induced spark, fuzes can be blown, vacuum tubes suspended in the air without being placed in any circuit will glow, electric leads, if anywhere near each other, may be made to spark across, thus striking an arc and blowing their fuzes.

In order to diminish the amount of damping, Dr. Lodge in his hollow cylindrical radiator surrounds the radiating sphere with a metal cap, which allows the rays to issue only in one direction. Fig. 3 shows half the natural size of such an apparatus emitting waves about 8 cm. in length. This form is a very feeble radiator and a very persistent vibrator, and for this reason it is suitable for interference and diffraction experiments.

A form of radiator devised by Righi is shown in Fig. 5. The radiating spheres *b b'* are placed in the walls of a wooden box filled with petroleum; the spheres B B' are connected with the Ruhmkorff coil, thus giving three spark-gaps. Of these the only one which is of importance in the production of vibrations is that between the spheres *b b'*. The waves produced by this radiator or vibrator are rather small; the diameter 1·06 cm. gives a wave-length of 8·0 cm., the diameter 2·44 cm. a wave-length of 8·2 cm., and a diameter of 3·97 cm. a wave-length of 8·8 cm.

Lebedew still further decreased the size of the radiator—a matter of great importance in the study of the Hertz waves, for the reason that the apparatus necessary to perform experiments in reflection, refraction, polarization, diffraction,

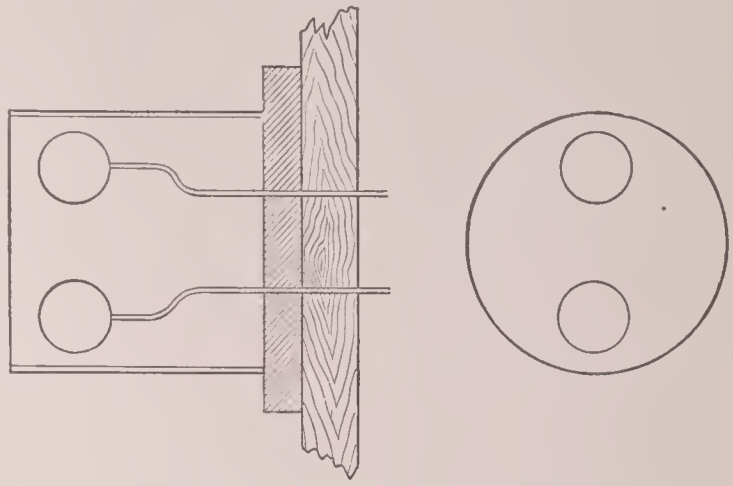
Fig. 3.

and other phenomena by means of which the character of the wave-motion can be most thoroughly investigated, demands apparatus which is very large as compared with a single wave-length.

This radiator (Fig. 4) consists of two platinum wires, $P_1$ and $P_2$, 1·3 mm. long and 0·5 mm. in thickness, fused into glass tubes, $G_1$ and $G_2$. Through these bits of platinum wire sparks pass over from the terminals $D_1$ $D_2$ of the Ruhmkorff coil, which terminals are inserted into the glass tubes as shown in the figure. The length of the waves thus obtained is 0·6 cm.

By a further special device Leopold Kann has succeeded in constructing a radiator that emits waves from 0·2 to 0·3 cm. in length. To obtain effective sparks the spheres or electrodes should be clean, and as often as they begin to oxidize they must be repolished. It is for the purpose of preserving such surfaces in good condition that the petroleum bath in Fig. 5 is used.

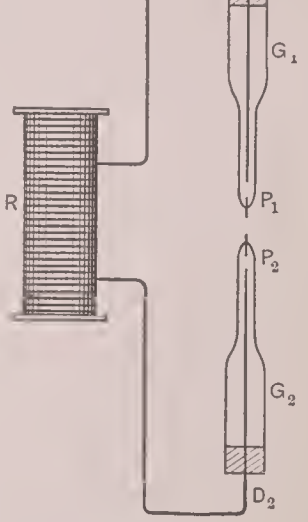

Fig. 4.

Of the many different means of detecting Hertz waves the following may be mentioned, all of which are based upon the production of some mechanical, thermal, or electrical reaction as the result of the energy of the waves in the resonator: (1) The explosion of gas mixtures, (2) the use of the thermopile, (3) the use of the bolometer (Rubens and Ritter), (4) the expansion of wires (Gregory), (5) the use of thermal junctions (Klemencic), (6) the production of sparks (Hertz), (7) the illumination of vacuum tubes (Dragoumis), (8) the use of the galvanometer (Fitzgerald), (9) the use of an air-gap and electroscope (Boltzmann), (10) the use of the "trigger tube" (Zehnder), (11) the use of the "impulsion cell" (Minchin), (12) the change of resistance of filings (Branly), (13) the use of the coherer (Lodge). The last named of these devices has proved much more sensitive than any of the others.

The coherer had its origin in the observations of Branly. The electrical resistance of a tube filled with metal filings, which is very great under ordinary circumstances, increases considerably if a Leyden jar is discharged in its neighborhood. By shaking the filings can be reduced to their normal resistance. Lodge was the first to apply the Branly tube as a sensitive detector of Hertzian waves, and he gave it the name *coherer*. The action of the coherer is not yet fully explained. Lodge's opinion is:

"I picture to myself the action as follows: Suppose two fairly clean pieces of metal in light contact—say two pieces of iron—connected to a single voltaic cell; a film of what may be called oxide intervenes between the surfaces so that

only an insignificant current is allowed to pass, because a volt or two is insufficient to break down the insulating film except, perhaps, at one or two atoms. If the film is not permitted to conduct at all it is not very sensitive. The most sensitive condition is attained when an infinitesimal current passes. Now let the slightest surging occur, say by reason of the sphere being charged and discharged at a distance of 40 yards, the film at once breaks down, perhaps not completely (that is a question of intensity), but permanently. As I imagine more molecules get within each other's range, incipient cohesion sets in, and the momentary electrical quiver acts somewhat like a flux. It is a singular variety of electric welding; the stronger stimulus enables more molecules to hold on. The process is surprisingly metrical. The incipient cohesion electrically caused can be mechanically destroyed. Sound-vibrations or any other feeble mechanical disturbance, such as scratches or taps,

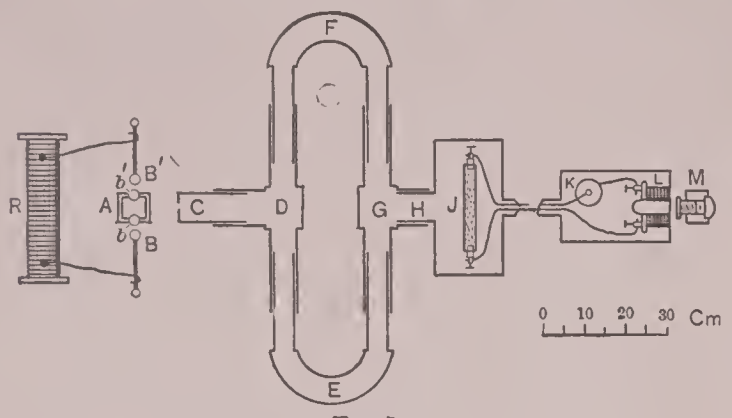


Fig. 5.

are well adapted to restore the contact to its original high resistance and sensitive condition."

There is a fine interference experiment with the coherer that corresponds exactly to the arrangement which Koenig made for the study of interference in acoustics. It was carried out by V. von Lang to determine the length of Hertzian waves. The place which would have been occupied by the sensitive film in Koenig's experiment was taken by the coherer; opposite the Righi resonator already described the branch tube C D E F G H is placed. This tube was made of cardboard and was lined inside with tinfoil; the diameter of the tube was 5·9 cm. E and F could be lengthened by 20 cm. Waves entering at C divide at D. The portions running separately through E and F respectively join again at G and pass together through H, where they are brought in contact with the Branly tube J. The latter is in contact with the galvanometer L and a dry cell K. Since the waves which fall upon any portion of the coherer circuit produce an effect, it is necessary to place the coherer cell, galvanometer coils, and connecting wires in a metal box, which must be very well closed in order that the screening may be perfect. The narrowest chink will permit the entrance of waves which will produce disturbance; only at the desired point in the circuit H an opening is made for the waves. The needle of the galvanometer is outside the box. If the paths traversed by the two portions of the divided waves are equal—that is, arrive at J without difference of phase—the effect upon the tube J is then at its maximum. If E be elongated the paths of the two waves become of different lengths, and when this difference has become a half wave-length the effect upon J should properly be zero. As a matter of fact, it becomes only a minimum, just as has been shown to be the case in the acoustic flame experiment of Koenig.

The foregoing paragraphs will suffice to show the nature of the apparatus by means of which the Hertzian waves can be produced, and their existence can be shown and investigated. Hertz did not rest after his discovery. He proceeded to apply it to the verification of what had already been indicated by theories concerning such waves. One of his most important experimental achievements consisted in demonstrating the interference of electric waves. He succeeded in producing a set of standing waves arising from reflection at the walls of his laboratory. Similar systems of standing waves in wires can readily be shown to exist. The following contrivance for studying them is due to Lecher:

Two pieces of sheet iron, A and A' (Fig. 6), 40 cm. square, are connected by wires to the pair of spheres at F. These are 3 cm. in diameter, and are separated by a distance of 0·75 cm. Plates are likewise connected to the terminals of the Ruhmkorff coil. Isolated pieces of metal of the same size, B and B', are placed opposite the pieces A and A', at a distance of about 4 cm. These two wires, B S T and B' S' T', extend to a length of at least 400 cm., the distance between them being from 10 to 50 cm. Between the ends $t$ and $t'$ a vacuum tube without electrodes, $g g'$, is placed. When the Ruhmkorff coil is set in action the tube $g\ g'$ is illuminated by the electric vibrations in the wires. If now a stirrup of wire, $x\ x'$, fastened to an insulating handle, is

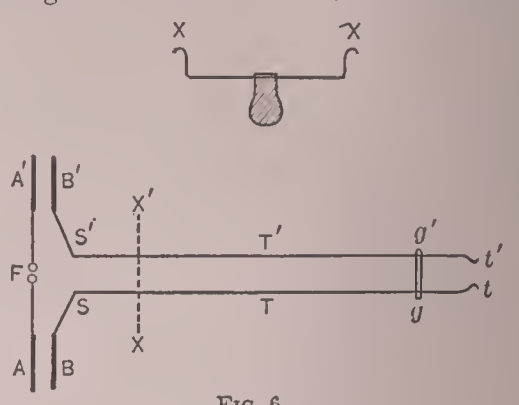


Fig. 6.

put across the wires in certain positions, the illumination ceases, to begin again when this bridge is moved to other positions. It is obvious that the cessation of illumination indicates that the tube $g\ g'$ is in a node in the system of standing waves.

By means of countless experiments with this and similar apparatus, Hertz and his followers worked out every detail of the theory separately, analyzing the electrical and the magnetic oscillations to which these phenomena are due. In spite of the great wave-length with which he had to work, Hertz showed the reflection with gigantic cylindrical mirrors 2 mm. in height, refraction by means of enormous prisms of pitch 1·5 mm. in height, and polarization by means of wooden frames 2 mm. in height, on which copper wires 1 mm. thick and 3 cm. apart were stretched.

At the present day, on account of the reduced wave-lengths which it is possible to obtain with resonators of Righi, Lebedew, and others, the same experiments are easily performed with apparatus scarcely one-fiftieth of the size of that employed by Hertz.

L. Kann.

Revised by E. L. Nichols.

**Herzegovina**: The progress of Herzegovina and Bosnia, which were occupied by Austria-Hungary with the consent of Europe in 1878, has been all the more remarkable because the Austro-Hungarian Government has had to deal with a population containing a large proportion of Mohammedans, notorious for their fanaticism and turbulence. The difficult task of introducing good government in these countries was confided to Governor-General Kallay, who in eighteen years succeeded in establishing public security and reconciling the Christian and Mussulman populations who formerly lived in constant feud. He constructed roads and railroads. There are in 1899 about 600 miles of railroads, and more than 5,000 miles of highways through regions which previously had no such means of communication. Commercial traffic has been doubled, and the number of travelers, including tourists, has been greatly increased by the erection of hotels and the security of the roads. The people of all creeds, Roman Catholic, Mussulman, and Orthodox Greek, have been placed on an equal footing as to education. Impartial justice is meted out, and the people are instructed in agriculture, cattle-breeding, and other industries. When Austria-Hungary assumed control there were only 5 primary schools, and they now number about 400. High schools and commercial and technical schools have been opened in all the principal towns. Agricultural schools with model farms have been established to illustrate the best systems of cultivation. The soil is rich and the Government invites colonists. It also offers grounds, sites, motive power, and fuel for the establishment of new industries, and also exemption from taxes for several years. In consequence of these measures, the population of Herzegovina and Bosnia increased 32 per cent. in seventeen years and numbered 1,565,357 in 1896. About 1,000 families, mostly Germans, have settled in the country as farmers. The inclusion of these regions in the general tariff system of Austria-Hungary has given much impetus to the trade of the country, which seems capable of important extension.

C. C. Adams.

**Hide**: originally, in English law, the portion allotted to each freeman constituting the freeman's homestead, with a portion of the arable lands and pasture-lands of the town. Later, from the foregoing use, the word *hide* came to be

used to designate a measure of area at first varying so greatly in different localities as not to be definitely ascertainable, but fixed in the twelfth century at from 100 to 120 acres. In the Doomsday Book the term is used as the name of a unit of assessment in calculating the danegeld, but is there used loosely, apparently referring rather to value than to area. See Stubbs's *Constitutional History*, vol. i., and Kemble's *Saxons in England*, vol. i. F. Sturges Allen.

**Hildreth**, Charles Lotin: author; b. in New York city, Aug. 28, 1856; was educated in the College of the City of New York, studied medicine, and practiced for four years. Besides editing several volumes of English verse, serving on the staff of *Belford's Magazine*, and contributing freely to various periodicals, he published *Art and Artists in America*; *Judith, a Novel*; *The New Symphony*; *The Masque of Death*, his collected poems (1888), and *Ol, the Mysterious City*. D. in New York city in 1896.

**Hill**, Frank Alpine, Litt. D.: educator; b. in Biddeford, Me., Oct. 12, 1841; prepared for college in the Biddeford high school; graduated at Bowdoin College 1862; principal of Limington Academy, Me., 1862; principal of Biddeford high school 1862–63; studied law 1863–64; principal of Milford, Mass., high school 1865–70; principal of Chelsea, Mass., high school 1870–86; head master of English High School, Cambridge, Mass., 1886–93; head master of New Mechanic Arts High School, Boston, 1893–94; secretary of the Massachusetts State board of education since 1894. The latter office was made famous by the first incumbent, Horace Mann; it corresponds practically to the office of State superintendent in most States. In 1894 Bowdoin College conferred on him the degree of Litt. D. He is well known as a writer and lecturer. C. H. Thurber.

**Hill**, Robert Thomas: geologist; b. in Nashville, Tenn., Aug. 11, 1858. Losing both his parents and his patrimony in the civil war, he was early thrown upon his own resources, and in 1874 moved to the frontier of Texas, where as he grew up he acquired a taste for geography and geology. In 1882 he went to Cornell University and began the systematic study of these subjects, but before graduating he was called to an appointment on the U. S. Geological Survey. Subsequently for two years he held the chair of Geology in the University of Texas, which he resigned to return to the U. S. Geological Survey, where he has since remained. In these services he made a series of explorations on the southern borders of the U. S. and Mexico, and under the auspices of Dr. Alexander Agassiz he visited Central America and the West Indies. Among his notable contributions to geology have been the demonstration of the existence of the Lower Cretaceous formations in the U. S.; the demonstration of the existence of conditions for procuring artesian wells over an arid area of Texas, which has since resulted in an abundant water-supply for that region; and numerous valuable scientific investigations of the physiographical, paleontological, and geological conditions of the Southwest. His West Indian and Central American studies have dealt with problems of the union of the continents, and the original relations of the Antilles, and his publications on these subjects are perhaps the most comprehensive yet issued. Prof. Hill's technical papers on geological and geographical subjects are more than fifty in number, many of which have been contributed to the *Proceedings* of scientific societies of which he is a member, but the largest and most important is his *Cuba and Puerto Rico, with other Islands of the West Indies* (New York, 1898). Marcus Benjamin.

**Hill**, Thomas: artist; b. in Birmingham, England, Sept. 11, 1829; went to the U. S. in 1840, settling in Taunton, Mass., afterward going to Boston, where he engaged in ornamental painting; removed to Philadelphia in 1853 and studied in the life class at the Academy; visited California in 1861, painting portraits and figure-pieces; studied art in Paris in 1866, and decided to devote himself to landscape-painting. His more notable pictures are *The Yosemite Valley*; *The White Mountain Notch*; *Donner Lake*; *The Great Cañon of the Sierras*; *The Heart of the Sierras*; and *The Yellowstone Cañon*.

**Hill**, Walter Henry: clergyman; b. near Lebanon, Ky., Jan. 21, 1822; graduated at St. Mary's College, Ky., in 1843; studied medicine; joined the Jesuit order in 1847; became Professor of Mathematics, Physics, and Rhetoric in St. Joseph's College in 1848; after teaching in the St. Louis University in 1855, was ordained priest in Boston, and joined the Jesuit novitiate in Frederick, Md.; became Professor of Logic and Metaphysics in the St. Louis University in 1864; was president of St. Xavier College, Cincinnati, 1865–69; afterward worked and taught in Topeka, St. Louis, and Chicago. Among his publications are *Elements of Philosophy, comprising Logic and General and Special Metaphysics* (1873; 8th ed. 1887), which provoked heated controversy and became a text-book in Roman Catholic institutions; *Ethics, or Moral Philosophy* (1878; 4th ed. 1885); and *Historical Sketch of St. Louis University* (1879).

**Hillebrand**, William Francis, Ph. D.: chemist; b. in Honolulu, Hawaii, Dec. 12, 1853; educated at Cornell University, and in Germany at Heidelberg and Strassburg Universities and the Mining School in Freiberg, Saxony; received the degree of Ph. D. from Heidelberg University in 1876. He settled in Leadville, Col., as an assayer, but in 1880 entered the service of the U. S. Geological Survey, first in Leadville and then in Denver, where he established the chemical laboratory for the Rocky Mountain division of the survey. In 1885 the laboratory in Denver was abandoned and Dr. Hillebrand was transferred to Washington, where he has since remained. His most important researches relate to the metallic separation of cerium, lanthanum, and the original didymium; the determination of the specific heats of those elements; and the detection of nitrogen in different varieties of uraninite, in which he called attention to the presence of a gas which he believed to be a mixture, but which subsequently was determined by Prof. William Ramsay to be the new element helium. The results of his chemical investigations have appeared in Poggendorff's *Annalen*, in Liebig's *Annalen*, and the *Zeitschrift für anorganische Chemie* in Europe, and in the *American Journal of Science*, the *American Chemical Journal*, and the *Journal of the American Chemical Society*. Among his papers are the following, all of which have appeared in the publications of the Geological Survey: *Notes on Certain Rare Copper Minerals from Utah* (Washington, 1889); *Analyses of Three Descloizites from New Localities* (1890); *On the Occurrence of Nitrogen in Uraninite and on the Composition of Uraninite in General* (1891); *New Analyses of Uraninite* (1892); *The Preparation and Specific Gravity of Crystallized Uranium Dioxide* (1893); *A Further Example of the Isomorphism of Thoria and Uranium Dioxide* (1893); and *Zinc-bearing Spring Waters from Missouri* (1893).

Marcus Benjamin.

**Hillis**, Newell Dwight, D. D.: Congregational minister; b. in Magnolia, Ia., Sept. 2, 1858; educated at Lake Forest University and McCormick Theological Seminary (Presbyterian), Chicago. He became pastor of the First Presbyterian church in Peoria, Ill., 1887; of the First Presbyterian church in Evanston, Ill., 1890; of the Central Congregational church in Chicago 1894; of Plymouth Congregational church, Borough of Brooklyn, New York city, 1899. He is the author of *A Man's Value to Society* (1896); *Foretokens of Immortality* (1897); *The Investment of Influence* (1897); *How the Inner Light Failed* (1898).

**Hind**, Henry Youle, D. C. L.: geologist and explorer; b. in Nottingham, England, June 1, 1823; studied at Leipzig and at Cambridge. In 1846 he became a professor in the Provincial Normal School, Toronto, Canada, and later filled the chair of Chemistry and Geology at Trinity College for thirteen years. He was sent by the Government as geologist on exploring expeditions to the Red river and the Assiniboine and Saskatchewan regions. He also made explorations in Labrador, in Newfoundland, and in the gold districts of Nova Scotia. He was the first to discover the great extent of the Canadian fisheries. At the Paris exposition of 1878 he received a gold medal and a diploma for his charts showing the movements of the fish along the eastern coast of North America. He received the degree of M. A. from Trinity University in 1853, and the honorary degree of D. C. L. from King's College, Windsor, in 1890. Among his published works are *Prize Essay on Insects and Diseases Injurious to the Wheat Crops* (1857); *Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858* (1860); *Explorations in the Interior of the Labrador Peninsula* (1863); *Eighty Years' Progress of North America* (1863); *Notes on the Northern Labrador Fishing-Ground* (1876); *History of the University of King's College, Windsor, N. S.* (1890).

**Hingston**, Sir William Hales, M. D., LL. D.: b. in Hinchinbrook, Province of Quebec, June 29, 1829; gradu-

ated in medicine at McGill University in 1851, and afterward obtained diplomas from leading European universities. He has remained in Montreal, where he began his practice, and ranks among the first in his profession. He has been a prominent member of many medical societies, was mayor of Montreal for three years, has been vice-president of the British Association for the Advancement of Science, and is an honorary member of the British Medical Association. He has received the honorary degree of LL. D. from Victoria University, Toronto, and was knighted May 24, 1895.

**Hinrichs**, Gustavus Detlef: chemist; b. in Lunden, Holstein, Germany, Dec. 2, 1836; graduated at the University of Copenhagen in 1860, and soon afterward went to the U. S. and settled in Iowa City, Ia. In 1863 he became Professor of Physical Sciences in the Iowa State University and Professor of Chemistry and Toxicology in the medical department, and in 1868 he was appointed chemist to the State Geological Survey. He organized in Iowa in 1875 the first State weather service in the U. S. He left the university in 1885. The Missouri Medical College gave him the degree of M. D. in 1872. He is a member of various U. S. and European scientific societies. He has contributed many papers on physics to scientific journals, edited the *American Scientific Monthly* during 1870, and has published the following books: *The Elements of Physics* (1870); *The Principles of Pure Crystallography* (1871); *The Elements of Chemistry and Mineralogy demonstrated by the Student's Own Experiments* (1871); *The Principles of Chemistry and Molecular Mechanics* (1874); and *First Course in Quatitative Analysis* (1874).

**Hippolyté**, Louis Mondestin Florvil: b. in Cape Haytien, Haiti, 1827; son of one of the ministers of the Haitian emperor, Faustin I., his mother being a Frenchwoman. He was educated for a military career in France, and on his return to Haiti entered the army, distinguishing himself in the defense of Bellair in 1865; headed the insurrection which overthrew President Légitime in 1889, and succeeded to the presidency. He was a stern and cruel ruler, executing many of his political enemies. D. in Port-au-Prince, Haiti, Mar. 24, 1896.

**Hire and Purchase Agreements**: the term by which are commonly designated in Great Britain those contracts of purchase in which it is stipulated that the payment of the purchase price shall be by installments, and that the title in the purchase of property shall not vest in the vendee until the last installment has been paid, the previous installments being considered as rent for the hire and use of the purchased article. Such contracts are commonly known in the U. S. as contracts of conditional sale. In England, as in the U. S., the making of such contracts and the rights of the parties under them are largely regulated by statutes, which in the U. S. vary widely in the different States. In England if the purchaser of goods on a contract of hire and purchase sells or pledges the goods to a third party who acts in good faith and without notice of the right of the seller, the sale or pledge is valid. (See Vendor's Act, 1889, sec. 2 and sec. 9; Helvey *vs.* Matthews, 2d Queen's Bench, 262.) The same form of contracts exists in Germany, and a full exposition of the subject as there existing is given in Cohn's *Die volkswirtschaftliche Bedeutung des Abzahlungsgeschäfts.* F. Sturges Allen.

**Hitchcock**, Ethan Allen: b. in Mobile, Ala., June 12, 1835; received education in New Haven, Conn., and settled in St. Louis, Mo., where he acquired large railway interests and became president of various manufactories; was appointed minister to St. Petersburg in 1897, afterward being promoted to the rank of ambassador. On the retirement of Cornelius N. Bliss from President McKinley's cabinet he was made Secretary of the Interior, entering upon the duties of the office in Jan., 1899.

**Hitchcock**, (James) Ripley (Wellman): author, editor, and critic; b. in Fitchburg, Mass., July 3, 1857 (son of Dr. Alfred Hitchcock, physician, author, and publicist, 1814–74); graduated at Harvard in 1877; went to New York in 1879 and engaged in literary work; in 1882 and 1883 made long journeys in the West, in Mexico, and in the Northwest as special correspondent of the New York *Tribune*; art critic of the *Tribune* 1882–90; has delivered several addresses on artistic, historical, and literary subjects. He is the author of *Some Modern Etchings*; *An American Landscape-Painter—George Inness*; *Etching in America*; *The Western Art Movement*; *Representative Etching*; *The Madonna in Art*; *Water-color Painting in America*; *Thomas De Quincey, A Study*, and other works; and has edited *The Life of an Artist*, by Jules Breton; *The Last Words of Thomas Carlyle*; *The Art of the World illustrated in the Paintings, Statuary, and Architecture of the Columbian Exposition*, with an introduction and other text; the Story of the West Series, including *The Story of the Indian*, *The Story of the Mine*, *The Story of the Cowboy*, *The Story of the Railroad*, and *The Story of the Soldier*, with introductions.

**Hittorf**, Johann Wilhelm, Ph. D.: physicist; b. in Bonn, Mar. 24 (27), 1824. He received the degree of doctor of philosophy at the University of Bonn in 1846, his thesis relating to the properties of conic sections. He soon afterward turned his attention, however, to physical chemistry, and it is to this field almost exclusively that his life work in science has been devoted. After graduation he became privat docent in the Academy of Münster, and in 1852 he was appointed Professor of Physics and Chemistry in that institution. Hittorf's name is best known perhaps as one of the pioneers in the development of the ionic theory. To this subject, particularly in its application to electrolysis, and to the subject of the electrical conductivity of gases, he has contributed many important memoirs. E. L. N.

**Hoag**, Charles E.: lawyer and author; b. in Molton Borough, Carroll co., N. H., Sept. 18, 1849. After his preliminary education he studied law and was admitted to the bar in Boston, Mass., in 1876; built up a practice in Peabody; traveled extensively for his health in 1882; practiced again in 1884; acquired an interest in a local paper in Peabody, which subsequently was also published in Boston, where he became largely interested in other newspapers. In 1893 his health failed again, and he traveled abroad, prior to which he settled his home in Springfield, Mass., where he has held numerous positions of trust, and where he still (1899) resides. Besides his contributions to the newspapers, he has written several novels, among which are *A Double Life* (1883); *The Fall of Eona* (1887); and *The New Commonwealth* (1889); and he has also published other short sketches under a *nom de plume*. He has recently published a volume of poems written by himself and his wife, entitled *Chords and Discords.* F. Sturges Allen.

**Hobson**, Richmond Pearson: naval officer; b. in Magnolia Grove, Greensboro, Ala., Aug. 17, 1870. In his sixteenth year he entered the Naval Academy, where he took first honors at his graduation in 1889. After this he went with Admiral Walker to recognize the Brazilian flag. Having shown unusual ability in naval construction, he was sent to Paris for five years, and won diplomas at the École Nationale Superior des Mines and at the École d'Application Genie Maritime. His paper on *The Situation and Outlook in Europe* was widely and favorably noticed. Returning to America, he organized a graduate course in construction at Annapolis, and was appointed instructor. On the outbreak of the war with Spain he was appointed to Admiral Sampson's staff. He volunteered to navigate a laden ship into the narrow harbor channel at Santiago de Cuba and there sink it, to block the harbor. The collier Merrimac was chosen, and with seven men he navigated her into the narrows and sunk her—all the while under the fire of the Spanish forts. Lieut. Hobson and his men, though unharmed, were unable to reach the launch which had followed the Merrimac, and were taken prisoners. Later they were exchanged, and Lieut. Hobson was welcomed back with great enthusiasm. Immediately after the war he devoted himself to raising the wrecked ships of the Spanish fleet off Santiago, and in Dec., 1898, he was ordered to the Asiatic station for similar duty.

**Hodges**, John Sebastian Bach, S. T. D.: clergyman; son of Edward Hodges, Mus. Doc. (*q. v.*); b. in Bristol, England, in 1836, and went to the U. S. in 1838 with his father, from whom he received a thorough musical education; was educated for and took holy orders in the Episcopal Church; rector of several well-known churches, including Grace church, Newark, N. J., and St. Paul's church, Baltimore, Md., where he now is. His compositions are entirely for the church, and include many services, anthems, chants, and hymn-tunes. In 1868 he compiled the *Book of Common Praise* as a companion to the *Book of Common Prayer.* His hymn-tunes are very popular both in the U. S. and in England. He is an accomplished organist and a fine singer. His elder brother, Jubal Hodges, and his sister, Faustina Hasse Hodges, were also both accomplished musicians.

D. E. Hervey.

**Hodgson**, Brian Houghton, F. R. S., D. C. L.: Orientalist; b. near Macclesfield, Cheshire, England, Feb. 1, 1800; educated at Haileybury College, and entered the Indian civil service in 1818; became assistant to the commissioner at Kumaon in 1819; secretary to the embassy at Nepal in 1820, continuing as such until 1829, when he assumed charge of the embassy; appointed resident in 1833, and held the office until Dec., 1843, when he retired from the service. He studied the religion, languages, literature, ethnology, and zoölogy of Nepal and Tibet, and published many articles on these subjects in the *Journal and Researches of the Asiatic Society of Bengal* and in other periodicals between 1824 and 1857. In 1824 he discovered the original Sanskrit Buddhistic scriptures, the basis of all present knowledge of the history of Buddhism. He distributed copies of these works throughout Europe, at his own expense, save some that were bought in France by the Société Asiatique. In 1835 the Grand Lama of Lassa gave him two complete sets of the Tibetan Cyclopædia, the *Kahgyur* and *Stangyur*, each containing 334 volumes. He presented one set to the library of the Asiatic Society of Bengal, and the other to the East India Company; the latter is now in the India Office library. He also made large zoölogical collections. Mr. Hodgson finally returned to England in 1858. He published *Literature and Religion of the Buddhists of the North* (1841); *Aborigines of India* (1847); *Selections from the Records* (1857). Some of his essays were republished as *Essays on the Language, Literature, and Religion of Nepal and Tibet* (1874) and *Miscellaneous Essays relating to Indian Subjects* (1880). D. May 23, 1894.

**Hofmann**, Joseph: pianist; b. in Cracow, Austrian Poland, Jan. 20, 1877, and was at first taught by his father; played at a charity concert in Warsaw in 1882, and in 1885 performed the Beethoven Concerto, op. 37, and other pieces of the same advanced character. He created a great sensation wherever he played, and in 1889 went to New York, where he was equally successful. Then he retired and devoted ten years to hard and serious study. For three years he enjoyed the tuition and friendship of Rubinstein. He was again in New York in 1898 and 1901, and gave several concerts with great success. D. E. Hervey.

**Hofmann**, Heinrich Karl Johann: musician; b. in Berlin, Jan. 13, 1842; was a chorister in the *Domchor* at nine years of age, and at fifteen entered Kullak's Academy. His earlier compositions were for the pianoforte. His first public notice came from his opera *Cartouche* (1869). Since then he has composed much in various forms, including symphonies and suites for orchestra; chamber music; the operas *Armin*, *Aennchen von Tharau*, *Wilhelm von Oranien*, and *Donna Diana*; several cantatas, and many songs. His cantata *Die schoene Melusine* (1875) is very popular, and is a favorite work with choral societies both in the U. S. and in England. D. E. Hervey.

**Holden**, Albert J.: organist and church composer; b. in Boston, Mass., in 1841; removed to New York in 1855, and has since resided there; studied entirely in New York, and has been a church organist more than thirty years at the Church of the Divine Paternity (Universalist) and the Church of the Puritans. He has composed very largely, including more than 300 anthems, hymns, and other church music. He has also written some songs and part songs, several ballads and choruses, and has edited and compiled a number of collections of music, both sacred and secular.
D. E. Hervey.

**Holder**, Charles Frederick: naturalist; b. in Lynn, Mass., Aug. 5, 1851; was educated at the Friends' School, Providence, R. I., at Allen's Seminary, West Newton, Mass., and at the U. S. Naval Academy; was assistant in the American Museum of Natural History 1870–77, and afterward visited various parts of the U. S., collecting rare specimens for the New York Aquarium; settled in New York city in 1880, devoting himself to literature and lecturing on zoölogy; is a fellow of the New York Academy of Sciences; has written a great deal for the instruction and entertainment of young people. Among his works are *Elements of Zoölogy* (1885); *Marvels of Animal Life* (1885); *The Ivory King* (1886); *Living Lights* (1887); and *Wonder Wings* (1887).

**Holland**, Henry Scott: Church of England preacher; b. in Underdown, Ledbury, Herefordshire, England, Jan. 26, 1847; graduated at Oxford, and was senior student of Christ Church 1870–85; tutor 1872–85; became canon residentiary of St. Paul's Cathedral 1884; precentor 1886; examining chaplain to the Bishop of Truro 1891, and to the Bishop of St. Andrews 1893. He is a very popular preacher, and has published several volumes of his sermons. S. M. J.

**Holland**, Thomas Erskine, D. C. L., LL. D.: English lawyer and diplomat; b. in Brighton, July 17, 1835; educated at Brighton College, and at Baliol and Magdalen Colleges, Oxford. He has held the positions of honorary professor of the University of Perugia, honorary member of the University of St. Petersburg, of the College of Toulouse, and of the Juridical Society of Berlin. He is a member of the Institute of International Law and a knight of the Order of the Crown of Italy. He was called to the bar in 1863, and made Vinerian reader of English law in 1874, and later Professor of International Law and Diplomacy, and assessor of the chancellor's court, and a fellow of All Souls College at Oxford University. Besides his best-known work, *The Elements of Jurisprudence* (8th ed. 1896), he has published *The Institutes of Justinian* (1873–81); *Essays on the Form of the Law* (1870); *The European Concert on the Eastern Question* (1885); *Studies in International Law* (1898); and other technical works, addresses, and essays.
F. Sturges Allen.

**Hollidaysburg**: borough; capital of Blair co., Pa. (for location of county, see map of Pennsylvania, ref. 5–D); on the Juniata river and the Penn. Railroad and canal; 7 miles S. of Altoona. It is the seat of a prosperous female seminary with 4 instructors, 75 students, and a library of 3,000 volumes. Pop. (1880) 3,150; (1890) 2,975; (1900) 2,998.

**Hol'lins**, George N.: b. in Baltimore, Md., Sept. 20, 1799; appointed midshipman U. S. navy in 1814, and was with Commodore Decatur on the frigate President when she was captured by the British, and held as prisoner at Bermuda during the remainder of the war; subsequently served with Decatur in the war with Algiers, and at its close commanded an East India merchant ship. In 1825 was commissioned lieutenant U. S. navy, rising to be captain in 1855. In 1854 he commanded the Cyane, and gained considerable notoriety by the bombardment and destruction of the town of Greytown (San Juan de Nicaragua). In 1861 he resigned from the U. S. navy, but his resignation was not accepted, though he effected his escape, and, joining the Southern cause, was appointed commodore in the Confederate navy. On the morning of Oct. 12, 1861, before dawn, with the ram Manassas, three fire rafts, and five armed steamers, he surprised the U. S. squadron blockading the mouths of the Mississippi, causing much confusion, but in reality effecting scarcely any damage, although he sent exaggerated dispatches announcing a great victory, and was made naval commandant at New Orleans. He was, however, superseded before the decisive attack of Admiral Farragut in 1862. D. Jan. 18, 1878.

**Hollis**: town; Hillsborough co., N. H. (for location of county, see map of New Hampshire, ref. 10–E); on the Boston and Maine Railroad; 7 miles S. W. of Nashua, 15 miles N. W. of Lowell, Mass. It is in an agricultural region; contains a high school, public library, and weekly newspaper, and manufactures large quantities of lumber and casks. Pop. (1880) 1,077; (1890) 1,000; (1900) 910.
Editor of "Times and Brookline Reporter."

**Hollister**: town (founded in 1868); capital of San Benito co., Cal. (for location of county, see map of California, ref. 10–C); on the S. Pac. Railroad; 94 miles S. of San Francisco. It contains a seminary, complete system of public schools, and two weekly newspapers, and is principally engaged in agriculture, stock-raising, and quicksilver-mining. The completion of extensive irrigation-works has led to much attention being paid to horticulture. Near the town are the richest tobacco plantations in the State. Pop. (1880) 1,034; (1890) 1,234; (1900) 1,315.
Editor of "San Benito Advance."

**Holliston**: town; Middlesex co., Mass. (for location of county, see map of Massachusetts, ref. 2–H); on the Boston and Albany Railroad; 26 miles S. W. of Boston. It is in an agricultural region; has manufactures of boots and shoes, straw and woolen goods, nails, pumps, etc.; and contains a public library, high school, and two weekly newspapers. Pop. (1880) 3,098; (1890) 2,619; (1900) 2,598.
Editor of "Transcript."

**Holloway**, Laura Carter: author; b. in Nashville, Tenn., Aug 22, 1848; graduated at the Nashville Female

Seminary in 1862; has edited the *Home Library Magazine*, and was for twelve years associate editor of the Brooklyn *Eagle*. Her publications include *Ladies of the White House* (1870); *An Hour with Charlotte Brontë* (1883); *The Hearthstone, or Life at Home* (1883); *The Mothers of Great Men and Women* (1884); *The Home in Poetry* (1884); *Chinese Gordon* (1885); *Howard, the Christian Hero* (1885); *Adelaide Neilson, a Biography* (1885); *The Buddhist Diet Book* (1887); and *Woman's Story as Told by Famous American Women* (1889).

**Holly Springs**: city; capital of Marshall co., Miss. (for location of county, see map of Mississippi, ref. 3–G); on the Ill. Cent. and the Kan. C., Mem. and Birm. Railroad; 43 miles S. E. of Memphis, Tenn. It is the seat of Rust University (Methodist Episcopal, opened 1868), which in 1890 had 15 professors and instructors and 314 students; of the State Normal School (founded 1870); of the Franklin Female College (non-sectarian, opened 1878); of the Bethlehem Academy (Roman Catholic); and of the Maury Institute (non-sectarian). It has a cotton compress, stoneware-factory, and a monthly and two weekly periodicals, and the principal business is handling cotton. Pop. (1880) 2,370; (1890) 2,246; (1900) 2,815.

**Holman**, William Steele: jurist and politician; b. in Dearborn co., Ind., Sept. 6, 1822; studied at Franklin College, Ind., but did not complete the course; practiced law at Aurora, Ind., and was judge of the probate court, prosecuting attorney, member of the Indiana Legislature, and judge of the court of common pleas: elected to Congress as a Democrat in 1859, and re-elected fifteen times, but not continuously. He became known as "The Great Objector" and "The Watchdog of the Treasury," because he strenuously objected to what he considered extravagant appropriations. D. in Washington, Apr. 22, 1897.

**Holmes**, Isaac Edward: b. in Charleston, S. C., Apr. 6, 1796; graduated with honors at Yale in 1815; became a lawyer of his native town in 1818; was one of the founders of the South Carolina Association and a leader of the extreme States' Rights party; was an able and distinguished member of Congress 1839–50; resided in California 1850–61; strove to avert the civil war in 1861. D. in Charleston, Feb. 24, 1867. Author of the *Recreations of George Telltale*, and, with R. J. Turnbull, of *Carolinensis* (1826), a political work.

**Holmes**, Theophilus Hunter: b. in North Carolina in 1805; graduated at the U. S. Military Academy in 1829; first lieutenant Seventh Infantry in 1835; captain in 1838; breveted major for gallant conduct at Monterey in 1846; major Eighth Infantry in 1855; resigned in 1861; commanded a Confederate brigade in reserve at Manassas, and afterward held command at Acquia; with the rank of lieutenant-general he held (1862–64) a command in Arkansas; attacked Helena July 3, 1863, and was repelled with heavy loss. D. June 20, 1880.

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